

Challenges To Telecommunications Development In Greece: A Case Study At OTE

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ABSTRACT

During the past twenty years, Greece has focused on developing its businesses and banks nationwide. The evolving telecommunications needs of these businesses, such as improved availability, quality and reliability, have placed unprecedented demands on Greece's monopoly service provider, Hellenic Telecommunications Organization (OTE). The challenges faced by telecommunications carriers were identified, based on a literature review, as (a) providing phone services within a country given the challenge of geography, (b) providing long-distance and international telecommunications services, (c) moving from a monopoly to a competitive environment, and (d) changing from technology driven to market driven focus. This list of challenges was used as the basis for analyzing the performance of Greece's OTE. The challenges faced by OTE and the strategies it used to overcome the challenges were then identified. The authors offer a set of explicit recommendations for information technology managers, based on their analysis of OTE's strategic responses to the challenges in its marketplace. These recommendations are useful for managers who are responsible for the strategic direction and management of their company's telecommunications networks.

INTRODUCTION

For most of the twentieth century, Greece, the cradle of Western civilization, has remained an agricultural country and has lagged behind industrialized countries. All telecommunications needs were met by the Hellenic Telecommunications Organization (OTE), the sole provider of local, long distance, and international telecommunications. During the past 20 years, Greece's focus on developing its industries resulted in the rapid growth of businesses and banks nationwide. The evolving needs of these businesses, such as the need to improve availability, quality and reliability of their services, have placed unprecedented demands on OTE's telecommunications services. OTE's experience in addressing its telecommunications challenges using appropriate strategies has practical value for Information Technology (IT) managers.

With rapid advances in technology and companies seeking to knit large markets together, IT managers need to find

and utilize appropriate strategies to meet telecommunications challenges. High-quality telecommunications are now seen as essential for a country's economic growth, to ensure that it does not fall behind in the race to the global information superhighway. As countries transform their telecommunications markets, telecommunications carriers worldwide are facing a number of significant challenges. The literature was analyzed to identify these challenges. This list of challenges then became the basis for analyzing the performance of Greece's OTE.

The strategies adopted by OTE to address its telecommunications challenges were identified through interviews with executives at OTE, and through analysis of OTE's performance data. Factors such as geography, demographics, demand and supply gaps, and financial performance were analyzed in determining successful strategic responses. The analysis of OTE resulted in the creation of a set of

explicit recommendations to information technology managers responsible for the strategic direction and management of their company's telecommunications networks.

OTE: GREECE'S TELECOMMUNICATIONS ORGANIZATION

Established in 1950 as a monopoly, the Hellenic Telecommunications Organization (OTE) is Greece's primary telecommunication and information services provider. Serving all of mainland Greece and the many Greek islands, OTE offers telephone services, data communications, and new services. Due to recent liberalization, OTE is no longer a monopoly in all its market segments and is adapting itself to meet fundamental changes in its marketplace. The goals of OTE are (Annual Report, 1994):

- to establish OTE as the main public provider of affordable, high-level telecommunications infrastructure and services in Greece
- to constitute OTE as an instrument of Greek economic and social development
- to survive and prosper in the continually expanding European market.

Financial Background:

OTE is one of the largest companies in Greece with revenues of US \$2.6 billion (600 billion Drachmas¹) for the year 1994 and employing 26,140 personnel. In 1983, OTE's

FIGURE 1
Employee Productivity

Increasing Employee Productivity

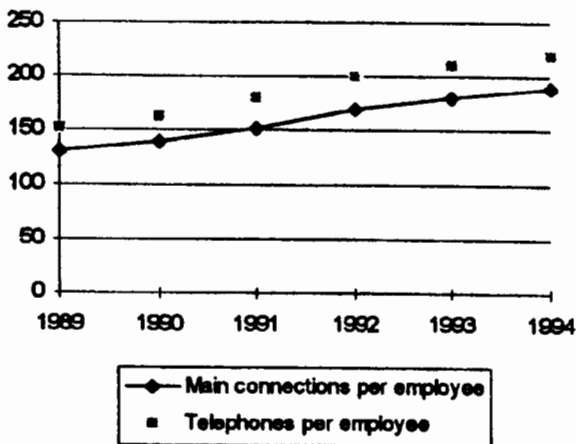
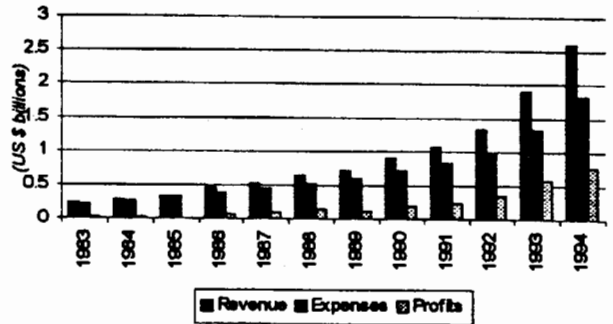


FIGURE 2
Profitability of OTE
Increasing Profitability



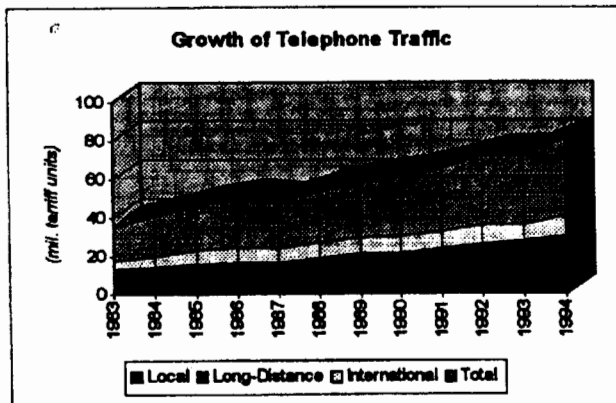
annual revenue was US \$236 million (54.2 billion Drs.) with 31,000 employees. Currently, OTE provides voice and data communications to 4.9 million subscribers. Employee productivity, indicated by the number of main connections per employee and the number of telephones per employee, has been going up steadily over the past decade (Figure 1). OTE has been reporting a higher profitability during this decade (Figure 2). Between 1993 and 1994, its net profits grew 36%, while revenue recorded a 38% increase. Total revenue between 1983 and 1994 has grown more than ten-fold.

