3 TELECOMMUNICATIONS ECONOMY

3.1 Industrial structure and environments

Telecommunications industry consists of public voice networks, data networks, cellular mobile networks, radio networks, paging systems, satellite systems, and various transmissions systems such as microwave, fibre optics, and coaxial cable systems. Even though data transmission is carried over PTOs’ network, and voice and data networks are poised to converge in the near future, the data communications is still treated as a totally separated industry by most analysts. Therefore this paper does not include the data communications industry.

Directly or indirectly telecommunications industry provides services to most of the world’s population. It employs many millions of people to design, build and manage the networks and systems, and also to analyse its operations or frame policies for its governance.

Telecommunications is part of a wider industry that includes computing, information technology (or data communications), films and broadcasting. It is concerned with the manufacturing and supply of the means by which communication takes place within this wider group. These industries are rapidly converging into a single communications and multimedia industry.

The table below shows the structure of this wider industry. (1)

<table>
<thead>
<tr>
<th>Layer</th>
<th>Product/Service</th>
<th>Typical companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment manufacture</td>
<td>Telephones, exchanges, computers</td>
<td>Lucent, IBM, Alcatel</td>
</tr>
<tr>
<td>Network</td>
<td>PSTN, private networks, cable TV, radio broadcasting</td>
<td>Telekom Malaysia, British Telecom</td>
</tr>
<tr>
<td>Production</td>
<td>Business information, information for residential users, music, films</td>
<td>Reuters, Warner Bros.</td>
</tr>
<tr>
<td>Distribution</td>
<td>Information suppliers, film distributors, radio and TV broadcasters</td>
<td>BBC, TV3</td>
</tr>
</tbody>
</table>

(sources: reference (1) with modification)
Telecommunications deserves special study for four reasons:
1. It is a central component in many commercial and government processes.
2. A relatively small number of powerful firms dominate the industry. Regulation is needed to protect consumer interests.
3. Telecommunications industry issues are economics exemplify issues.
4. It is widely seen as spearheading social change based on the use of new technology.

Telephone networks rank among the world's largest business. The owners of the networks, usually called public telecommunications operators (PTO) such as Telekom Malaysia, are among the largest enterprises in every country. Even though the industry is driven by technology, the potential for technological change is not enough to ensure that the change happens. The most important factor driving change is the increasing complexity of the market. The management of telecommunications networks in today's world requires a flexibility, focus and depth of knowledge, which is not readily available to governments and their employees alone. This is the main reason privatisation usually taking place first in this industry. For the same reasons, no single operator can be expected to command all the skills needed to provided the rapidly widening range of services now available. (3)

Trade and market liberalisation has widened the horizons of business planners and the level of business risk. The industry is becoming more competitive. PTOs are venturing outside of their domestic country to gain more revenue. With the opening up of the domestic market to foreign competitors, the once single monopolistic operator of a country now facing more pressure from the competition in the market. Similarly, equipment vendors have experienced greater competition in their market due to more liberalisation.
3.2 Telecommunications policy and regulation

3.2.1 Ideas about telecommunications policy

Telecommunications has been at the forefront of a worldwide movement towards the privatisation of public utilities and strategic industries. (1) Telecommunications policy analysis includes the rich field of market structure, price, regulation and economic welfare. Government may have policies to force the pace of telecommunications development beyond that which would be produced by the markets on their own in the belief that this will stimulate growth in the wider economy.

The dominant telecommunications operator such as Telekom Malaysia has to satisfy the objectives of its stakeholders. The stakeholders are:

1. The owner who are the providers of capital who want an adequate return.
   In Telekom Malaysia case, its owner is Malaysia government;
2. The customers, who want reasonable prices, adequate service quality, useful innovation and choice;
3. The workers, who want reasonable pay;
4. Equipment vendors, wanting reasonable terms of business;
5. Society at large, requiring responsible behaviour and attention to broad quality aims.

In a perfect competitive market prices will be determined by the supply and demand. Regulation requirement is relatively not intensive in a perfect competitive market. However, competition in telecommunications is imperfect because of the large capital requirement and the prevalence of sunk costs. This makes regulation inevitable for the foreseeable future.

