FINAL REPORT

NATIONAL INDUSTRIAL POLICY

INFORMATION TECHNOLOGY SECTOR

Prepared for
The Planning Institute of Jamaica
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by

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1.0 Executive Summary

The metaphor of the global village linked by a "superhighway" has already become commonplace, creating a vision of participation, in which the individual nation participants are linked by the capability to receive and disseminate information; by implication, only those who participate in this global information network will be able to share in its benefits. It then follows that every member nation must have not only a highway that connects it to the superhighway but also the savvy to maintain such a highway. One way to accomplishing this is by transforming it into a conduit of economic activity, thus leading to greater national wealth.

This report presents in detail the nature of the emerging global community linked by telecommunications and networked computers and the way in which Jamaica can become not only an active but a thriving member in it. Thus the first half of this report presents a detailed review of the global trends in information technology (IT). Specifically, it analyses the developments and projected advances in the fields of data communications, telecommunications, semiconductor VLSI electronics, consumer electronics, computers and software. The development of the Internet and its further growth is then outlined, especially with regard to its application as a distribution channel for on-line services.

The conclusions are that the availability of low-cost, personal computer (PC) platforms incorporating powerful single- and multi-chip microprocessors coupled with the availability of low-cost software tools and applications make it possible for nations such as Jamaica to create significant IT-related products and services. More importantly, the emergence of the Internet and its unprecedented market reach is enabling such nations to offer their products and services to global customers.

The second half of this report examines Jamaica's currently emerging information technology sector comprising not only products and services *per se*, but also the supporting infrastructure of telecommunications, human resources and education among others. A vision for Jamaica's information technology sector is then presented. Four areas of development within information technology are envisioned: Internet-related products and services; information technology-based services; on-line data services; software. Policy options and strategies for fulfilling this vision are outlined, then specific recommendations including timing and priority are made for each area of development.

By implementing these recommendations, Jamaica can successfully transform its current two-lane country link to the global community into a twenty-first century multi-lane highway.

2.0 Introduction

Information technology (IT) and the telecommunications industry are not only changing but are the catalysts for massive and permanent societal changes. The technology developments in telecommunications together with the evolutionary advances being made in very large-scale integrated (VLSI) electronics and in software engineering are enabling the three key sectors - telecommunications, networked computing and interactive entertainment, to grow into a single industry. The new information technology age will completely distort distance and significantly alter work habits, and make permanent changes in global commerce and business transactions[1].

Developing countries such as Jamaica must find ways to adapt and absorb information technology in order to participate fully in the global village, otherwise these technological changes could be a potential barrier to economic growth and development.

In order for Jamaica to participate profitably in the global changes already brought about by information technology, and to prepare its citizens for new developments, the recommendations made in this report should be implemented as quickly as possible.

[1] According to the International Data Corporation, the Framingham, Massachusetts provider of information on information technology, as reported at their Directions 95 Conference held on March 1995 - worldwide spending in 1994 for information technology - computer hardware, software, data communications equipment, and services, grew by 10.1 percent to US$430 billion. Companies in the US generated 43 percent of this spending. Sixty-two percent of these companies receiving revenues were based in the United States. Spending in the U.S. grew by 10 percent in 1994, exceeded only by the Asia/Pacific region at 12.9 percent. The expenditures of $430 billion was divided as follows: IT services (34 percent), single-user systems (28 percent), packaged software (18 percent), and multi-user systems (15 percent). Data communications equipment (modems, network interface cards, hubs, routers and other networking equipment) amounted to 5 percent or less than $5 billion.

Information technology is making a significant transition to the era of the Information Superhighway. The focus globally is on building connections between businesses and consumers, as well as government and educational institutions. This is borne out by the following statistics: whereas proprietary mainframe computers and minicomputers peaked with 10 million users in 1980, personal computers, LANs and open systems are peaking in 1995 with 100 million users. The Information Superhighway will peak in the year 2015 and will mature into the full blown Information Society by 2025. By the year 2000 in the U.S., there will be 40 million home PCs with CD-ROMs, 30 million televisions with interactive TV set-top boxes and 25 million video games with CD-ROMs all on the Information Superhighway. Also by the year 2000, the typical PC will have 128MB of memory, 8 gigabytes of disk space, a 400 MHz processor, 32-bit sound, a HDTV monitor, a 1.2 MB/s CD-ROM. Nicholas Negroponte, Professor of Media Technology at MIT and Founding Director of the MIT Media Laboratory, predicts that over 1 billion users will be connected to the Internet by the year 2000.

2.1 An Approach to Identifying Information Technology Policy Objectives for Jamaica

This report begins with an analysis of world trends in the key technologies that comprise information technology. An analysis of the current status of the Jamaican information technology sector and an explanation of working with the Internet is followed by a vision for the future of the information technology industry in Jamaica. Out of these considerations emerges a series of suggested policies which should be adopted by the Government of Jamaica in order to allow the country the opportunity to participate profitably in the global transformation which is taking place in information technology and commerce. Conclusions and recommendations are presented in Chapter 8.

2.2 How This Report is Organised

This report is organised in eight chapters as follows:

Chapter 1 is the **Executive Summary**.

Chapter 2 - **Introduction**, describes the organisation of the report. It discusses the purpose of this report and outlines the main objectives. The differences between information technology, the Internet and other similar terms are defined.

Chapter 3 - **Global Information Technology Trends**, provides an overview of the global trends for the technologies that make up information technology. Included are brief discussions on the main trends likely to occur over the period 1995 to 2010 for data communications, telecommunications, solid state and very large-scale integrated (VLSI) electronics, consumer electronics, computers and software. The relevance of each of these technologies and implications for Jamaica's industrial development is discussed.

Chapter 5 - **Situation Analysis for Jamaica**, discusses the present status of information technology in Jamaica. The main components of the existing information technology infrastructure are reviewed. The conclusions and findings of recent market research data are presented.

Chapter 6 - **A Vision of the IT Industry in Jamaica**, describes a basis for implementing a wealth producing IT industry in Jamaica. Four key components of such an industry are outlined.

Chapter 4 - **Accessing Markets in the Global Village: The Internet and the Information Superhighway**, provides an insight into the new workings of the information superhighway. It describes how multi-national businesses are using this new media for commerce, and suggests how the Internet may be used for export promotion of Jamaica's traditional and future products.

Chapter 7 - **Policy Options and Strategies for the Implementation of a Jamaican IT Industry** addresses various policy options and IT implementation strategies. Each option is related to the market size and practicality of implementation.

Chapter 8 - **Conclusions and Recommendations** states conclusions and recommendations.

3.0 Global Information Technology Trends

3.1 Overview

Information exists in many forms, the most common being - textual (alpha), numeric, audio, video (visual) and graphical. The technologies that allow any one or more of these forms to be processed i.e. transmitted and/or received, manipulated, stored and retrieved use one or more of the following:

- Data communications
- Telecommunications
- Semiconductor VLSI electronics
- Consumer electronics
- Computers
- Software

All of the above technologies make up Information Technology and each of these will now be defined as follows:

- Data Communications is primarily concerned with the transmission of digital data
- Telecommunications is concerned with communications using telephony techniques (wired or wireless)
- Semiconductor VLSI electronics combines the hardware logic functions within integrated circuit chips which are used as key hardware components
- Computers are programmed machines having central processors and peripheral circuits that are either used in stand-alone mode or may be embedded in appliances as in the case of a cellular phone
- Software is that technology that allows the computer and/or the personal appliance to function according to a predefined set of instructions.

Technology advancements have enabled significant changes in the IT industry: information can now flow in a "seamless" manner across different media or platforms. For example, data from remote databases and on-line newspapers can be accessed by computer and TV monitors where it may be stored and printed at will. Before the year 2000, information and entertainment content will be widely distributed by video servers to high-performance computers in the home which will be able to execute computing and multi-media functions using multiple microprocessors, CD-ROM and other advanced forms of high-density storage.

The global information technology industry is characterised by:

- The fast pace of technological development
- Rapidly declining product prices
- Large research and development expenditures
- Large capital costs
- An extensive global reach with expanding consumer markets

The determining factors that have shaped the global IT industry are:

1. Economies of scale

2. Close interaction among the players in the industry chain -- An increasingly large number of the functions of research and design, manufacturing, marketing, application development and customisation for a given product are done not by one firm but by several firms that contribute complementary strengths. For example, semiconductor fabrication equipment suppliers work closely with semiconductor chip manufacturers so that advanced integrated circuit systems can be produced with high yields at the lowest costs.

3. Improvements in one industry segment benefit others -- there is considerable diffusion and cross-fertilisation of ideas and concepts between companies. For example, advances and breakthroughs made by Compaq Corp., - a leading personal computer systems manufacturer, in predicting in real-time the reliability of hard disk storage devices, are now being adopted and incorporated across the computer industry - by software companies such as Microsoft and hard disk manufacturers such as Seagate Technology.

4. Firms of Different Sizes Play Complementary Roles -- The companies that make up the IT market span a large range of sizes. In the computer hardware industry, for example, large companies such as IBM and Compaq dominate the established markets through economies of scale, while smaller companies concentrate on specialised products. Of the more than 25,000 electronic manufacturing firms in the U.S., more than 95% of that number are small firms with assets of less than US$10 million.

5. Competition co-exists with Cooperation -- Cooperation does co-exist with competition. For example, IBM and Toshiba at present are cooperating in the development of next-generation 64Mbit DRAM technology. Similarly, Apple Computer and IBM, traditional computer competitors, now work in cooperation to produce new personal computer operating system software.

6. Competitiveness through technology development and market strategies -- The cost of labour is no longer the major determinant in factory location. Instead markets, capital costs access and technology infrastructure have become important.

7. Developments in Telecommunications and Computing have made distance irrelevant, thus enabling collaboration, cooperation and exchange regardless of physical distance.

Information Technology Market Size

The global information technology market between 1985 and 1990 grew from US$745 billion to US$1,263 billion, and is projected to grow to US$2,065 billion as shown in Table 3.1.

The information technology services segment, valued at US$290 billion in 1990 and expected to rise to US$380 billion in 1995, is comprised of revenues from film, publishing and other

specialised services. This segment is of particular interest to Jamaica since these services include data entry, telemarketing, value-added IT services such as multimedia content (film, publishing, music, art), databases.