Growth in Telephone Usage:

As in other developing countries, telecommunications is increasingly felt to be a need and not a luxury by the citizens of Greece. The duration of telephone use has more than doubled since 1983, resulting in a six-fold growth in the revenue of OTE. The average annual growth rate of telephone connections has remained of the order of 5.5% during the past decade and now the number of telephone connections amounts to 4.97 million. Telephone density has steadily increased over the past decade from 33.5% in 1983 to 47.81% in 1994. OTE has been reporting increased usage of its telephone circuits during this decade in all the sectors of local, long distance, and international usage. International traffic demand is growing even more as Greece becomes further absorbed into the European Union. Local and long-distance traffic has expanded steadily over the years. This matches with the explosion of urban development in Greece's main cities of Athens and Thessaloniki and the country's increasing interaction with the European Union and the rest of the world.

¹ 1 US \$ = 240 Drachmas (Drs.)

FIGURE 3
Growth of Telephone Traffic at OTE



Growth in Data Communication Usage:

Until 1990, data communications were possible through the public telephone, Telex networks, and leased circuits. The telephone network had been designed for voice transmission, and not for the high fidelity signals required for data transmission. The leased circuits offered limited possibilities since they were designed for point-to-point connections.

As the businesses and banks in Greece grew rapidly in the 1980s, there was an increased need for improved quality, reliability, and security in data communications. OTE developed a Public Packet Switching Data Network (HELLASPAC) to offer a wide range of services and facilities. The network includes 8 nodes as shown in Figure 4 with a single management control center at Athens. There has been a steady growth of data communication users and there are currently 13,000 data users spread across the country.

As the network has grown and volume of transactions increased, OTE has been designing and implementing strategies to address the challenges faced since 1983. These are described next.

IDENTIFICATION OF MAJOR CHALLENGES FACING TELECOMMUNICATIONS CARRIERS

A decade after the divestiture of American Telephone and Telegraph (AT&T), many countries are reexamining the strategies for fostering telecommunications in their countries. Although competition for telecommunications services has been driven by dynamic changes in technology and sophistication of user demand, not all countries are convinced of the benefits of privatization and liberalization, and

even if they are, their economies may not be able to support a fully privatized system (Jussawalla, 1993). Although the challenges faced by each country differs, there are some common challenges adopted to face these challenges. The literature was analyzed in order to identify the challenges that were faced by telecommunications carriers. This list of challenges then became the basis for analyzing the performance of Greece's telecommunication organization, OTE.

Table 1 provides a comparison of the telephone density of the 24 countries in the Organization for Economic Cooperation and Development (OECD) and six countries in the Eastern European region (Steinfeld et al., 1994). Telephone density is a commonly used measure to gauge the availability of phones to citizens of countries. This table shows that a few countries such as Sweden, Switzerland, and Denmark lead in telephone density, whereas, countries such as Romania, Hungary, and Poland have telephone densities of less than 10 per 100 people. Also, in developing countries, telephones are concentrated in a few large cities, and much of the population lives in areas with little or no service. In the countries on the top of the list, the telephone density is fairly uniform across each country; in those at the bottom of the table, telephone density is several times greater in the main cities than in provincial towns and rural areas (Saunders, et al., 1994). Greece is in the middle of the table, showing that its telecommunications networks have high potential for growth. The telephone density has increased from 39.3 to 47.81 during 1991 to 1994 showing the increased emphasis

FIGURE 4
Original Data Network

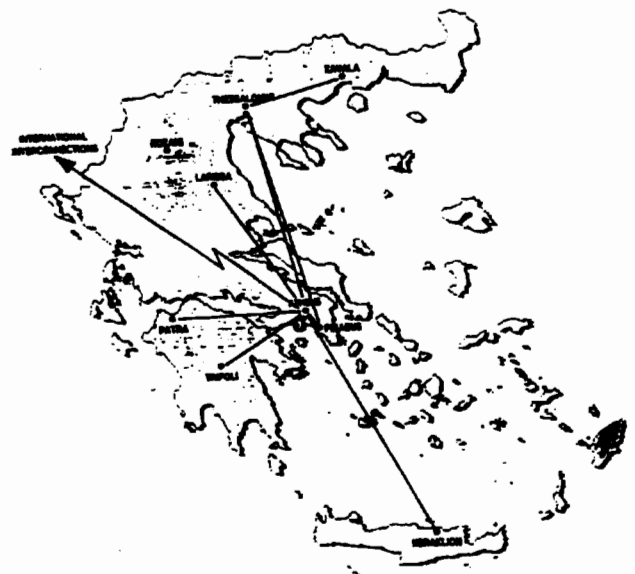


TABLE 1

**Comparison of Phone Lines per Inhabitants
in 24 OECD Countries and 6 Eastern European
Countries as of 1994
(ITU World Telecommunications
Development Report)**

Country	Main Telephone Lines per 100 Inhabitants
Sweden	68.31
Denmark (EC)	60.37
United States	60.17
Switzerland	59.74
Canada	57.54
Iceland	55.73
Norway	55.40
Luxembourg (EC)	55.35
Finland	55.11
France (EC)	54.74
The Netherlands (EC)	50.87
Australia	49.60
United Kingdom (EC)	48.87
Germany (EC)	48.31
Japan	47.98
Greece (EC)	47.81
New Zealand	46.96
Austria	46.51
Belgium (EC)	44.90
Italy (EC)	42.94
Spain (EC)	37.13
Portugal (EC)	35.03
Ireland (EC)	35.00
Bulgaria	33.52
Czech Republic	20.89
Turkey	20.10
Slovak Republic	18.82
Yugoslavia	18.40
Hungary	17.04
Poland	13.06
Romania	12.34
Average for Europe	31.95
Average for World	11.57

EC: These countries are members of European Community.

on improving telecommunications in Greece.