In Malaysia, the implementation of policy is kept within the Ministry of Energy, communications and Multimedia. To enable the implementation of the CMA, the Multimedia Commission is in the process of drawing up subsidiary legislation, guidelines, roles and codes in consultation with PTOs, broadcasters and IT associations.
While market liberalisation and deregulation may be a threat to incumbent PTOs such as Telekom Malaysia, it is a huge opportunity for equipment vendors like Lucent Technologies. Telekom Malaysia has to prepare itself to face more competitions brought in by new operators. But to Lucent, it simply means more customers and higher sales revenues.

3.2.2 The Communication and Multimedia Act

The Communication and Multimedia Act, 1998 implemented in Malaysia has specifically declared the Government’s 10 national policy objectives (17) for the communications and multimedia sector. They are:

(1) to establish Malaysia as a major global centre and hub for communications and multimedia information and content services;
(2) to promote a civil society where information based services will provide the basis of continuing enhancements to quality of work and life;
(3) to grow and nurture local information resources and cultural representation that facilitate the national identity and global diversity;
(4) to regulate for the long-term benefit of the end user;
(5) to promote a high level of consumer confidence in service delivery from the industry;
(6) to ensure an equitable provision of affordable services over ubiquitous national infrastructure;
(7) to create a robust applications environment for end users;
(8) to facilitate the efficient allocation of resources such as skilled labour, capital, knowledge and national assets;
(9) to promote the development of capabilities and skills within Malaysia’s convergence industries; and
(10) to ensure information security and network reliability and integrity.

The underlying principles of the new regulatory regime are: (18)

(1) Transparency - to ensure fairness to all market participants;
(2) Technology Neutral;
(3) Self Regulation - industry recommends codes and standards;
(4) Industry Development - industry responsible to promote, grow, create and facilitate;

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(5) Incentive Based Regulation - regulatory concessions and rights are matched to undertakings;

(6) Social Responsibility - to serve in underserved groups/areas;

(7) Consumer Interest - to promote and protect interests of users.

The creation of a licensing regime is an important step in regulation. It provides a clear statement of the rights and obligations of the operators. Licenses with such provisions are valuable economic documents, especially for a privately owned company given the right to enter a market in which entry is restricted. A new licensing regime will be adopted under the Communication and Multimedia Act. Licenses to be issued will be grouped under 4 categories: (17)

(1) Network Facilities Provider;

(2) Network Service Provider;

(3) Application Service Provider; and

(4) Content Application Service Provider.

Malaysian Commission for Communications and Multimedia has given licences to new operators in early 1990s. There are now five major fixed line operators: Telekom Malaysia, Binariang, Time Telekom, Sapura Telekom and Multiara Telekom; and seven mobile service network operators: TM Touch, Maxis, Celcom, Digi-1800, Adam, Mobikom and ATUR. Licences also given to STW for operating Wireless Local Loop (WLL), and to Uniphone, Sapura and Skytel for providing public phone services. With new Communication and Multimedia Act in place, more companies will be given new licences to operate in telecommunications and data services.

A major contributing factor to the difficulties currently faced by the telecommunications and broadcasting companies is the severe competition created by too many operators and service providers chasing after the same limited clientele, over duplication of networks and excessive investments. Globalisation and easing of international market entry bring in global competitors. The real competitors are not at home they are out there in the
global arena. Telekom Malaysia must realise this trend and prepared itself for more competition, not only at home but also in the international arena.

3.2.3 Economic Regulation
The purposes of economic regulation are to promote consumer markets, which offer choice, quality and affordability; any-to-any connectivity for network services; competition in communications markets; and investment and innovation in the sector. One major way of achieving these objectives is to regulate the profit of the telecommunications operators.

3.2.3.1 Direct control of the profit rate
A direct control on profits, through the imposition of a maximum rate of return on capital, comes closest to the idea of holding the operator to making normal profits. The operator must separate the regulated from the unregulated parts of the business and may split up the regulated business into services. These involve extensive work in four areas:
1. Cost and asset allocations, for the calculation of achieved rates of return on capital on the regulated services.
2. Establishing the cost of capital.
3. Estimating price elasticity so that the post-tariff increase in revenue and the future rate of return can be accurately forecast.
4. Special regulatory financial accounts to show the rates of return actually achieved.