Segment	Value in US$ billion			
	1985	1990	1995	CAGR[6] (%)
IT Hardware[1]	200	380	730	12.8
Software and Services[2]	70	175	400	18.4
Telecom Equipment[3]	80	108	145	6.0
Telecom Services[4]	225	310	410	6.2
Information Services[5]	170	290	380	8.2
Total	745	1263	2065	9.5

Table 3.1. Global Information Technology Market, 1985 - 1995[7]

3.2 Data Communications: The New Topologies

The key system component for data communications is the hardware backbone and the corresponding signalling protocol that is used to control the digital data. For many of the services that are envisioned for the future, the delay in their introduction is due mainly in part to the transmission limitations of existing copper cable networks and the inherent high cost of new networks based on new protocols such as asynchronous transfer mode (ATM). Other protocols such as integrated services digital network (ISDN), an all encompassing CCITT standard for global digital communications - voice, data, facsimile, video and on a single system, has been making slow progress. While the implementation of ISDN on a massive global scale is far off, its adoption is being accelerated by the intensive use of graphics on the Internet. While new developments in digital voice compression techniques will allow the original 64 Kbps ISDN rate for PCM-coded voice to be adequate, there is still much resistance to the large-scale adoption of ISDN. At the present, it is reasonable to predict that the driver for accelerated adoption of ISDN will be the predicted large growth of graphical clients on the Internet.

Another type of cabling infrastructure, fiber-optic, still represents the largest single investment for most data communications networks in most countries. As the economies of scale evolve, the cost of fiber-optic cable is now within the reach of most large data networks for large businesses and campuses.

[1] Includes semiconductor components, consumer electronics, computers, private telecommunications equipment.
[2] Includes value-added networks, services and maintenance
[3] Public switched telecommunications network (PSTN) plant equipment
[4] PSTN revenues
[5] Revenues from film, publishing and specialised information services.
[6] Excludes consulting services. CAGR = Compound Annual Growth Rate
[7] Source: *World Bank estimates*

Asynchronous Transfer Mode (ATM)

Asynchronous Transfer Mode is an emerging high-speed mode of operation that supports broadband integrated services on digital networks. Its advantage of high speed is at present offset by its high cost, which is projected to decrease significantly by the year 2000. All of the information - voice, data, image and video, in the form of digital data that is to be transmitted, is first fragmented into short, fixed-sized frames known as cells. These packets are then switched and routed using packet-switching principles.

In addition to transporting voice, video and data, some ATM field trials are taking place for transmitting video-on-demand. Compared with ISDN which allows data, video and voice to be sent over the same phone line, ATM is primarily used to distribute these various media types to multiple points on a local- or wide-area network (LAN or WAN). The projected rate of adoption for ATM at Fortune 1000 sites is shown in Fig. 3.1. It is projected that the number of Fortune 1000 sites in the U.S. connected with ATM WANs will increase from 5,200 in 1998 to over 120,000 sites by the year 2005.

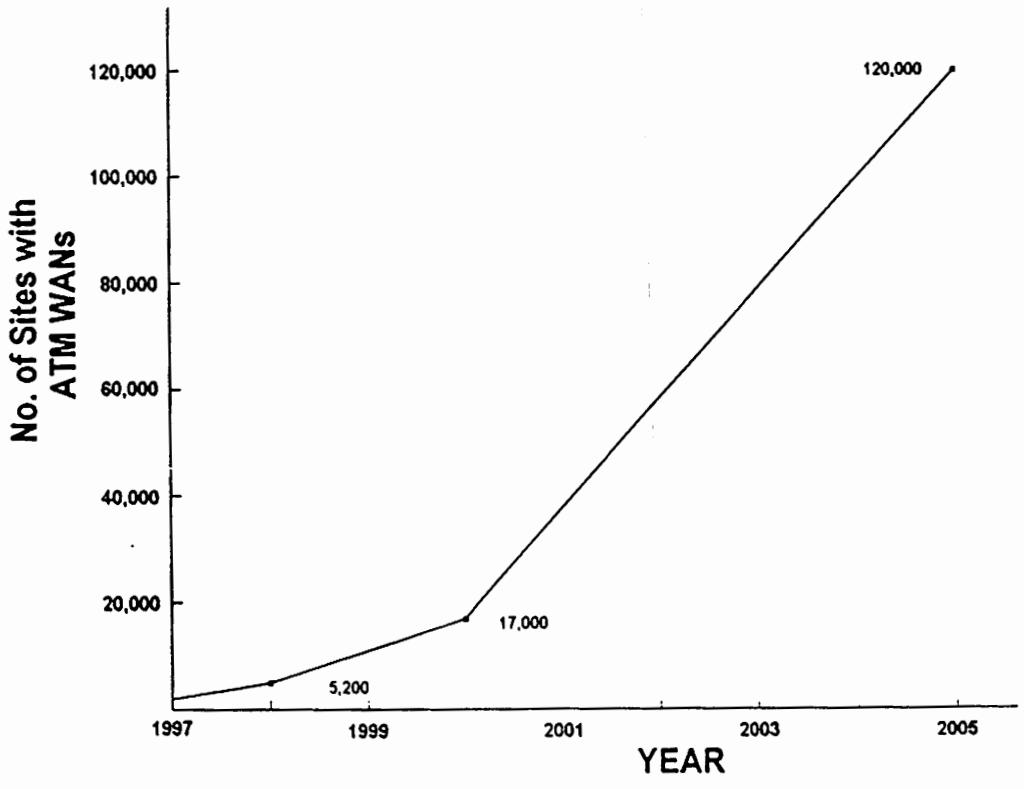

Fig. 3.1 Projected Adoption of ATM Technology in U.S. Fortune 1000 Sites

Technical Status of ATM in 1995

At present, the various system vendors are establishing standards and specifications that will allow ATM to be available as a desktop standard by the early 2000's. The three major issues are cost,

mature standards and inter-operability. The ATM Forum, an organization of 600 members created to formulate standards for the operation of ATM recently met and agreed on a variety of issues related to the adoption of ATM on the desktop. In order to bring the low-cost ATM to the marketplace, the body backed a low-speed specification for running ATM at 51 Mbps. There are also two other proposals that would reduce the cost of wiring the desktop even further by reducing the speed to 25 Mbps. The other major issue is inter-operability. It is expected that by 1997 there will be full inter-operability between various vendors' adapters and switches.

Future for ATM: 2000 - 2010

It is expected that ATM will be the dominant networking standard by 2010. The scenario for the evolution of networks for the period 1995 to 2010 is shown in Fig. 3.1. Although ATM components are already appearing on the desktop, there will not be widespread use of ATM technology within LANs until 2010. Before then however, ATM technologies will have migrated from use within switching systems at the central office to the wide area network (WAN). By the year 2000, ATM switches will be standard equipment on the high-speed backbone sections of networks, with full migration to the desktop by the year 2010. By then all PCs and workstations will incorporate video-conferencing.

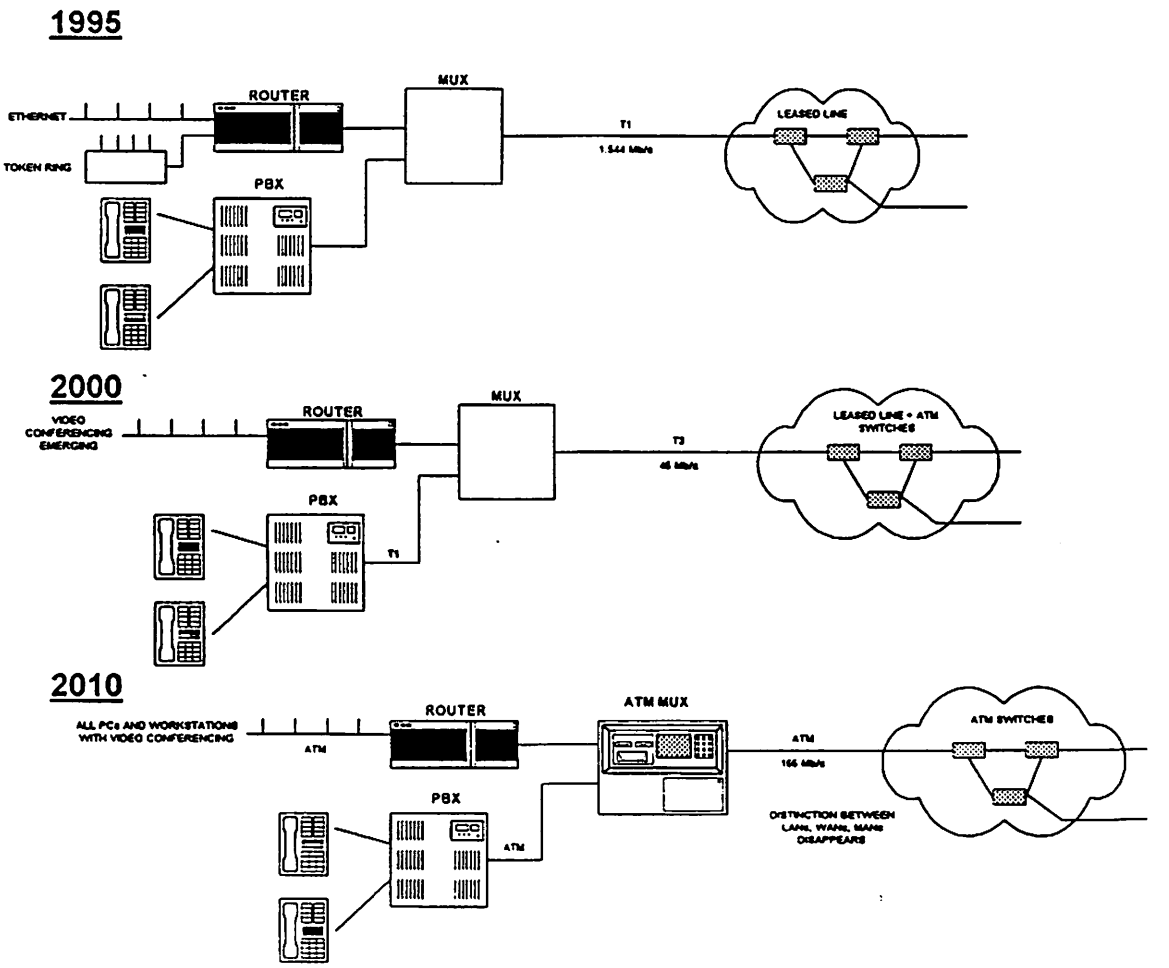

Fig. 3.2 Projected Evolution of Networks Showing the Role Of ATM Technologies - 1995 - 2010

Data Communications Protocols - Future Scenario

Presently there are two sets of data communications protocols in use - OSI, or Open Systems Interconnect, and TCP/IP, or transmission control protocol/internet protocol. The OSI protocol defined by the International Organization for Standardization (ISO) consists of several transport protocols and applies to the specific part of the network on which they run. The TCP/IP protocol, controlled by the Internet Architecture Board/Internet Engineering Task Force (IAB/IETF) is connection-oriented user-to-user protocol or service. It provides handshaking by establishing, maintaining and releasing connections. It also handles the requests for the reliable delivery of the information to its destination.