The literature was reviewed in order to understand the challenges faced by these countries in providing telecommunications services to their citizens (Steinfeld et al., 1994; Jussawalla, 1993; Saunders et al., 1994; Sussman & Lent, 1991; Muskens & Gruppelaar, 1988; Mansell, 1993; Dholakia,

1994; Kellerman, 1993; & Davies, 1994). An analysis of this literature resulted in identification of four major challenges faced by telecommunications carriers. These are:

- (a) Providing Phone Services within a Country Given the Challenge of Geography
- (b) Providing International Telecommunications Services
- (c) Moving from a Monopoly to a Competitive Environment
- (d) Changing from Technology-Driven to Market-Driven Focus

Each of these challenges is discussed next.

(a) Providing Phone Services within a Country Given the Challenge of Geography: The first challenge is to provide local and long-distance phone services within a country given its own unique geography and political setup. Countries such as Singapore and Hong Kong are city-states and it is cost-effective to connect the citizens to advanced telecommunications networks. Countries such as the USA and Australia have large regions with very little population and providing advanced telecommunications services in these regions is not profitable for the companies. They have to be subsidized by the governments in order to provide universal service (Davies, 1994). Other countries such as Greece and Philippines face the complexity of providing telecommunications services to citizens living in many islands in the country.

Another aspect of geography is that whereas the whole world may be interconnected through cheaply priced, direct-dialing communications systems, information-producing centers might emerge in the world cores, as against areas of mere information consumption located in the world peripheries (Kellerman, 1993). A country might therefore be an information producer or a consumer and the geographical placement of the country might have a major impact on the development of the telecommunications systems. For example, United Kingdom is geographically the connection point between Europe and the USA. It shares 23% of the world's international banking and 7.9% of the world's stock markets (Kellerman, 1993). Actually, New York, London, and Tokyo serve as whole cities for a whole continent and are further tightly interconnected among themselves, so that they serve as the top of the pyramid of the global urban hierarchy. Among these three cities, they share 48% of international banking and 72.3% of the stock market activities (Kellerman, 1993). Some countries might not be in the middle of such a network or might present geographical challenges such as mountains, islands, etc. These need to be addressed by a country's telecommunications company.

(b) Providing international telecommunications services: A high growth segment in telecommunications services has been the use of international phone lines for voice and data communications (Dholakia, 1994). The inflow and

outflow of these calls differ widely across countries. For example, telecommunications traffic between Europe, America, and Japan accounts for 75% of global traffic (*Economist*, 1991). Almost two-thirds of European outgoing international telecommunications is generated by three countries, Germany, the UK, and France. In addition, this is the most profitable part of the telecommunications services provided by the carriers. Therefore, the ability of a country to provide international telecommunications is another major challenge.

(c) **Moving from a Monopoly to a Competitive Environment:** From a segregated assembly of national monopolies protected by a government, Post, Telephone, and Telegraph (PTT) authorities in developed and developing countries are increasingly coming to terms with a system of changing value-added services that do not carry assurances of guaranteed markets (Jussawala, 1993). The information revolution has rendered problematic the old monopoly forms of telephone organization (Davies, 1994). Three alternative paths have emerged: modernization led by the public monopoly, but with competitive supplies of peripheral services (France); private, and in the medium-term competitive supply of long distance and local lines (Britain and from 1994, Finland); and a decentralized system of regional telephone monopolies separated from long distance networks (the United States and Denmark). This change from a monopolistic provider to a competitive company is a major challenge faced by many telecommunications carriers.

(d) **Changing the Company from Technology-Driven to Market-Driven Focus:** Information technology is clearly shifting away from the support and administrative functions to the more mainstream and strategic functions in many companies (Sheth, 1994). This in turn has resulted in a competitive environment of the information technology providers including computer companies and telecommunications carriers. These carriers are being forced to change from a technology focus to a market focus. The challenge for companies such as US West is not simply to do a better job of meeting customer needs in a timely fashion with quality products, but to do so under the constraints of regulation (Dodson and Schirmer, 1994). They discuss how US West has adopted a market-based management philosophy in order to become more customer focused. In addition, in the past, most carriers charged a price that was computed by adding a profit margin to their costs and they were guaranteed this price due to monopolistic conditions. In a market-based focus, prices will be determined by the market and it will become important to contain costs and improve quality of service. This change from a technology-driven focus to a market-driven focus is another challenge faced by telecommunications carriers.

We analyzed the data obtained from OTE in order to

identify the challenges they faced and the strategies they adopted in order to meet the challenges. These will be discussed next.

STRATEGIC RESPONSES OF OTE TO MEET GREECE'S TELECOMMUNICATIONS CHALLENGES

OTE had to meet a number of important challenges while achieving growth and expansion in national and international markets. Some of these challenges are unique to Greece (such as its geography), while other problems are similar to those encountered by other telecommunications organizations in developing and developed countries. This section describes these challenges and discusses the strategies adopted by OTE in addressing them.

The critical challenges faced by OTE were similar to the other telecommunication carriers:

- **Providing Phone Services within a Country Given the Challenge of Geography:** In Greece, the major challenge was to provide reliable local and long-distance telecommunication services to the hilly mainland and to the 169 inhabited islands.
- **Providing International Telecommunications Services:** In Greece, providing international ship-to-shore and ship-to-ship connectivity for one of the world's largest commercial maritime fleets was the major challenge.
- **Moving from a Monopoly to a Competitive Environment:** The major challenge was to navigate the newly liberalized and highly competitive telecommunications environment in Greece, where OTE has to fight harder for market share.
- **Changing from Technology-Driven to Market-Driven Focus:** The major challenge for OTE was to manage explosive growth while containing costs, improving profitability, and fulfilling market demand.

Challenge 1

Providing Local and Long-distance Phone Services within Greece Given the Challenge of Geography

The geography of Greece poses special challenges to the development of modern telecommunications in the country. Greece's land mass is only 50,926 square miles, but the area of sea that it occupies is approximately 154,440 square miles. About a fifth of its land area is accounted for by the more than 2000 islands. Of these numerous islands, 169 are inhabited (*Key Economic Indicators*, 1993). Mainland Greece's terrain is marked by an abundance of mountains and hills, covering three-fourths of its land area. Wherever one stands in Greece, one is always within sight of moun-

tains and rarely more than 50 miles from the sea. Mountains and sea thus divide Greece into non-contiguous regions that place differing demands on OTE in providing telecommunications service.