The method presumes that the actual and correct rates of return for the operator can be determined. The investment decisions are based on returns expected in the future rather than past rates. However, the future rates require many speculative assumptions. Rate of return regulation is basically a 'cost-plus' system because it adds the profit allowed by the regulator to any pre-existing structure of costs to arrive at prices. Tight control of profit weakens incentive to cut costs. The operator may see little point in reducing costs to enhance profits if the regulator is going to take the extra profit away. Therefore a more promising way for an operator to increase profits would be to persuade the regulator to agree to:
The need for extra investment
A rate of return exceeding the cost of capital
Excessively long accounting lives for assets
The overvaluation of assets

Limitation of the maximum rate of return may get the regulator too closely committed to individual investment decision. (1)

3.2.3.2 Direct control of price
The regulator may control the rate of profit indirectly by placing upper limits on price. There are four merits of direct price control:
1. It meets the direct concern of the users, who understand prices better than a rate of return.
2. The fixing of price limits in real terms provides a stronger consumer guarantee on prices than can be obtained from rate of return regulation. In rate of return regulation only the operator's profit margin is guaranteed.
3. The operator has a strong incentive to cut costs to enhance profits.
4. A relatively low level of regulatory effort is required. Rate of return regulation requires more information for its implementation.

The prices are control using the CPI-X (CPI minus X) rule (1), which was first used for the privatised British Telecom in 1984. The essence of the scheme adopted is that a limit is placed on the weighted average price change by reference to the consumer price index (CPI). An X factor is used to set the upper limit to price change. The allowable price increase is less than the CPI increase by X. As an example, if inflation (as measured by the CPI) rises by five per cent over a year and X is set at two (a two per cent real fall), the maximum permitted price increase is three per cent. CPI used is the last known inflation figure for the period prior to the one during which prices are controlled. Implementation of CPI-X price control scheme leaves a number of choices to be made:
- Frequency of price changes;
- Which prices to control;
- Control of an average price of a basket of services or individual service prices;
- The balance of prices;
- Choice of X
- Review period for X in the limit;
- Information to be collected for monitoring;
- Public or private process;

The system works well with relatively stable inflation, but it can cause systematic deviations during long periods of rising or falling prices. Rapid and unstable inflation can create unacceptable risks for the operator, which may find its costs rising while prices are held at a low level based on passed inflation rate. Telekom Malaysia must have the expertise to negotiate all the above issues with the regulator in order to maintain its dominance in the market.

3.2.3.3 Equal Access
The Malaysian Government has decided to introduce Equal Access in Malaysia on 1st January 1999. It is part of the liberalisation plan in the national telecommunications policy, which is being implemented in accordance with world-wide development of competition in the industry. This will bring the Malaysian telecommunications services in line with many other countries around the world. It is also the belief that healthy competition in a strong market will benefit the operators and the customers.

Equal Access means that the Malaysian fixed line telecommunications market will be opened up to competition from several network operators. This is achieved by the new operators in the market interconnecting their networks to Telekom Malaysia's nationwide fixed line network, and vice versa. From existing telephone lines, customers will be able to select which operator they want to use to carry their long distance and international telephone calls. They can select an operator on a call by call basis by dialing a 3-digit code before the telephone number. However, if no code is dialled before the telephone number, the call will automatically be carried by the operator to which the customer is connected. The services that will fall within the scope of Equal
Access are essentially long distance calls and international calls from fixed lines to fixed line.

New operators who do not have as large customer base as Telekom does could tap the revenue from Telekom's customers by encouraging them to dial their Access Code which offer lower rates. However Telekom Malaysia is not so much threaten because of two main reasons:

(1) Telekom Malaysia has a network that serves millions of homes in rural and urban also business premises, includes a truly nation-wide long distance network and connects to the most international destinations. Due to short time in operation, it is unlikely that other operators' networks are as comprehensive as Telekom Malaysia's and thus would pose limitations in terms of capacity and coverage to serve the customer demand.