Before 1994, these two protocols were viewed as rivals from two different worlds. After nearly two years of negotiations, an agreement was struck in mid-1994 between the two bodies for information sharing and cooperation in ensuring compatibility between these two major networking standards. It is expected that the TCP/IP addressing schemes presently in use will be modified to allow for the large growth that is foreseen for the Internet population and also to allow for compatibility with the internationally installed base of OSI-compliant networks. The other changes expected to be incorporated in the IP protocol are support for mobile operations, enhanced provisions for security and auto-configuration features.

Other Data Communications Topics

The projected developments in modem technologies for the period 1995 to 1999 are shown in Fig. 3.3. The current standard is the International Telecommunications Union (ITU) V.34 standard. More than one million modems which support this standard which supports up to 28,800 kbps operations are expected to be shipped in 1995. Global sales of V.34 modems will rise to 7.65 million units by 1998 corresponding to US$1.5 billion revenues. The range in types of modems are from network-managed units to simple ISA bus and PCMCIA fax/modem cards for personal computers. The key market driver in 1995 and for a number of years will be the personal computer interface to the Internet's World Wide Web. Because of the unprecedented growth in applications for the Web, users are and will demand increasingly faster communication interfaces using the present connections of two-wire copper telephone wires for browsing complex graphics video and sound content on the Web. The next standards will be the ITU's V.34bis which will support line speeds up to 35 kbps. After that it is projected that the capabilities of analog modems to support more than 40 kbps on a standard telephone line may reach its limits. This will leave an opening for ISDN and ADSL technologies to enable users to connect interfaces of between 64 to 128 kbps of digital data to their home computer. The number of ISDN switches in the United States rose from 116 in 1992 to 2,400 in 1994, with the base of customers tripling from 100,000 to 300,000 in the same period. Although less than 70% of the US phone lines are ISDN ready, some regional carriers such as Pacific Bell are offering ISDN rates as low as $22.50 per month and a rebate on the $250.00 installation fee. While future analog modems will not have the capability to support line speeds as high as 128 kbps, it clear that there are other technologies such as ISDN, ADSL and Cable modems which will fill the need. ADSL and cable modem technologies are discussed in Chapter 6.

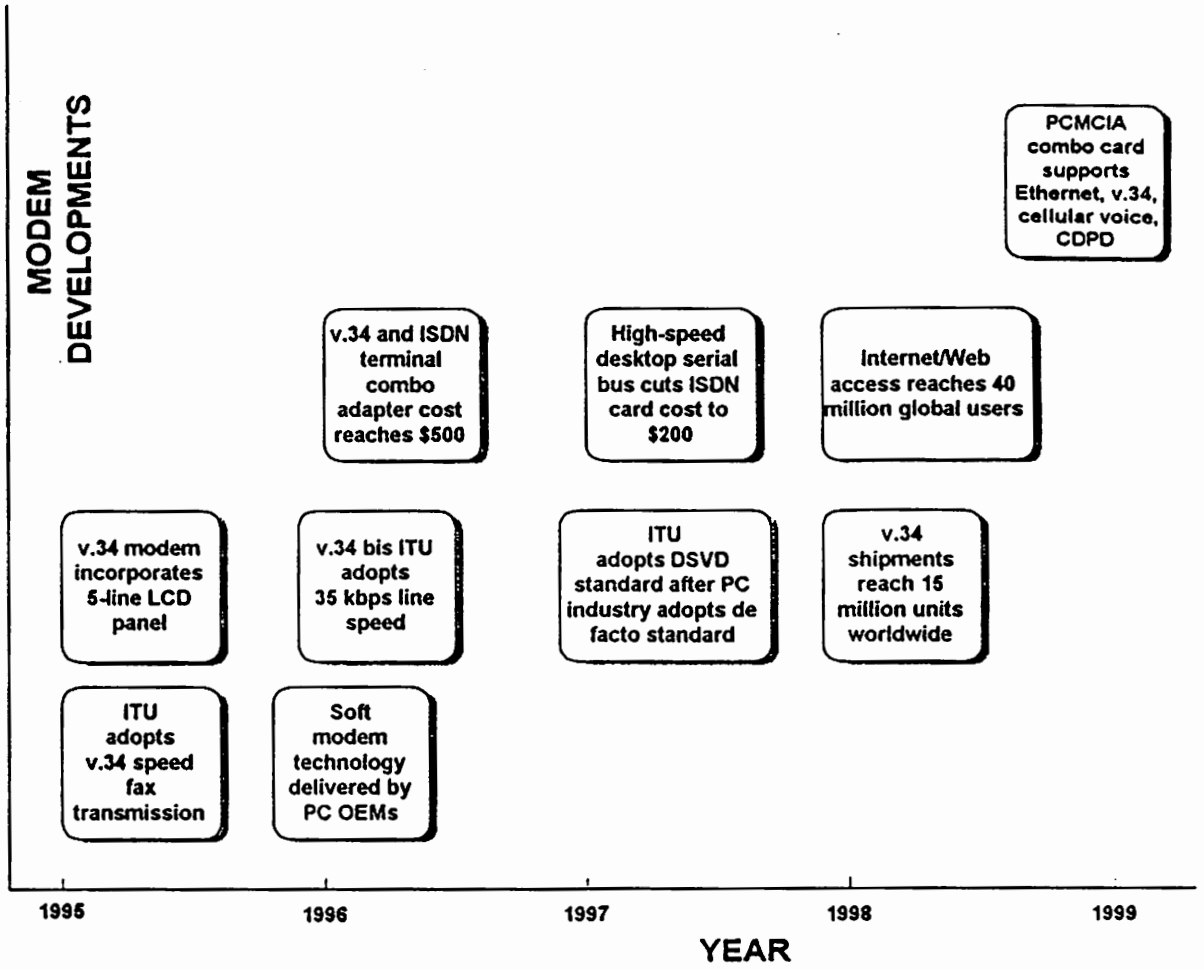

Fig. 3.3 Projected Developments in Modem Technologies - 1995 - 1999

3.3 Telecommunications: Wired and Wireless Technologies

The telecommunications industry is in the middle of a second wireless revolution. The first wireless revolution occurred with the adoption of citizens band (CB) radio between the late 1960's and early 1970's. That revolution was a victim of its own success due to the high growth rate of CB installations and the concurrent rapid and uncontrolled saturation of the radio spectrum and the corresponding lack of proper traffic management services. The CB phenomena however clearly indicated that there was a demand for an in-expensive portable means of communication.

Today's wireless revolution is the result of advances made in low-power semiconductor electronics and satellite communications systems. Further emerging wireless systems developments will allow a global seamless wireless network to be possible by the year 2000. Such a system will allow users from anywhere and at anytime:

1. To access a range of personal information and messaging services with a notebook computer or palm-sized personal digital assistant (PDA) or communicator with a wireless interface.

2. To place and receive calls on portable personal telephones to access either an office wireless local-area network when inside a building or public personal communications network (PCN) when outside.

Such systems will allow users and machines to communicate anytime, anywhere using voice, data and messaging services.

Telecommunications Projections for the Period 2000 - 2010

Although at present there is no one telecommunications technology or system that will support all applications or end-user needs, it is expected that the evolving set of systems and technologies ranging from narrow-band cordless systems to advanced digital cellular technology will eventually merge to serve the required applications seamlessly across the varying environments.

The end-user environments for wireless telecommunications can be categorized into four service zones as follows:

1. Global or National Service Zone - this zone is characterised by universal coverage throughout the given country or region or for that matter the entire globe; low user densities; minimal bandwidth requirements. Wireless service in this zone is typically provided by satellite systems having mega-cell coverage and radii of hundreds of miles. These satellite systems comprise more than one satellite either in low-earth orbit (LEO) or geo-synchronous orbit. The 77-satellite Iridium system is a typical example which is discussed in detail below.

2. Mobile Service Zone - characterised by radio coverage in urban, sub-urban and populated rural areas; has medium to high user densities; low to medium bandwidth requirements and high-speed vehicular service. Service for this zone is provided by terrestrial-based macro-cells with coverage of 1-20 miles. The North American AMPS system is typical of this service.

3. Local/Micro Service Zone - Radio coverage of densely populated areas, malls and transportation centres; high end-user densities; medium bandwidth requirements; hand-held portable terminals and low-speed mobility. Service to this group is provided by terrestrial-based systems having micro-cell coverage with radii of less than one mile. Spectrum re-use is common in this service area operating with low-power hand-held units for use in both mobile and stationary applications.

4. Indoor/Pico Service Zone - characterised by in-building radio coverage, low to high user densities, medium- to high-bandwidth requirements and very low mobility. The cell size in this zone is typically hundreds of feet.

The wireless model of communications typically is a single terminal for voice or data that can be used seamlessly across all environments. This model of a seamless, end-to-end global service will be a reality by the year 2010.