Mainland Greece's mountainous terrain makes transportation difficult, so most land-based telecommunications cable routes follow the valleys or stay near the coastline. Since many of Greece's islands are not clustered in a contiguous area, guarantees on service restoration times are hard to keep. Rough seas, heavy winds and rapidly changing weather patterns place restrictions on the amount of available time for repair and maintenance.

Athens, the capital of Greece, has a population of more than 3.5 million people and is Greece's largest city. 42% of all telephone traffic for the entire country in 1994 were carried out from the Athens area (Annual Report, 1994) and it leads the country in telecommunications growth. Historic Thessaloniki, near the cradle of Alexander's world empire in northern Greece is now the country's second-largest city, with a population of 1 million. There are about 10,000 Greek villages, nearly half of them with populations of less than 2,000 people. These demographics have made it difficult to fulfill increased local and long-distance telecommunications demands.

Strategies to Provide Phone Services within Greece Given the Challenge of Geography

Meeting Local Demand: Expand number of exchanges, convert to digital networks

OTE has been migrating its installed base of manual and semi-automatic telephone exchanges to digitized, fully automatic exchanges. At the end of 1994, 2207 automatic local exchanges were in operation, with 31.4 million local calls per day. OTE has been able to field increased demand by converting more of its network to digital and automatic equipment, installing over 2400 miles of land-based fiberoptic cables and 417 miles of submarine fiberoptic cables. The cost of these services has remained below the consumer price index during the 1983-94 time-period.

Conversion to digital exchanges has helped OTE offer new facilities such as abbreviated dialing, three-party dialing, three-party service, call waiting, call barring and call diversion, etc., as well as improved quality of its services.

Meeting Long-Distance Demand Within Greece: Increase bandwidth, modernize cable routes

Long-distance demand has been increasing in Greece over the past decade (Figure 3). OTE's strategy to meet this demand has been in two directions: (a) Modernizing the communication network, and (b) increasing the bandwidth.

OTE's existing long-distance telephony depends on its trench, trunk and overhead phone lines. In 1994 alone, OTE has dug 1,432 km of trenches for the installation of phone

cables. New overhead installations of cable totaled 320 km in 1994. OTE has created "Telecommunications Rings" consisting of underground and overhead cables linking a geographically contiguous area completely. OTE's plan is to create many such rings linking major traffic routes. Four such rings are currently under construction, and are expected to be completed in 1997. Once these rings are complete, each of the rings can then be interconnected to the other easily, thus providing the foundation for a national telecommunications backbone network. This network will eventually be used for a large variety of applications including telephony, data collection and exchange, remote-printing, etc.

Concurrently, OTE has focused on increasing the bandwidth available from its installed network. To achieve this, OTE has been replacing its existing cable routes with fiberoptic cables, and installing fiberoptics in its new cable routes. The utilization of fiberoptics has yielded increased bandwidth gain to OTE while containing the costs of procuring, installing and maintaining its cables throughout the country. OTE has also significantly reduced its analog routes while digitizing its telephone exchanges and routers. For instance, by the end of 1994, the percentage of installed digital connections reached 31.37%, as compared to 21.83% in 1993.

Meeting Data Communications Demand: Grow HELLASPAC & HELLASCOM

The Hellenic Public Switched Data Network (HELLASPAC) is the country's premier data communica-

FIGURE 5
Data Network After Expansion



tion network, providing its subscribers with services such as X.75, X.25, X.32, X.28 data communications services, frame relay, virtual private networks, etc. Due to increased demand for these services, HELLASPAC is currently being expanded and has 53 new nodes installed, connected with an N-ISDN network (Figure 5). Five management control centers are responsible for a variety of operations including usage charges, statistics and quality control.

HELLASCOM is a high speed fully digitized leased line network with centralized management that allows data transmission at rates up to 2 Mbps. The network has now about 1,000 circuits, but it is going to gradually extend to 4,000 circuits by 1998. With the completion of this digitized network, OTE expects to be able to meet the region's data communications traffic demand to the end of the century.

Challenge 2

Providing International Telecommunications Services: Fast, Reliable Maritime and International Telecommunications

Greece has long been one of the world's shipping pioneers, with epics such as *The Illiad* and *The Odyssey* describing fantastic voyages across the seas. Modern Greece's merchant fleet is the seventh largest in the world and its most important port is Piraeus (Athens' seaport). Since Greece's sea-to-land ratio is approximately three to one, maritime telecommunications are vital for the sustenance and development of the maritime industry.

The continuing globalization of world economy linked by fast-paced changes in the telecommunications industry worldwide and the realities of a single European market highlight the demands placed on OTE's telecommunications services for international connectivity. Businesses no longer reside solely within their own country; OTE expects a continuation of the dramatic increase in the demand for international voice and data communication links.

The two examples below illustrate the demands of the maritime industry and those of international telecommunications:

Problem 1: Maritime Demands

A cargo of green Ecuadorian bananas is ripening slowly in the hold of a refrigerated Greek ship on its way through the Panama Canal bound for Rotterdam. The hold temperature has been set to ensure that the fruit will be ready for market two days after the ship docks. But a rescheduled cooking programme on Dutch television the evening of the ship's arrival is likely to create a huge demand for ripe bananas. To utilize this business opportunity, the hold temperature in the ship must be increased a few degrees so that the bananas will be ready for sale as soon as the ship docks.

Without a fast and reliable method of relaying the

changes required of the ship's captain, the message could take up to 15 hours to arrive; three hours in the traffic queue at the coast radio station, as much as 11 hours until the radio officer comes back on watch, and another hour following notification that a message is en route. The fruit will never ripen on time!

Problem 2: International Telecommunication Demands

A long-distance truck is driving north through central Spain, bound for Brussels with a cargo of melons. Word reaches the owner of the consignment in Thessaloniki, Greece, that he can get a better price in Switzerland. Can he divert the truck in time to catch the market? The conventional way to contact a vehicle on the road is to wait until the driver stops to phone in a regular, often daily, report. This arrangement links base and vehicle once a day, at the driver's convenience and only as long as he finds a working phone. For long-distance trucking, ground-based mobile radio is usually impractical because of range and reliability problems.