(2) The regulator has imposed a limit to the amount of discount (20%) that all operators can give. This rate might be good for large customer but it is not attractive enough for small users to switch to other operators. To enjoy the 20% discount the users have to re-register with another operator; pay additional deposits charged; dial additional codes (digits) in front of the telephone numbers when making national (STD) or international (IDD) calls; and receive more telephone bills from more operators. All these might discourage any small user for switching over to another operator.

3.2.4 Regulation of service quality

Regulators and the public often feel that they must intervene to maintain quality standards especially in private industries. Provisions concerning the quality and availability of the service provided and the nature of any public service obligations are also needed.
Regulators are pragmatic and vary in the way in which they deal with service quality issues and the trade-off with cost. It usually encourage the provision of alternative levels of quality, pricing them in a way which reflects cost differences. If the operator feels that the money can be made out of quality improvement, this improvement is more likely to be seen. However, minimum quality requirements need to be clearly specified. Regulator could collect and publish statistics of service quality for all the main operators to exert peer pressure on them.

3.2.5 Improvement of market efficiency

Dominant operators, such as Telekom Malaysia, are usually required to show transparency in pricing. Regulation intended to prevent cross-subsidy and anti-competitive behaviour is likely to be applied to dominant firms in recognition of their market power and may not be applied to their competitors because of the weakness of their market position.

Dominant operators are common carriers. They have to provide service to all new comers at reasonable and standard rates. The emergence of pluralistic networks, in which common carriers face competition from competitors without common-carrier obligations, requires regulation to ensure that they work together as an integrated service. This involves attention to interconnect arrangements, quality of access, technical compatibility, quality, privacy and other matters where there may be a conflict of interest between carriers. Users also need indirect protection by safeguards to prevent competitors with efficiency greater than that of the incumbent from being driven out of business by unfair trading practices. Antitrust legislation may restrain vendors with excessive power but not eliminate it. The aims are normally confined to protection of the consumer against excessive prices or undue restriction of choice.

The new operators compete for long-distance and international traffic, but most of them do not have local networks through which they can access their customers. New entrants need to be able to pass calls through the networks of other operators if the full benefits of competition are to be achieved. Only in
this way a caller can reach all other addresses without duplication of facilities. Interconnection is arguably the key competitive issue in market evolution. Interconnection terms can erect substantial barriers and legal provisions may be needed to reduce them.

Telekom Malaysia is likely to want an interconnect payment which includes a contribution towards supposed losses on its local loop. A structured and open regime with published interconnect rates will provide for greater market efficiency. There should be provision for interconnect with mobile and other operators. Interconnect requirements will depend on the extent of network competition expected. The regulator may have to put down interconnect conditions if the parties cannot agree.

3.3 Costs structure

3.3.1 Factors that affect cost

The most important factor limiting the cost minimisation of network is the difficulty of forecasting demand and technological change. Operational cost determinants are listed below:

- Billing
  Billing accounts for a significant element of total costs. It is typically around five to ten per cent of infrastructure costs. (3)

- System density
  The geographical density of the network has an effect on costs. Scattered rural areas are relatively expensive to serve because of high average number of wire length per line and the economies of scale from the traffic volumes on individual routes are low.

- Daily traffic profile
  Number of telephone calls varies hour by hour in a systematic way. In typical business scenario the network experience daytime (morning and afternoon) peak with a dip at lunchtime. The number of calls for residential users may peak in evening. Operators always provide an amount of
equipment for the daytime peak. They also have to meet the peak load with acceptable grade-of-service (QoS) limits.

- Directories and directory enquiries
  The cost for supplying millions of telephone directories to customers is increasing every year. With the advance in technology, directory enquiries services is more fully automated and cost less.