The Iridium Global Communications System - A LEO System for the Period 1996 and Beyond

The Iridium system's principal sponsor is Motorola Satellite Communications Inc. of Washington, D.C. This Big LEO (because of its operation above 1 GHz) type of global telecommunications system is also supported and financed by a number of foreign countries and governments.
The system is comprised of a constellation of 77 satellites where at least one satellite is in radio line of sight (LOS) at all times with every point on earth. It forms then a global low-user density cellular service at a higher price than terrestrial cellular. In areas of the world where there is a terrestrial service, Iridium acts as a backup, and in other areas where there is no terrestrial cellular, Iridium is the mobile service providing additional cellular channels with shorter delays to areas already served, and telephone service to areas not already served.

Each of the satellites is in low-earth orbit at an altitude of 420 nautical miles (778 km), allowing the system to provide service to each Iridium user within a range of 1250 miles (2315 km) of a given satellite. Thus the power requirements for Iridium's radio telephones are much less than that required for telephones associated with the 19,000 mile range of the comparable geo-synchronous satellite communications system.

The satellites are interconnected in space via microwave cross links with linkages to ground via gateways. Each gateway has an interface to the local public switching telephone network. The radio links between the satellites and users are in the 1600 ton 1700 MHz frequency range, and the satellite links are at 18 to 30 GHz. The battery life of the hand-held terminals or communicators are projected to be 24 hours on a single charge, and 23 hours of standby (able to receive an incoming call or ring) plus one hour of continuous calling time. The power output is typically 600 mW.

In addition to voice, Iridium customers will be able to use the following transmit and receive communications services:

1. Two-way messaging and radio determination location
2. Digital voice communications - full duplex at 4.8 kb/sec.
3. Paging - using instantaneous satellite paging for global coverage
4. Facsimile - standalone as well as mobile
5. Data at a 2.4 kbps rate

The projections for the number of subscribers for the Iridium system for the period 2000-2010 are shown in Table 3.2. Approximately 1.8 million subscribers are expected to be on the system by 2000 rising to 3.2 million by 2010.

Segment	2000		2010	
	US	World	US	World
Maritime	7,000	8,000	8,000	45,000
Business	180,000	448,000	270,000	800,000
Telecommuters	210,000	820,000	335,000	1,515,000
Aeronautical	13,000	22,000	16,000	34,000
Industrial	50,000	140,000	70,000	230,000
Government	36,000	292,000	50,000	450,000
Rural	0	67,000	0	150,000
Total	496,000	1,824,000	749,000	3,224,000

Table 3.2. Projections[1] for the Number of Subscribers to the Iridium Communications System -- 2000 and 2010

Other Global Communications Systems

Other systems based on global satellite communications that are expected to be in service by the year 2010 include the little-LEOs. These systems operate at frequencies below 1 GHz and also use clusters of low-earth orbit satellites to provide primarily data, electronic mail and paging and other brief digital messaging services. The most ambitious little-LEO development is underway at Teledesic Corp., Kirkland, Washington. This development will produce a system employing over 900 satellites to relay data packets at speeds as high as 1.244 Gb/sec.

Other U.S. firms that have little-LEO development programs underway include Orbital Communications Corp, Reston, VA., and Starsys Global Positioning Inc., Lanham, MD.

3.4 Semiconductor and Very Large Scale Integrated (VLSI) Electronics: Sub-micron Semiconductors Yield Gigabit Memory and High-Speed Microprocessors

Semiconductor electronics is considered to be the prime driver for most of the other technologies or segments of the IT industry that use microprocessors, memory and logic chips. Due to advances in lithography and semiconductor fabrication, it is expected that by the year 2000, microprocessors with up to 10 million transistors offering 1200 MIPs, and 1 Gbit memories will be in production. The evolution of three generations of complex instruction set computer (CISC) -type IBM PC-compatible microprocessors over the last nine years is shown in Table 3.3.

[1] *Source: Motorola*

Microprocessor Type	Year	Technology	No. of Transistors	Clock Frequency (MHz)
80386	1986	1.5 micron CMOS 2-layer metal	275K	16
80486	1989	1.0 micron CMOS 2-layer metal	1.2M	33
Pentium	1993	0.8 micron CMOS 3-layer metal	3.1M	66
Pentium	1995	0.35 micron CMOS 3-layer metal	3.1M	120
P6	1995-'96	0.6 micron CMOS 3-layer metal	~ 5.0M	140
P10 (?)	2000	0.25 micron CMOS 3-layer metal	~ 10M	250

Table 3.3 CISC Microprocessor Generations - Technologies, Transistor Count and Clock Frequency - 1986 - 2000

Another type of microprocessor - the reduced instruction set computer (RISC) microprocessor, continues to make advances. These RISC microprocessors are at the heart of typical workstations.

The performance of typical RISC microprocessors available in 1995 is shown in Table 3.4.

Microprocessor	Alpha 21164	MIPS 10,000	PowerPC 620	UltraSparc
Company	DEC	MIPS Technologies	IBM, Motorola	Sun Microsystems
No. of transistors (millions)	9.3	6.4	7	3.8
On-chip data/instr. cache	8/8	32/32	32/32	16/16
Main memory	2^{40}	2^{40}	2^{40}	2^{41}
No. of independent units	4	5	6	9
Instructions				
Max. issued	4	4	4	4
Out-of-order issue	No	No	No	No
Out-of-order execution	No	Yes	Yes	Yes
Speculative execution	No	Yes	Yes	Yes
Clock Speed (MHz)	300	200	133	167
Memory Bus Width (bits)	128	64	128	128
Estimated SPECint92	330	300	225	275
Estimated SPECfp92	500	600	300	305
Power (watts)	50	30	30	30

Table 3.4 64-bit RISC Microprocessors - Representative Characteristics, 1995

Memory

Because of the complexity of application software and operating systems, the demand for memory continues to rise. The average dynamic random access memory (DRAM) capacity required in new personal computers grew from 0.5 MB in 1984 to 8 MB in 1994. It is expected that 16 MB will be the minimum configuration by the year 2000. Because of this demand for memory, it is expected that the 256 Mbit DRAM chip will be in production by the year 2000.

The dominant trend in the evolution of semiconductor components is towards lower power dissipation. These components are used primarily in mobile computing and other portable personal communicator products for the telecommunication and computing segments. This trend is expected to continue as the end-user demand for portability and intelligence at the point-of-use continues.

The design technologies that form the core of these chips are now adopted for use in CISC microprocessors.

3.5 Consumer Electronics: Using Software and Embedded Microprocessors to Link Appliances to Computers

Consumer electronics products are characterised by large volumes and low prices. The trend of incorporating powerful embedded microprocessors and graphics features into interactive consumer games continues. It is expected that the distribution of games and other interactive entertainment will be offered via the Internet and other wired services.

There will also be an emphasis on satellite services for providing content to consumers. In 1995, DirecTV, a multi-channel service offered by GM Hughes and US Satellite Broadcasting made its debut. Using MPEG-1 video-compression technology, it provides over 150 channels of broadcasting to consumers with a 18-inch dish. Because of the high compression ratios that can be achieved, it is expected that technologies such as JPEG and MPEG will be commonly used throughout the industry by the year 2000.

3.6 Large and Small Computers: From PDAs to Workstations and Supercomputers

Computational power continues to increase geometrically. The processors used in the IBM PC have quadrupled in power every three years throughout the decade.

In 1992, a typical workstation had a performance of 50 SPECmarks. By 1995, the IBM PowerPC 620 microprocessor will provide up to 800 SPECmarks. By the year 2000, processors developed jointly by Intel and Hewlett Packard will achieve over 2000 SPEC marks. The projected increases in raw power at lower end-user prices have major implications for all of computing. The expected trends are as follows:

- Program address space will increase from 32 bits to 42 bits
- RAM from 8 MB to 64 MB
- Processor performance from 80 SPECmarks to 64 SPECmarks
- Disk storage from 340 MB to 7 GB

This is illustrated in Fig. 3.3.

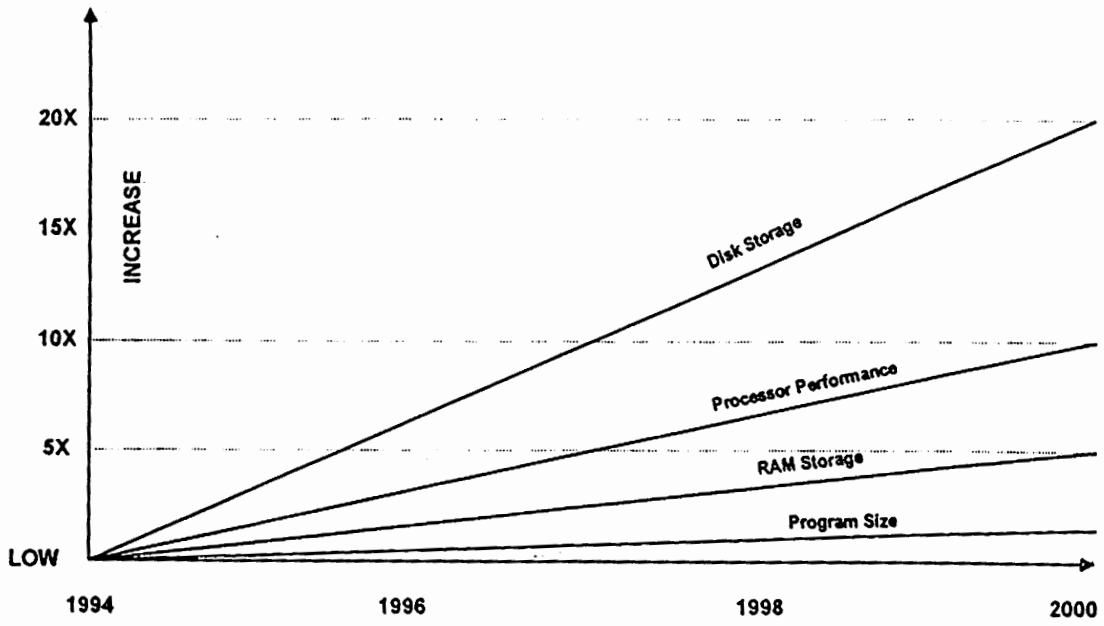

Fig. 3.3 Small Computer Performance Trends, 1994 to 2000

More importantly, it means that intelligent "offshore" IT services can be developed around these powerful systems with relatively small capital investments. Such offshore services may be termed "*back-office*" operations and must be considered as vital adjunct services essential to the operation of the new re-engineered corporations. These intelligent information technology services will be discussed in more detail in Chapter 6.