Strategies to Meet the Challenges of Maritime & International Demands

Satellite Systems — INMARSAT

OTE has increased data transmission speed to ships by subscribing to the services of Inmarsat. Inmarsat-C receivers (not much bigger than a car radio, less than 6 kilograms in weight and consuming 15/50W of power) could be placed in the ship and the headquarters, and can send or receive messages from anywhere to anywhere on the globe. The charge to the Atlantic and Pacific Ocean region is about 28 Drs. (US \$0.12) per minute and to Indian Ocean region is 20 Drs. (US \$0.09) per minute. This system is backed by Inmarsat, the world's first and largest mobile satellite communications enterprise, and by the communications organizations in about 60 countries, as well as a wide network of equipment manufacturers and distributors. Inmarsat uses eight satellites on its global system, some carrying commercial communications traffic and the rest as back-up spares to ensure continuity of service.

Every terminal commissioned into the Inmarsat system is allocated a unique Inmarsat mobile number. This is similar to a telephone number. Only messages addressed to that number are received by that terminal. Free services such as special distress altering coordination and medical assistance features are offered to ships that obtain these services. These services automatically generate and send a priority distress message, incorporating position and other information, to a Rescue Coordination center.

OTE has depended upon the Inmarsat-C satellite to provide two-way store and forward and data messaging from anywhere on the globe, using simple, low-cost, and easy to

install mobile terminals. Thousands of Greek vessels around the world, from fishing boats and leisure yachts to giant tankers and cruise liners, now have the same connections to the international telecommunications networks as everyone else, through Inmarsat. Connections to Intelsat, Eutelsat, and Inmarsat provide the phone satellite connections to the inhabitants of the islands and the crew in the ships.

Direct-dial telephone, facsimile, data, Telex, electronic mail and other services are now available through Inmarsat-C, backed by the reliability and 24-hour availability of satellites. For example, a cruise-ship passenger may make a credit-card telephone call home. The call will be routed through the ship's Inmarsat installation, which also handles the ship's data, Telex and facsimile traffic, as well as receiving a daily data news feed for the ship's newspaper. Some Inmarsat ship terminals can handle the equivalent of up to four simultaneous telephone transmissions, as well as automatic transmissions of position and other status reports from a vessel.

The use of these technologies provided by OTE can provide a solution to Problem 1 (Meeting Maritime Demands) posed earlier:

Solution 1: Maritime Demands - INMARSAT

With Inmarsat-C and an Inmarsat installation on-board the ship, however, the owner at Athens sends a message directly to the ship's bridge. Within minutes the captain is reading his new instructions as they come off the printer. The hold temperature is adjusted, and five days later, the bananas are unloaded in perfect condition for sale on the market.

International Services Growth - INTELSAT, EUTELSAT

International telephony for OTE is served by three international digital telephone exchanges. An obsolete analog exchange was taken out of operation in 1994. The 25% growth in international phone usage has been serviced by 8,428 telephone circuits connected to the United States and Canada through land-fixed links and to the rest of the world through four INTELSAT Satellite Earth Stations. OTE has initiated installation of new digital networks between Greece, Bulgaria, Italy, France, Cyprus, Albania and Croatia.

Intelsat satellite communications are provided by three earth satellite stations at Thermopylae's satellite communication center and one station at the Nemea satellite center. OTE uses three satellite stations for communications through the Eutelsat system. With eight satellites in orbit, EUTELSAT is by far the largest European space communications operator, providing distribution of television through satellite, satellite newsgathering, radio, telephony and the recently introduced Euteltracs mobile service.

Two communication systems, serving trucks moving in Europe, have been recently installed by OTE, through its subscription to the Pan-European Euteltracs system. A

second mobile satellite station, supporting the transmission of TV programmes is under purchasing procedures. A wide area paging system covers major parts of Greece.

With these newly acquired technologies, OTE could propose the following solution to Problem 2 (Meeting International Telecommunication Demands) posed earlier in the Challenge section:

Solution 2: International Telecommunication Demands: Mobile Satellite systems

The Greek truck on the Spanish highway is fitted with a satellite-based mobile communications system. In the cab, mounted on the dashboard is a simple keyboard and compact printer. With a muted buzz, the printer comes to life and delivers a message transmitted a few minutes earlier.

It's from the owner of the cargo in Thessaloniki, telling the driver to divert to Geneva. It continues with a clear description of the new route to be followed and finishes with the name, address and phone number of the Swiss destination. No repetitions or misunderstandings; just a clear permanent record that the driver can refer to whenever needed. The driver presses the "received and will comply" button and sets off down the road to increased profits.

Increase Market Share: Provide new services

New services, such as videotext and videoconferencing are now being offered. Videotext service is offered throughout the country. Video conference services are offered through studios and Eutelsat connections. A message handling system is under purchasing procedures, covering Greece, and providing services such as electronic directory, electronic mail, and electronic data interchange (EDI). A pilot narrow-band ISDN system is under construction, covering 12 digital exchanges within the country. This network will support circuit and packet traffic. OTE has introduced cardphones and phonecards in 1992, and has sold 1.5 million of them in 1994. OTE plans to retain and increase its market share by offering such new services at competitive prices.

Challenge 3:

Moving from a Monopoly to a Competitive Environment

OTE's operating conditions and environment have been radically altered due to the developments in technology and the liberalization of the telecommunications market at the national, European and international level. Having had a free rein of the Greek telecommunications market since inception due to its charter as the country's sole service provider, OTE faces a new challenge as Greek telecommunications markets are liberalized and private telephone companies are allowed to operate. The process of opening the market formally began in 1992 with the formation of a national regulatory body that promulgated the Liberalization Law

2075 authorizing competition to OTE. This regulatory body, called the "National Committee of Telecommunications," is responsible for regulations, licenses, and in safeguarding the rules of fair competition, similar to the FCC in the United States. E. Polythodorakis, OTE's Director of Telematic Services states (Mohan, 1994):

It is difficult to make the move from a subscriber-driven company to a customer-driven company. We have to change the mind and the behavior of our employees. We also have to make organizational reforms and reorganize some divisions. But we see that it is the only way to survive in the hard, new environment. The moves towards the formation of strategic alliances and internal reorganization are irreversible processes in coping with market transformations.