### 3.3.2 Asset Valuation and Costing

Economic of value of an asset is determined by the discounted value of the future income that can be earned from it. The usual methodology for assets valuation is modern equivalent asset (MEA)\(^{(1)}\), which is close to economic value. MEA depends on

- The cost of plant to be bought in future
- Future maintenance costs
- Future volume of services provided by it
- Future price for those services

In the imperfect markets that characterise telecommunications, analysis of costs is the only effective way of finding a basis for prices. The costing of telecommunication services will usually be carried out using historic-cost accounting figures. The cost derived from this method is referred to as Fully Allocated Cost (FAC)\(^{(1)}\). FAC accounting usually distributes costs on a proportionate basis based on the ideas of fairness or equity. The five main elements of cost analysis are:

1. Distinguishing between fixed and variable costs.
2. Analysing the operational structure of the business to identify activities for study.
3. Sample surveys to help split up large blocks of variable non-capital cost among individual activities
4. The allocation of capital costs to a level as close as possible to final services. Capital costs such as local exchanges, which are shared between separately priced elements of service, are cascaded down to final services in a manner similar to that used for non-capital costs.
5. Assessment of capacity costs for use in peak/off peak charging schemes.
The main objective of costing is to achieve transparency in calculation of the service prices. Transparency is necessary to ensure fairness to all market participants and confidence in investment decisions. The pressure for transparency is forcing operators such as Telekom Malaysia to be more cost efficient in its telecommunications operation.

3.3.3 Cost trends

The trends of cost in telecommunications services are determined by two major components:

1. Input prices of basic infrastructure and utilities such as land, building, labour, electricity, etc.
2. New products and substitutes. Technological change has been reducing the volume of inputs needed to provide same capacity or in other words, more capacity is available with same amount of investment capital.

Land and labour are usually on a rising trend as well as building rent. Significant real price-reduction trends can be anticipated in capital equipment. The equipment includes local switches, main switches, transmission cable, transmission equipment, network computers, and all inland conveyance. The reduction in cost is largely due to step changes in technology.

Costing process might not change significantly in the future but it will be getting more complicated as more and more new services are brought in. The convergence of voice and data networks might cause some changes in the costing. PTO such as Telekom Malaysia has to understand more about the allocation of cost among its various services. This is important for Telekom Malaysia, as a dominant operator, in drafting up the interconnection agreement with other new operators.

To maintain its position in a competitive market, Telekom Malaysia must be able to provide services at lower cost. There are many ways Telekom Malaysia aims to achieve this objective. For example:

(1) Incorporation of new technology to the existing network.
(2) Increase utilisation of existing network so as to benefit from economies of scale.

(3) Increase call success rate and other quality targets.

(4) Focus capital expenses and new investment in areas which can generate early cash returns so as to preserve shareholder value.

(5) Reduce bad debt to below 2% by effective credit controls. (12)

With these measures under implementation, Telekom Malaysia is position itself as a low cost producer among the various competitors.

Vendor such as Lucent should be aware of the costing process of its individual customer so that a better network solution could to propose to the customer. New entrants usually have limited knowledge about the solutions to the service that they would like to offer. They usually depend on their vendors for the information. Vendors with better understanding of the service costs are more likely to win the contract from the new comers.

3.4 Service prices

3.4.1 Pricing process

There are five stages to the process of tariffs setting for a large operator, such as Telekom Malaysia, who is able to influence market prices and subject to profit control:

1. Analysis of cost
2. Forecast of demand
3. Calculating the revenue target
4. Setting tariffs to meet the target
5. Negotiating them with the regulator

A minimum figure for the revenue target for the large operator would be the cost of capital. Other operators usually take price from the market or by discounting against the largest operator and possibly against each other.
The criteria for regulated tariff structures are:
1. Fairness, often interpreted as favouring equal mark-ups for overhead;
2. Economic efficiency, favouring cost-based prices;
3. Social welfare, which involves either or neither of these but maximises aggregate consumer satisfaction.

3.4.2 The price for access
The price of access to the network is reflected in the rental. The supply of an access facility can be separated from call provision. However, the allocation of costs between calls and connections is difficult and to some extend unnecessary except as an indication of entry costs. Market segmentation has already producing a range of access prices to suit different demand requirements.

Many operators charge higher rentals to business users than to residential users. It arises from four main factors:
1. Residential customers tend to display higher price elasticity.
2. Political sensitivity of residential rentals, bolstered by welfare consideration.
3. Higher maintenance costs on business lines.
4. Tariff structures that have not caught up with the technology changes, which have undermined call prices, and which have become too dependent on profits from calls.