3.7 Software: CASE Tools and Client-Server Applications

Computer software has become the lifeblood of business, industry and government worldwide. The term "software" refers to the instructions that direct the operation of a computer. There are two general types of software:

- **Systems software** - which is used to manage the components of a computer system such as the operating system, which controls input and output operations.

- **Applications software** - which allows the computer to be applied to the execution of tasks such as word processing for writing and spreadsheets for calculations.

Over the last twenty years the software industry has grown to complement the PC industry. In doing so, it has not only become large but more specialised. The three major market categories of software are:

1. **Embedded software** - this is at the core of machine tools, telecommunication and power generation equipment and consumer appliances such as the televisions, stoves, automobiles.

2. **Customised software** - software used in financial and government services and other specialised business processes.

3. **Packaged application software** - this software is used primarily in the business office and the engineering and architecture fields among others.

Software is now used in all major industries from tourist and travel management to the control of containers in the Port Authority of Jamaica; and within any given sector of an industry, software increasingly requires a new range of application skills and technical know-how.

Globally the software industry shows strong growth. In the advanced economies, it is a leading source of job creation and economic growth. The software industry is an example of a healthy economic sector as evidenced by the following key indicators - keen competition, large sales growth, a mixture of large firms, rapid technology innovation and, most importantly, good export potential. In 1987, the software market was valued at US$100 billion and it is estimated to reach in excess of US$400 billion, by the end of 1995. The growth of the global software market by region is shown in Table 3.5

	1985	1990	1995
U.S.A.	50	90	172
Western Europe	25	65	134
Japan	9	30	66
Other	9	28	70
TOTAL	93	213	442

Table 3.5 Growth of the Global Software[1] Market 1985 - 1995 (US$ billions)[2]

With falling hardware costs, software accounts for an increasing proportion of IT investments. Software costs have now exceeded the hardware costs associated with a typical IT capital investment. Although there are a number of well-established, and visible large firms in the global software market such as Microsoft, Computer Associates, Lotus Development and Novell, in addition, there are tens of thousands of small firms each with a handful of developers profitably producing software for a variety of markets. Also, the software industry has relatively low capital requirements for startup.

The trends in software point to the industry-wide adoption of the object-oriented approach to the design and development of software applications and tools. This approach enables the creation of software components. A single software component from a given vendor must not only be created, but must also be made to fit with other components made by other vendors.

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[1] Source: *World Bank estimates*

[2] Operating systems and basic software application packages account for approximately half of the market and do not provide realistic software entry opportunities for small businesses.

As a result of this, common object-oriented technology standards are being defined by organizations such as the Object Management Group (OMG). Such standards will allow consistent quality from software created outside of large software companies and should make it possible for software developers in locations such as Jamaica to add value to existing large-installed base application programs or to develop high-quality custom application software.

3-8 Information Technology Services: Growth Due to the Re-Engineered Corporation

The re-engineered corporation and the growth of IT outsourcing services that result from this process is discussed in Section 5.2.7. This section presents the prevailing market and growth projections for these services.

In the United States, Fortune 1000 companies continue to downsize their operations and workforce, and streamline their company processes. As this trend continues, many of the internal computer operations are contracted to outside companies, a practice which has come to be known as "outsourcing". In addition, new distributed personal computer client-server technologies are evolving so quickly, that operations such as LAN management and installation, client-server implementation, enterprise network management, legacy application software management, conversion and development, data-centre management - operations which are essential to today's corporation, have become candidates for outsourcing. Outsourcing services also include help-desk support, break-fix services and distributed systems management technologies that facilitate the re-engineering of business processes. In a recent study[1], it was reported that as of July 1994, 72% of Fortune 1000 respondents were using outsourcing services compared to 63% in 1992.

The same is true for Europe. The European market[2] for IT outsourcing, estimated to be worth US$4.3 billion in 1993 is expected to grow at an average CAGR of 14% to reach a value of US$8.3 billion by 1998. The three largest markets are the U.K., France and Germany, each worth approximately US$1 billion. Spain and Italy are identified as the fastest-growing markets with CAGR's of 22% and 18% respectively. For Europe, the bulk of the activity is in systems management, with the fastest growth segments being applications management and network management having growth rates of 20% and 25% respectively.

Another aspect of outsourcing is the use of software programming teams in foreign countries to make up for the short supply of skilled domestic programmers and to cut programming costs. India for example, which has developed a strong software and hardware engineering infrastructure in Bangladore, now derives over US$198 million annually in revenues from outsourcing operations. In the U.S., a Forrester Research Inc. survey of fifty-one Fortune 1000 companies revealed that only 12% of their programmers were proficient in the C or C++ programming language, and only 3% were skilled in object-oriented software technologies. The use of foreign programming teams can result in significant cost savings. Firms have indicated that such programming teams can save up to 50% in costs. For example, one U.S. retail operation paid US$500,000 to create a Cobol/CICS/DB2 database warehousing operation in less than a year. The same operation would

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[1] *"Fortune 1000 firms embrace outsourcing; integrators getting positioned for a bonanza"*, Computer Reseller News, July 11, 1994, p. 143.

[2] Information Systems Outsourcing Market in Europe, Report by Frost & Sullivan, Mountain View, California, May 1994.

have cost approximately US$1.5 million if it had been done by a software contractor using U.S. labour.

Thus it is clear that outsourcing of information technology systems operations and programming within the developed economies such as the U.S., and Europe to companies within these developed economies[1] and foreign countries is a part of the globalization of the IT service industry.

3.9 Conclusions

The review of global trends in information technology has shown that rapid developments continue to take place in the several fields that are related to information technology. For example, in the VLSI electronics area, several million more transistors are packed into a single chip each year, resulting in higher performance, more portablility and longer battery life. Concurrently, advances are being made in networking and software which have resulted in the global network of networks - the Internet.

The 1970's and the 1980's saw attempts to develop the hardware electronics sector in Jamaica but success was elusive because certain essential characteristics, described in Section 3.1, were not present or were unfeasible for Jamaica.

The opportunities for Jamaica in the 1990's and beyond into the twenty-first century lie not in the design, development and production of semiconductor VLSI circuits nor in the assembly of hardware or telecommunications equipment, but rather in the creation of content and the distribution of that content directly using on-line services. Content is by definition, the realisation of audio, video and other multimedia types which can be recorded to a physical medium such as computer hard drive, CD-ROM disk, a digital audio tape or other form. The delivery of this content is not through the conventional buying and selling at the record store; instead the physical medium is merely the storage or master source from which the content is distributed on-demand via the on-line services of the Internet to global customers.

By 1998, the estimated number of homes in the U.S. that will be equipped with high-speed modems suitable for receiving high-bandwidth content such as real-time, full-screen video or full-stereo CD-quality sound, from the Internet will exceed 30 million. This constitutes a burgeoning market which will be demanding new content. The U.S. market will be supplemented by a similarly growing market in Europe to be followed by other areas worldwide. Thus Jamaica must take advantage of the opportunity offered by this tremendous growth in demand for content material.

[1] The leading outsourcing companies include: US - Electronic Data Systems (EDS), Computer Sciences Corporation (CSC), IBM; Canada - Information Management (ISM), International Data Corp., Siemens Nixdorf Information Systems, IBM Canada; Europe - IBM, Siemens-Nixdorf, Systemhaus. Numerous small companies in India, Singapore, Ireland, Philippines, Russia also share in the global outsourcing market.

4.0 Accessing Markets in the Global Village: The Internet and the Information Superhighway

4.1 Introduction

In this chapter we will review the global opportunities in information technology and the changes in the expectations of global consumers[1]. We will analyse the projections and statistics for on-line services and make proposals on how Jamaica could benefit from these services. Specifically, two representative organisations in Jamaica - the Jamaica Tourist Board and the Jamaica Promotions Corporation, are identified as entities that could initially benefit commercially from the Internet services.

Since the introduction of the personal computer in 1981 and the evolution of the computer from a single-entity, stand-alone device to a networked element, several factors have influenced the expectations of consumers. The four key events that have led to the present situation are as follows:

1. **The remote control device** - has fed and highlighted the consumer's need for more control over the media and the information[2] .
2. **Annualised revenues in video games and other interactive entertainment devices** - now in their fourth generation, by 1996, will exceed the revenues of the motion picture box office.
3. **Home personal computer** - PCs are now installed in over 35 million US homes.
4. **Internet** - the use of the Internet has exploded because consumers can not only communicate via e-mail, but can also access and exchange any type of digital information - files, audio, video or animation.

Before 1980, telecommunications and information technology were thought of as distinct non-overlapping areas. Today there are ample products and applications that indicate that these two areas are converging rapidly - desktop and notebook personal computers that combine telephony and speech recognition, portable hand-held organisers that combine facsimile telephony and application software that emulate and control the standard telephone. The Internet is a visible example of the power and utility of networked computers and telecommunications technologies. Through the Internet, an end-user with a personal computer and equipped with a graphical browser can interrogate and be connected to any one of the other 30 million computers on the network. Through inter-networking, any such user can send and receive electronic mail, participate in newsgroups and create source material for others to access using the rich Internet services.

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[1] The estimated expenditures in the United States by advertisers and end-users for products and services associated with the communications industry totaled $224 billion in 1993. These products and services include television, filmed entertainment, radio, recorded music, newspapers, books, magazines, business information services and interactive digital media.

[2] These changes will be reflected in the commerce and consumer transactions take will place. In 1993, US retail business amounted to US$790 billion. Of this home shopping services that are available through TV networks such as the Home Shopping Network and QVC have a total annual sales of $3 billion. Mail order catalogs represent another US$50 billion. Only a fraction of the entire $790 billion is now done electronically. The Internet offers a powerful medium that will replace the traditional mail order business.

More importantly, Internet today is offering new possibilities for commerce globally. It will cross national boundaries and allow global consumers and producers to conduct commercial transactions in new ways using on-line services.

4.2 What is the Internet?

The Internet is the largest and fastest growing collection of networks that are within another collection of networks which can be called a matrix. The distinguishing feature of the Internet from the other networks is that the host or client must have direct interactive Internet Protocol (IP) connectivity to the Internet in order to access it.