Strategies to Address the Challenges of Privatization and Competition

Form strategic alliances

OTE realizes that change is the only way to survive in the newly competitive telecommunications marketplace. The Telematics Division, for instance, has adopted the philosophy of change early. OTE is in the process of forming strategic national and international alliances with key providers of telecommunication technology with whom it will collaborate in the development and marketing of technology and services. A cooperation protocol has been signed with the Georgia, South Russia, and Albanian Telecoms so that OTE can play a role in the creation of the Trans-European Network. This will connect the Central ex-Eastern Bloc European countries with the South-Eastern part of Europe.

Introduce Profit & Loss Model (Reengineer)

OTE is in the process of a broad organizational restructuring. As an example, OTE has reorganized the Division of Telematics into a profit-and-loss model with independent income-and-expense accounting. The department will have its own personnel department and become a company within the company. This Profit and Loss model is being applied to OTE's various divisions in order to make each division more flexible, responsible and accountable towards the firm's profitability. This will place accountability with responsibility at each division of OTE.

Change employee attitude and focus

Since its reorganization began in 1992, OTE has focused on creating a customer- and service-oriented workforce. Emphasis has been placed on customers exercising their choice. The introduction of modern technology, the challenge of the year 2000, and the competition in the common European Market require continuous updating and training of personnel, in order to achieve professional expertise and to increase productivity. Employees are provided incentives such as

monetary prizes, technical and administrative retraining. OTE's gradual reorganization, comprising the restructuring of central and regional departments is within the framework of its modernization. A new Key Accounts department was formed to better serve large and important customers. Studies were made for the introduction of new working methods and operational systems, while OTE staff participated in international conferences, seminars, and working groups. OTE's main target was to improve and maximize the operation of its various departments and services.

Challenge 4

Change from Technology-Driven to Market-Driven Focus: Contain Costs and Improve Quality in High-Growth Period

Without proper controls, the high growth in traffic (approximately 12% per year) since 1983 could have been satisfied by an equivalent growth in expenses of OTE. With the rapid introduction of new and sophisticated telecommunications technologies, it would have been easy for OTE to spend enormous sums of money on these technologies. Similarly, OTE could have increased the number of its employees along with the growth. It would have been easy to let quality drop as growth spiraled forward for telecommunications. As the market becomes competitive, it is important for OTE to refocus its marketing strategies to be market-driven rather than technology-driven. During the past decade, OTE had been preparing for this market change by containing costs and improving quality of operations.

Strategies to Meet the Challenges of Cost-Containment amid Rapid Growth

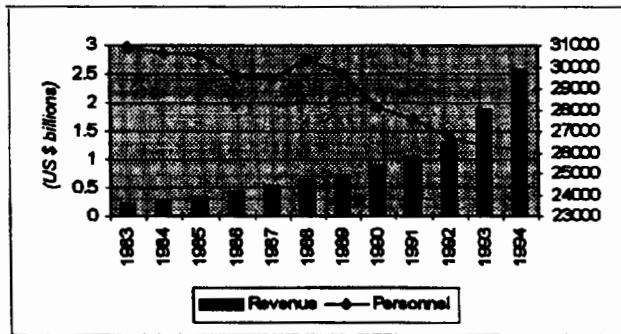
Improve operational efficiency

A comparison of statistics shows that OTE has increased the productivity per employee. The number of employees on OTE's payroll has decreased from 1983 to 1993, while revenue has increased consistently (Figure 6). OTE has improved its operational efficiency by three methods:

1. Change and/or replace labor-intensive processes
2. Maintain tight fiscal and debt control
3. Increase average wage per employee while reducing the number of employees.

For example, the average OTE employee in 1983 earned 1,068,000 Drs (US \$4,450); in 1994 the employee earned 6,636,000 Drs (US \$27,650). During the same time period, the number of employees decreased by over 4,765. OTE's administrative staff remained at the same level as in previous years. OTE has also increased the number of part-time personnel which has given it greater flexibility in managing its projects and people.

FIGURE 6
Improving Operational Efficiency



Reduce expenses, self-finance investments

OTE's operations expenditure to total revenue ratio has decreased since 1989 to 70, which is comparable to most European countries. OTE has also been able to finance its own investments through increase in cash flow, capital, and reserves as shown by the cash-flow-to-investments ratio (Table 2). The Cash Flow figure in the table shows the ratio of OTE's profits and depreciation as compared to its investments. OTE's profits have been increasing consistently through the 1989-94 time period, and at the same time its investments have also been increasing. The Cash Flow ratios, however decreased from 1989 to 1994, leading to the conclusion that OTE has been able to increase its investments expenditure substantially by financing them from its own profits. The 1994 investment program decreased by 15.9% from 1993 due to a change in how projects under construction were recorded. OTE's profits have also increased considerably, covering the total of OTE's debts, as indicated by the figures in the last row of the table. OTE has increased its revenue, increased its profits and increased the amount of its available cash, which it has then chosen to

reinvest in enhancing its technology. In summary, OTE has increased its profits since 1983, modernized its network, self-financed more of its investments, and at the same time held down costs.

Improve service quality

Substantial improvements have been made to the quality of services and further improvements are being planned. Unsuccessful calls have decreased from 5.8% in 1993 to 2.9% in 1994 and unsuccessful long-distance calls decreased from 3.7% to 2.5% during the same time period. OTE has improved its Quality Control processes, decreased phone downtime and is introducing new telecommunication services at the same time. A modern network management center has been installed in Athens and began operation during Summer 1995. OTE has also created a 24-hour "watch-dog" system to handle any reported problems, resulting in a decrease in the time required for fault correction.