The Equal Access regulation introduced by Malaysian Government has effectively prevented operators from charging a high rental on network access. But with more intense competition, the access prices might be lower in the future.

3.4.3 Price for calls
The cost of a call has three elements:
1. The call setup, which engages circuits and switches across the network.
2. The use of telecommunications equipment during the call.

A constant per-minute or per-unit charge is the most frequent way of charging for long distance calls. Two different charging periods are commonly used. Off-peak prices should be high enough to recover marginal costs but should be lower than peak prices to reflect the use of the spare capacity of circuits provided to meet the peaks.

If local calls are not to be supplied free there has to be a way to measuring them. The high number and low average value of local calls led to the development of metering equipment which measured the aggregate duration of calls rather than their total number. The introduction of electronic control to telephone exchanges enabled more precise measurements to be made on local calls.

Trunk calls cost more to handle than do local calls because they pass through more than one exchange. Calls of relatively heavily used routes are cheaper to handle because of the economic of scale. They are the routes on which competition was quickest to develop. International calls are the most expensive calls because they pass through more than one operator in two or more countries.

3.4.4 Price for value added and data service
The market for audiotex services (services that provide valuable information, such as stock price, by voice through telephone) has grown rapidly in recent years. In the basic audiotex operation an information provider sets up a recorded-message service which is accessed through the PSTN at a special premium rates.

Virtual private networks, VPN, provide a PABX like networks for small and medium business. VPN costs less than leased lines and is particularly attractive to companies with insufficient levels of business to justify leased lines.
Companies using their own private networks for data transmission usually set these up with leased lines which are priced at a fixed rate. Another way of sending high volume data is through public packet network. Data transmission over a public packet network depends on the volume of data sent and the transmission speed.

Call diversion and related services are more expensive to provide than telephony between two fixed points. Usually monthly charge and call diversion setup charges are imposed for these services.

Internet access pricing has three elements, a time-based fee for local call to the PTO, a time-based fee to the Internet service provider (ISP) and a value-added charge. Telekom Malaysia starts to time the local calls due to the demand of Internet traffic. A special number is also provided for Internet access for each ISP in order to analyse the Internet service cost most accurately. The charges levied by ISP are basically time based although with a series of flat rate options. TM Net, subsidiary of Telekom Malaysia, is one of the ISP in Malaysia. Value added charge is additional charge incurred for the special products and services such as software packages.

The low level of transmission costs and the improvement of systems for sending voice traffic over packet networks has led to the development of Internet voice telephony for long-distance and local traffic. The interest on Internet telephony has been stimulated by its apparent cheapness due to at least three factors:

1. Overpricing of long-distance service on the PSTN
2. Internet pricing not fully adjusted to voice telephony
3. Service quality differences

Internet telephony will eventually move long distance PSTN prices closer to cost as market become more liberalised. However, the lines used by Internet telephony cannot provide capacity any more cheaper than the capacity which PTO have for their own use. With a potential higher cost base, money will then be made out of Internet telephony only if PSTN charges remain well in
excess of cost, or if there is a market for a quality difference or for the convenience offered.

3.4.5 Prices trends
Tariffs across the world are adjusting to structural changes in underlying costs and the development of greater competition in markets. The changes in cost structure have produced and exaggerated differences in profitability between services. Greater competition is accelerating the change. Dominant operators, new entrants, resellers, dial-back operators and card-based operations are exerting a downward pressure on international tariffs.

The effect of competition is to encourage the development of diversity in the price and quality of services. Even early competitive pressures will start to drive prices towards cost, encourage pricing structure with finer graduations and bring in a wider range of quality choices. Nevertheless perfect competition in telecommunications services is not likely to appear. With the global trend of price reduction, Telekom Malaysia might see the profits from long distance and international calls falling. It has to work harder to reduce the cost as described in the section earlier and in the same time increase its customer base, especially the multinational organisations.

The lower prices mean that new operators need longer time to recover their capital expenses. This will affect the way equipment vendor such as Lucent selling their products. New operators will demand more financial assistance from the vendors. Lucent might have to allocate higher project capital in order to secure profitable projects from new operators.