As Fig. 4.1 shows, taken all together, all networks form a matrix - an interconnected set of networks that exchange electronic mail. The Internet is the fastest growing network in the matrix which also includes UUCP[1], FidoNet, BitNet and thousands of enterprise IP networks within corporations and other organisations.

The matrix is defined as the total number of networks that can exchange electronic mail with each other. The total number of users within the Matrix is estimated at approximately 30 million users.

The Internet on the other hand is made up of two segments:

1. The Core Internet - 7,800,000 users on 2,500,000 hosts
2. The Consumer Internet - 13,500,000 users on 3,500,000 hosts

The other networks are shown in Table 4.1 along with their qualifying characteristics. Electronic-mail is the most important distinction between the matrix and the Internet. While electronic-mail is the simplest and most widely-used network service within the matrix, it is not the distinctive characteristic of the Internet. The distinguishing feature of the Internet is its interactive services supported by a unique protocol -Transmission Control Protocol/Internet Protocol (TCP/IP). Some of these services can be accessed from other networks, but the access of these services over the Internet provides significant differences and enhancements in speed, convenience and functionality.

[1] UUCP - UNIX-to-UNIX Copy Program is a protocol used for communications between consenting UNIX systems. It is also a UNIX-based network closely associated with USENET.

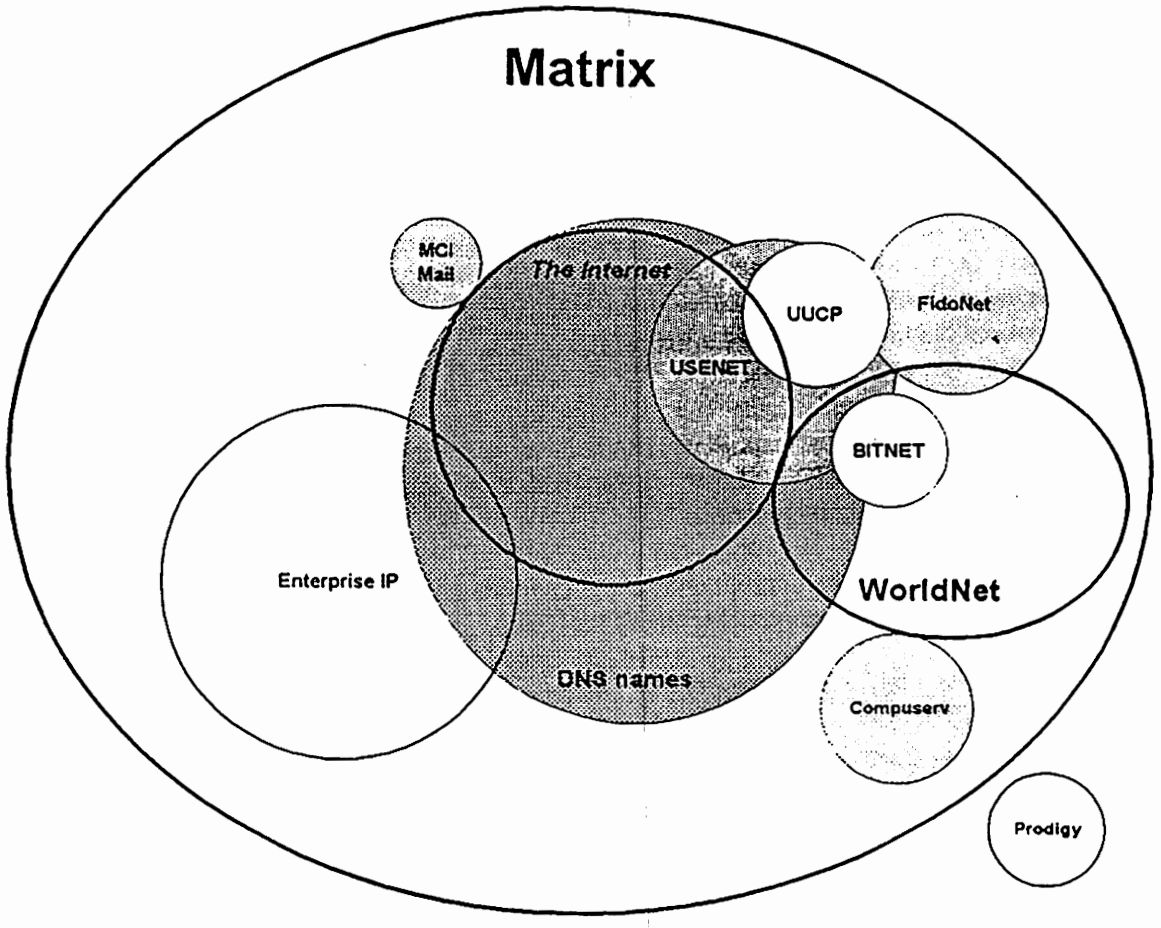

Fig. 4.1 Matrix of Networks - No. of Countries, Hosts, Users and Networks

Number of Countries	Hosts	Users	Networks
na	2,500,000	7,800,000	Core Internet
88	3,500,000	13,500,000	Consumer Internet
54	1,481	111,000	BitNet
96	32,000	2,560,000	FidoNET
144	18,800	564,000	UUCP
na	na	8,000,000	Conferencing
Total	na	29,975,000	The Matrix

Table 4.1 Matrix of Networks - Number of Countries, Hosts, Users and Networks

Types of Access to the Matrix of Networks

The types of access to the matrix of networks are:

1. Mailnet service via UUCP and FidoNet which allow exchange of mail but do not put one on the Internet. Electronic mail and or USEnet news can be sent or received, but the interactive services such as file transfer protocol (FTP) cannot be used.

2. Conferencing services via providers such as Prodigy, CompuServe, Genie, Microsoft Network, SprintMail, EasyLink, MCIMail, BIX, AT&T Mail. Some of these conferencing services are moving towards providing gateway access to the Internet. When they do, they will be part of the Internet Consumer Network.

Types of Access to the Internet

Access to the Internet can be achieved primarily in two ways:

1. Log-in Host access
2. Dial-up access

Log-in host access provides most Internet interactive services via service providers, because the log-in host provides Internet connectivity as one of its services.

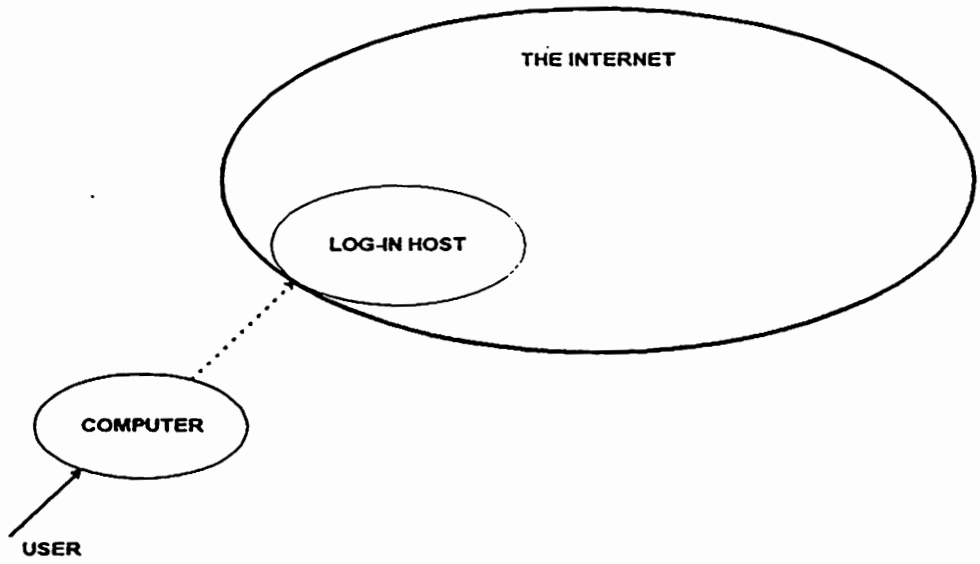

Fig. 4.2 Log-in Host Access to the Internet, using Internet Host Provider

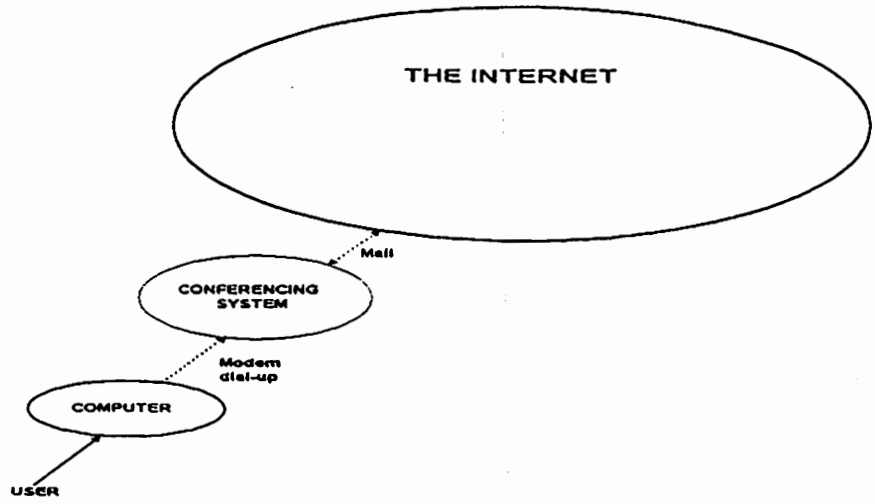

Fig. 4.3 Access to the Internet Using Conferencing System such as America-on-Line (AOL)

Governance of the Internet

The Internet grew out of the early work done in the 1980's by the ARPANET which was funded by the US government. The Internet has now become a global network and has grown far beyond being a government sponsored and/or controlled entity of the US or any other country.

The Internet has no overall organizational, financial, political or operational authority. Instead it is governed by a federation of organisations.

The policy body for the Internet moved from the ARPA to a succession of government committees. Because of funding controls, the National Science Foundation (NSF) has historically played a leading role in the setting of Internet policy in the US. At present the Advanced Research Projects Agency (ARPA), the Department of Energy (DOE), the National Aeronautics and Space Agency (NASA), the National Institutes of Health (NIH) and NSF participate in the Federal Networking Council which is the coordinating body for all Internet-related issues for the Federal Government. It is expected that the Department of Commerce will play a significant role in the activities of the Internet as electronic commerce on the Internet becomes more significant at both the national and international levels.