FUTURE PLANS OF OTE

Since it is only two years since the liberalization move, it is a little too early to say how well OTE has coped with the change. Many new projects have been initiated for European Community and they have an impact on the change in OTE. For example, Greece's belonging to the European Community helps since they are part of the program for rapid telecommunication deployment within Europe. Organizational reforms also need to be done. Slowly, the employees are understanding that it is important to change; but a high amount of resistance is there. Sale of a 25% stake in OTE to the public is likely to go ahead. During March 1994, a contract for installing one million digital lines was given to a joint venture between Siemens Hellas and Intracom (*Mediterranean Update*, 1994).

Although pending demand for new telephone connection still remains at 407,000 applications, the rate of outstanding connections has decreased by 2.2% during this decade. This is an area where more work could be done to

TABLE 2
Financial Ratios Computed for OTE

Ratios	1989	1990	1991	1992	1993	1994
<u>Operations Expenditure</u> Total Revenue	83.6	81.6	79.3	76.0	70.0	70.5
Cash Flow: <u>Profits + Depreciation</u> Investments	111.7	105.9	77.9	54.1	60.8	84.1
<u>Net Profit before Taxes</u> Own Capital	12.7	16.5	19.5	23.6	32.7	39.1

reduce the outstanding applications. Modernization of the exchanges, new telecommunications equipment, and increased training of employees should address this challenge in the future.

OTE plans to continue investment in satellite communication systems in the future. The convenience, ease of use, unparalleled reach and cost-effectiveness of satellite-based systems are only now beginning to be realized. Greece's northern border meets the four other countries that make up the Balkan Peninsula, namely Albania, Yugoslavia, Bulgaria, and Turkey. As OTE expands into the Balkan and Eastern European regions, it expects to leverage its investments in satellite communications to increase its business presence in these new markets.

RECOMMENDATIONS TO IT MANAGERS BASED ON OTE CASE STUDY

OTE's responses to the challenges in its telecommunications marketplace provide a body of knowledge that could be transferred to other situations, and provide information that could be useful in improving the service, increasing employee productivity, and containing costs for telecommunications systems in developing and/or developed countries. The analysis of OTE helped create a set of explicit recom-

mendations to information technology managers responsible for the strategic direction and management of their company's telecommunications networks. Table 3 summarizes our recommendations for IT managers to meet telecommunications challenges similar to those faced by OTE in their organizations and countries. An explanation of these recommendations follows next.

Digitizing and expanding the telecommunications network enabled OTE to provide new services such as the HELLASCOM and the HELLASPAC data network, audiotex, paging, video conferencing, and phone cards. This is similar to British Telecom's efforts to introduce new services in the competitive telecommunications market in the UK. In the U.S., both the long-distance and the local telecommunications companies have been digitizing their networks, enabling them to offer innovative new services such as call forwarding, voice mail, and ISDN networks. Further, digitizing networks reduces network downtime, and provides automated mechanisms to track and correct faults in a timely manner. OTE's 24-hour "watch-dog" group that is always on call for resolving network problems is one such way to ensure that the overall quality of service offered to the customers is improved.

Another strategic response of OTE has been to deploy

TABLE 3

Possible Strategic Responses of IT Managers

USE THIS STRATEGY	TO MEET THIS CHALLENGE
• Digitize and expand the telecommunications network	– To provide new services and improve quality.
• Deploy fiber-optic cables	– To provide higher bandwidth services.
• Create "Telecommunication Rings"	– To meet challenge of geography and create a National Telecommunication Backbone Network.
• Invest in INMARSAT Satellite Technology	– To meet maritime demand.
• Invest in INTELSAT/EUTELSAT Satellite Technology	– To fuel international services growth.
• Form Strategic Alliances	– To increase worldwide market presence.
• Privatize telecommunications sector	– To improve quality and decrease price of services to customers.
• Make individual departments accountable for Profit and Loss	– To improve firm's profitability.
• Make employees customer-focused	– To change company's attitude from monopoly to competitive environment.
• Improve operational efficiency	– To improve employee productivity.
• Self-finance investments and pay down debt	– To reduce debt burden and increase profitability.
• Improve service quality	– To change from technology-driven to market-driven focus.

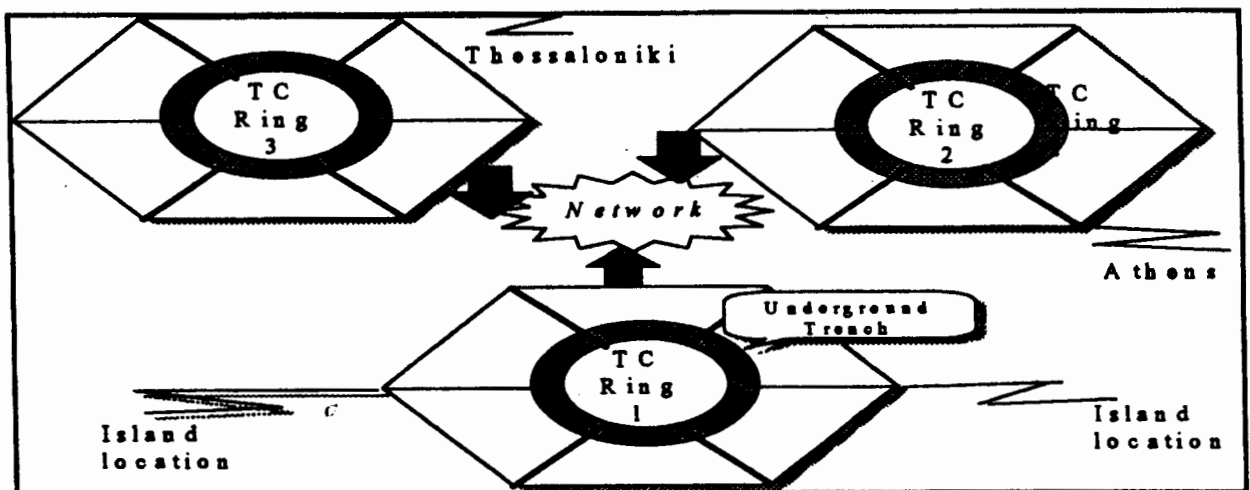
fiber optic cables in high demand areas so that high bandwidth services could be offered to customers. This fiber optic network also ties in with the development of Greece's core switching network. Telecommunications carriers around the world have been increasingly deploying fiber optic networks since they are lighter and provide a much higher bandwidth compared to coaxial cables. Information technology managers in developing or developed countries could use this strategy of deploying fiber to offer high bandwidth services. Although the initial cost of fiber optic networks is higher than conventional copper, the benefits provided by new services and lower maintenance costs more than offset the initial costs. Information technology managers at OTE consciously embraced change and adopted new technology into their networks, which has resulted in increased network usage for the company, a strategic response that could be used by telecommunications managers in other countries.