The NSFnet backbone with policies set by the US government, is the most visible backbone. In addition, there are several other backbones -- some run by government, others run by private agencies. In the US, there are approximately twelve regional networks connected to the Internet, as are thousands more at large and small companies, universities, government and state agencies. In other countries, there are national backbones which are part of the Internet. These include EBONE (European Backbone) in Europe and WIDE (Widely Integrated Distributed Environment) in Japan.

The specifications for the Internet however are written by the Internet Engineering Task Force (IETF), and overseen by the Internet Architecture Board (IAB), which in turn is affiliated with the Internet Society (ISOC), a non-profit organisation. The IETF produces working documents called

Requests For Comments (RFCs), which when adopted by the IAB become Internet standards. The relationships between various Internet working bodies and associated working groups are shown in Appendix C.

Internet Services

The key services offered by the Internet are mail-based and other file, text or database oriented retrieval services. Mail-based services include *ftpmail*, *listproc*, *listserv* and *Majordomo*. File, text or database retrieval services include File transfer protocol (*Ftp*), *Gopher*, Wide-area Information system (*WAIS*), World Wide Web (*WWW*), *Telnet* and *Finger*. These services are described in detail in Appendix D.

File transfer protocol is at present the most popular service on the Internet as measured by the number of bytes or packets transferred across the NFSnet. During the period January to December 1994, the *Web* was the second most used service and is destined to become the largest service on the Internet by 1996. It has grown from approximately 50 *Web* servers in January 1993 to more than 10,000 *Web* servers by March 1995. The amount of packets of information transferred over the NFSnet using WEB servers has grown from less than 0.5 million Mbytes in 1993 to over 3.5 million Mbytes in January 1995. Fig. 4.2 shows the growth of each of these services over the NFSnet for the period January to December 1994.

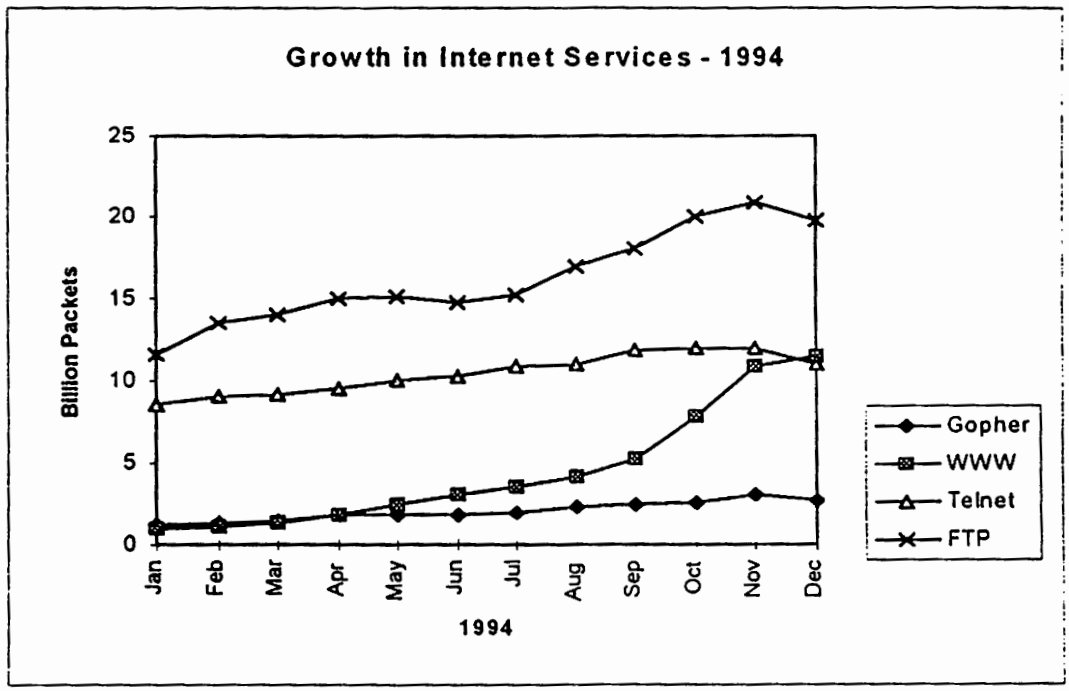

Fig. 4.4 Growth in Internet Services over the NFSnet, January to December 1994

4.3 The Internet Market

Growth of the Internet by Domain Type

The Domain Naming System (DNS) is the official naming system used within the Internet community. The top-level domains are divided into:

- *.edu* for educational institutions
- *.com* for commercial entities
- *.org* for organisations
- *.net* for networks
- *.gov* for government
- *.xx* corresponding to each country except the US

For example, a user *yy* at an educational institution in Jamaica would be registered as *yy.edu.jm* where *edu* refers to the educational institution and *jm* refers to the country code for Jamaica. The naming of the a sub-domain at a registered site is under the authority of that designated site.

For the period August 1994 to January 1995, the commercial (*.com*) domains in the US have grown at an average of 8%. Network domains have posted the next highest growth rate climbing from 238 domains in August 1993 to 1,598 in November 1994 . Organisation (*.org*) domains posted the third highest growth - rising to 2,751 domain names from 750 domains in the same period. The growth for all domain types except the *.com* domain is shown in Fig. 4.5

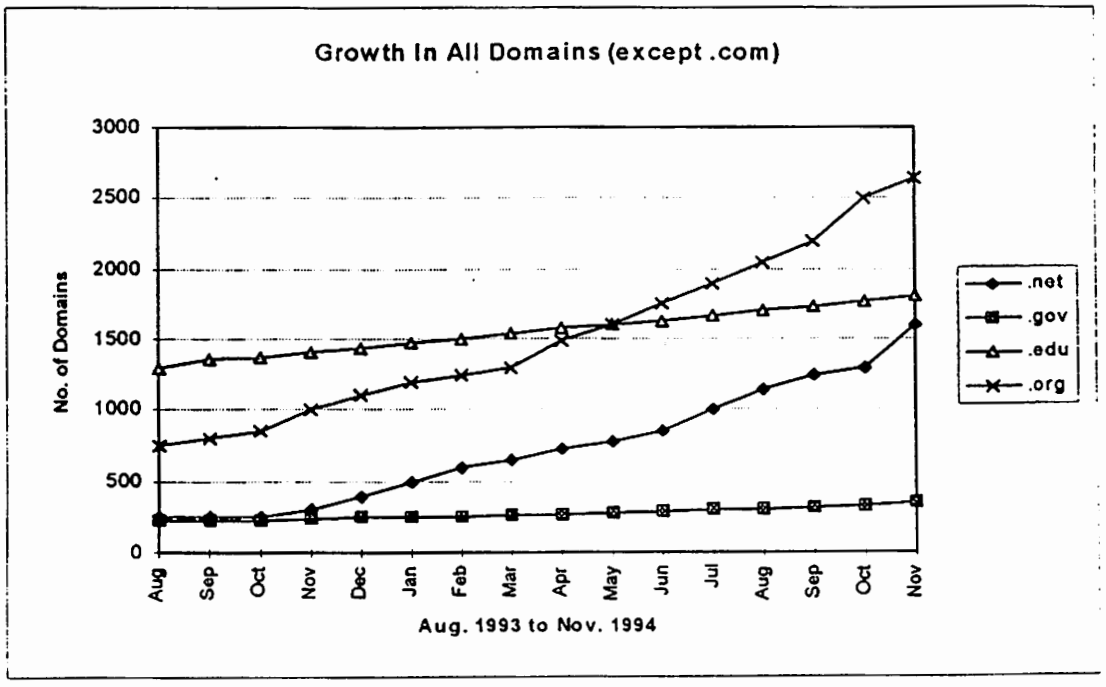

Fig. 4.5 Growth in All Domains Except *.com*

The growth for the *.com* domain is shown in Fig. 4.6.

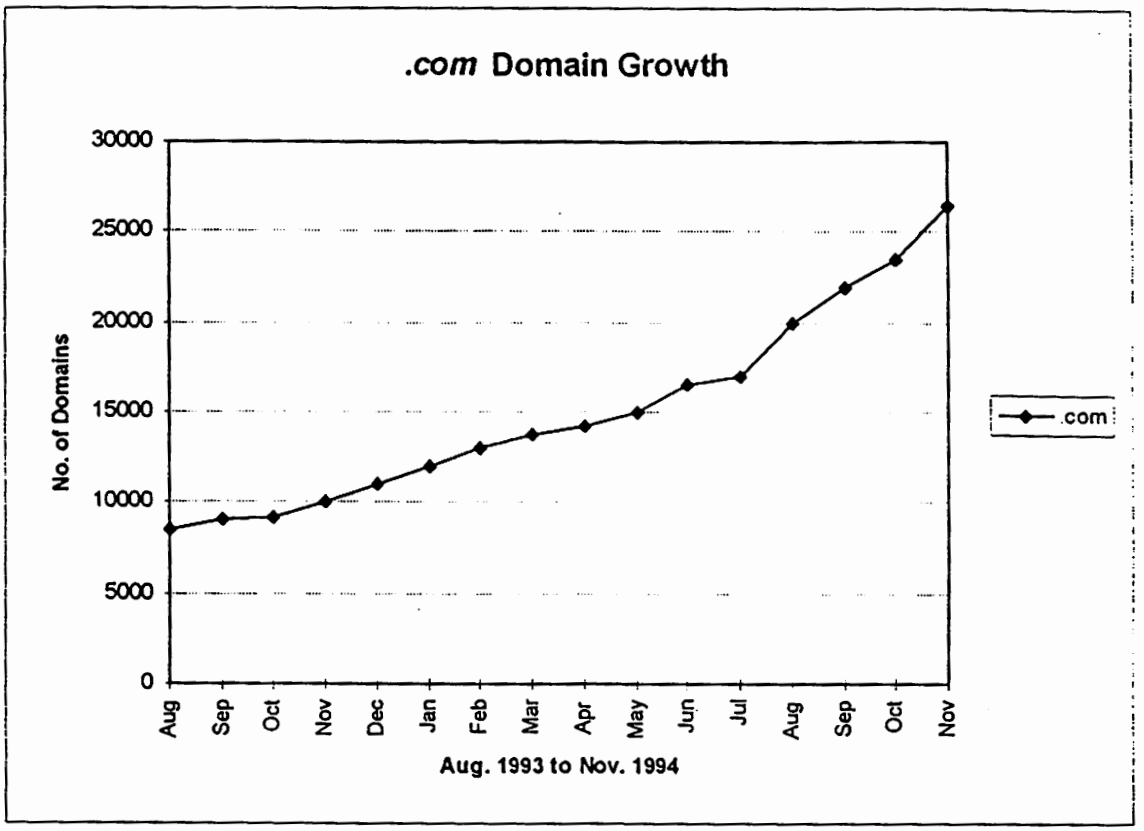

Fig. 4.6 Growth in the *.com* Domain, August 1993 to November 1994

Fig. 4.7 shows the distribution of Internet domains as of December 1994 by domain type.