OTE created "telecommunications rings" consisting of underground and overhead cables linking geographically contiguous areas. Figure 7 shows a schematic of a telecommunication ring. Such rings provide an ability for OTE to create a National Telecommunications Backbone network. The Telecommunication Ring strategy is an effective way for countries to create backbone networks nationwide that are architecturally scaleable. This strategy provides end-to-end connectivity between various geographic regions, as well as a disaster-recovery backup mechanism. As countries race towards the global information superhighway, the creation of a national backbone network is an important goal, and OTE's strategy could be successfully applied elsewhere.

OTE has invested in satellite technologies such as INMARSAT, INTELSAT, and EUTELSAT to meet maritime and international demands. This approach has been effective in dealing with the unique demands of mobile commercial operations on land and at sea. In Europe, the Scandinavian countries have also invested in satellite technologies to cater to their maritime traffic. This response would be of use to countries that have many islands and have a strong maritime economy. New satellite technologies such as Iridium are being created that would provide more cost-effective solutions to consumers in the future. The use of satellite technology allows telecommunications companies to receive and transmit a large part of their international telecommunications traffic (telephony, television programs, faxes, and data) through earth nodes that relieve network congestion and provide increased reach to telecommunications markets in other parts of the world. Further, these earth nodes serve as a transit point between neighboring countries and the countries of Europe, the Middle East, the Americas and Africa. Both INTELSAT and EUTELSAT are well-established satellite services whose services can be leased by IT managers, and provide a competitive advantage to their telecommunications organizations.

OTE's extensive international relations were further developed in 1994 and 1995. Telecommunications cooperation with Cyprus, France, Bulgaria and other countries has been promoted by OTE, including the signing of strategic alliances and reciprocal arrangements with these countries. This is in keeping with the worldwide trend of companies that are increasingly forming strategic alliances in order to

FIGURE 7
Example of Telecommunications Rings



increase their global market presence. For example, France Telecom has formed a strategic alliance with British Telecom, German Telecom, and United States telecommunications carriers so that it could offer global services to companies. The big three United States telecommunications companies have all formed various strategic alliances with the primary telecommunications carriers around the world to ensure that they retain a competitive market edge. This strategy of forming international alliances would be an effective way to ensure that a country does not get left behind in the fast-paced telecommunications world.

With the privatization of state monopoly, OTE has begun to reorganize its operations to maintain a leading position in a competitive telecommunications market. Privatization of telecommunications companies throughout the world has been considered to be a major step in improving quality and decreasing price of services to customers. OTE has been focused on the move towards privatization, but the pace of privatization has been relatively slow. This is quite similar to the situation in other major European countries, where all telecommunications services have been provided by state-run monopolies. Europe is only two years away from a wholesale deregulation of its telecommunications markets, by a commonly agreed upon statute. United Kingdom is arguably the most deregulated of the world's major telecommunications markets, with freewheeling competition among long-distance and local telephone carriers, including American companies such as Nynex. Germany, France, and Switzerland still operate as monopolies, but the European and global trend is toward deregulation and open-market competition in the telecommunications area, resulting in pressure on telecommunications carriers to privatize. Deregulation of telecommunications carriers has been proceeding at a hectic pace in the United States. Information technology managers worldwide could use strategies similar to OTE's to face the inevitable forces of change leading toward liberalization and privatization of telecommunications markets.

OTE has put in place a reengineering plan that places increased accountability and responsibility for every division by creating individualized Profit and Loss model. This strategy seems to be working at OTE's Telematics and New Services Department, which is negotiating the fundamental changes in its marketplace by emphasizing individual accountability and responsibility. Creating division-wide accountability is an effective strategy for IT managers to sustain their services and make them responsive to both customer and competitive needs. This would also be a useful way to identify profitable sectors in order to increase attention to those areas of the market, and to find out the unprofitable divisions so that they could be returned to profitability.

An important recommendation to information technology managers is to change employee attitudes so that the com-

pany's employees become focused on customer needs and requirements. As OTE's Polythodorakis states, "Little by little, the employees understand that they have to change. We see that this is the only way to survive in the hard, new environment." Changing employee attitudes is a long-term task that needs to be undertaken by IT managers if they intend to have the solidarity and support of their staff in facing the newly competitive environment. OTE's Polythodorakis' strategy, for example, was to educate his employees about the new market realities, and to provide them with a set of guidelines. These guidelines were backed up by incentives that encouraged customer-focus.

OTE improved operational efficiency so that the productivity per employee was increased. OTE has focused on increasing the quality of its personnel rather than their number; 86% of the employees have university or higher education degrees. OTE also invests resources in employee training programs. This strategy of hiring higher quality employees, and training them to perform their jobs better could be effectively utilized by IT managers at other companies; this strategy provides the additional benefit of not having to increase the overall headcount, since a better trained employee becomes more productive at work. Similarly, OTE's strategy of self-financing a large part of its investments and the paying down of its debt, has resulted in the reduction of interest and debt burdens on the company, with a significant increase in overall profitability. As telecommunications carriers around the world become poised to offer new services, self-financing investments and keeping a light debt-burden would provide increased leverage in improving productivity and containing costs.

One of the most important recommendations to IT managers is to improve their network's service quality. In an era of increased competition, globalization of businesses and tougher fights for market share, creating and maintaining a reputation for high service quality could become a potent competitive differentiator. OTE's examples in reducing the percent of unsuccessful calls, introduction of a new Quality Control process, and the installation of new 24-hour network management centers, provide important lessons for IT managers who have been entrusted to change their company's focus from being technology-driven to becoming market-driven. The above discussion points out that the strategic responses adopted by OTE could be used by IT managers in resolving the challenges faced by their companies in developing and developed countries.

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