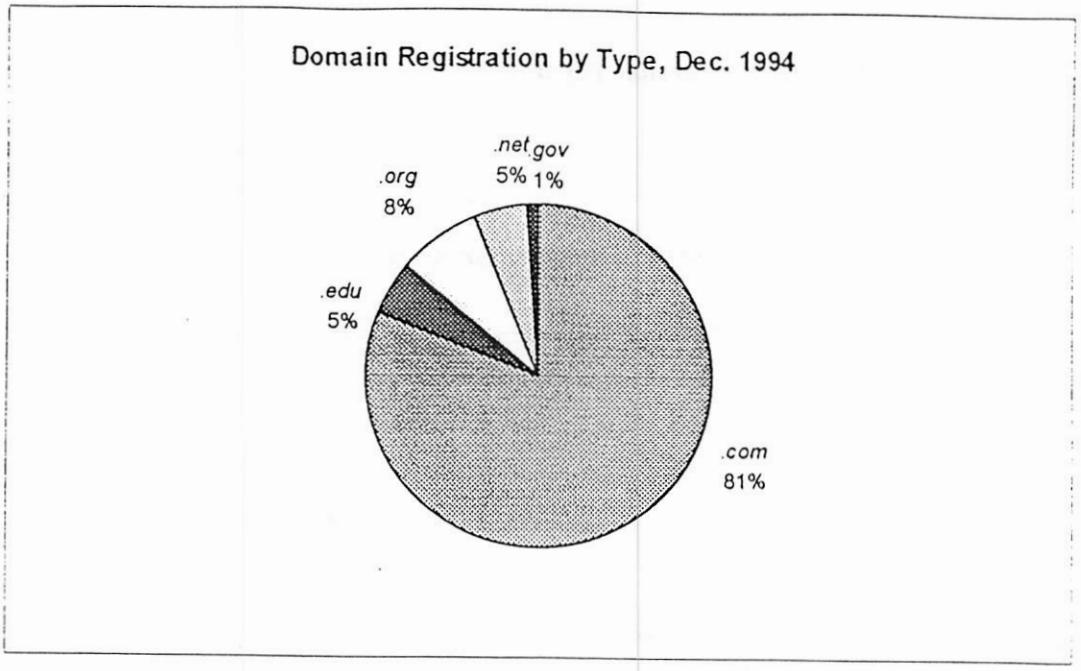

Fig. 4.7 Distribution of Internet Domains by Domain Type

Global Market Dynamics

An estimated 30 million users are connected to the Internet network. The growth rate is estimated to be in excess of 15% per month[1] .

On the Internet, the traditional sales and marketing model does not apply. The reason that this is so is because the people who operate in a networked environment are committed to active communication and to the exchange of ideas and information with others who share the same environment. Fig. 4.8 illustrates the interaction/information matrix. The horizontal axis plots customer interaction whereas the vertical axis plots information content.

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[1] " ... *Nobody knows how many people use the Internet, because, first of all, it is a network of networks. As of October 1994, more than forty-five thousand networks were part of the Internet. There were more than 4 million host processors (growing at more than 20% per quarter), but that is not a helpful measure for estimating the number of users. All that needs to happen is that one those machines serves as public gateway to, say, France's Minitel system, and all of a sudden you have an additional 8 million potential users on the Internet.*

The state of Maryland offers the Internet to all of its residents, as does the city of Bologna, Italy. Obviously all these people don't use it, but in 1994, 20 million to 30 million people seemed to. My guess is that 1 billion people will be connected by the year 2000. This is based on the fact that the fastest growing number of Internet hosts (percent change) in the third quarter were Argentina, Iran, Peru, Egypt, the Philippines, the Russian Federation, Slovenia, and Indonesia (in that order). All showed more than 100 percent growth in that three-month period. The Internet, affectionately called the Net, is not North American any more. Thirty-five percent of the hosts are in the rest of the world, and that is the fast-growing part. ....." from "*Being Digital*" by Nicholas Negroponte, MIT Media Lab., Alfred A. Knopf, New York, 1995.

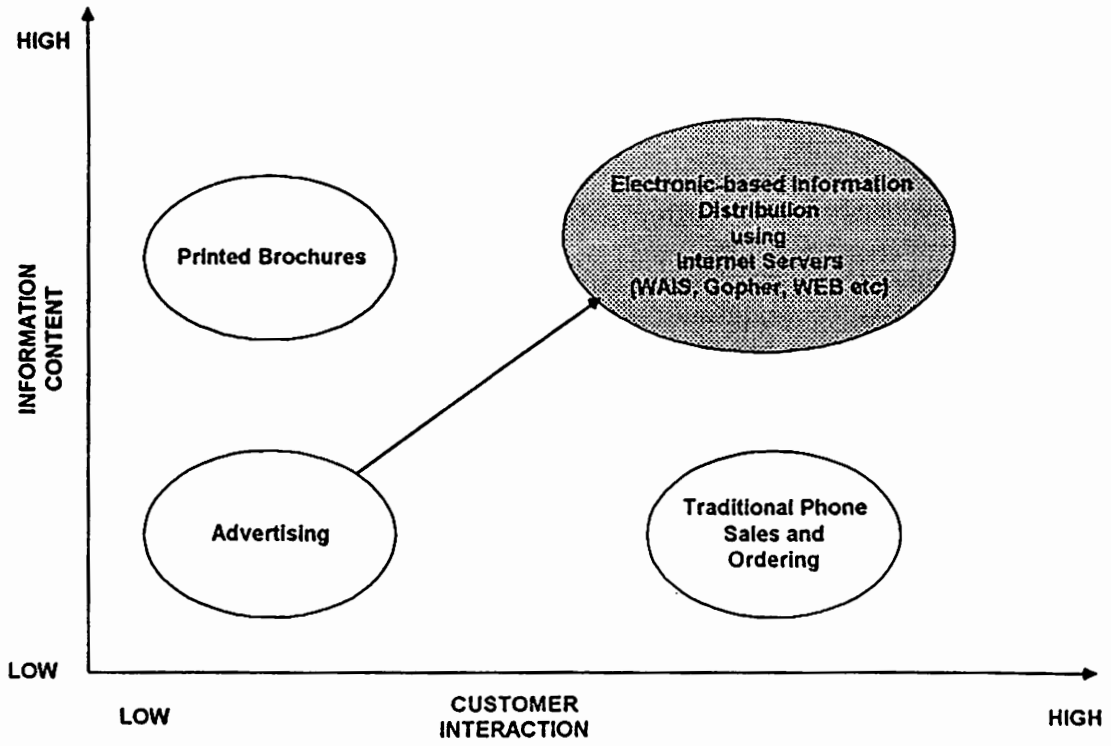

Fig. 4.8 Information Content - Contained in Advertising, Printed Brochures, Traditional "One-on-One" Sales vs Customer Interaction

Broadcast-style advertising which carries a one-way message devoid of any interaction , is located in the lower left of the graph.

Electronic-based information distribution that is suitable for Internet distribution is content-rich and offers maximum interaction with the user is shown in the upper right of the graph.

The distribution and marketing of products and services can be implemented using any one of the following Internet services: anonymous *ftp* servers, *gopher* servers, newsgroups, mailing lists or electronic newsletters.

Once the method of delivery is chosen, the next realization is that the audience is large, complex and segmented. For this reason, there should be a defined strategy of inter-marketing, and steps should be taken to apply these to the marketing of a product or service. These steps are as follows:

1. Identification of the market segment or interest group.
2. Maximisation of the organisation or group that is connected to the product or service.
3. Present only essential information.
4. Allow for open communication with the potential customers.
5. Respond in a timely manner to potential customers.
6. Monitor results.

The four cardinal rules that apply to Internet marketing are as follows:

1. Mass mailings do not work and with an global audiences as large as those of the Internet -- 30 million or more; it is important to think about direct mailing lists using interest groups.
2. To win credibility, it is effective to use discussion groups and use them to actively participate in the exchange of ideas. It is also important not to "tack" up or post news releases and then walk away.
3. Internet users have been brought up on free information or samples. It is therefore very important not to give out scant, sparse or incomplete information.. To obtain the maximum from the Internet, something must be given out for free.
4. The Internet and its culture will be evolve with time, so the long-term success on the Internet will depend on how much time and effort is spent on adjusting the marketing message to the changing market.

Summary of Marketing Strategies

The following are the key marketing strategies that should be considered when the Internet is used in marketing a product or a service:

1. Direct mail
2. Press release postings
3. The use of bill-boards at the end of a message of a mailing list or a Usenet discussion group
4. Relationship marketing - where in addition to posting a press release about a company's product or service, a discussion group is formed or found which focusses on topics related to the product or service.
5. Display advertising using the World Wide Web (WWW). A collection of home pages corresponding to several individuals or companies will allow lower-cost entry to a single individual or company and will maximize the visibility for any one of the home pages.

Internet Growth Projections

Global networks such as the Internet are here to stay. These high-speed inter-connected networks are fundamental to business, research, education and all forms of human activity for the 90's and beyond. Although the components of the Internet may change - its technical base will evolve, the "look-and-feel" of browsers - the Internet function of interconnecting a growing number of networks, computers, organisations and individuals around the world will not change.

The continuing theme of the Internet is growth. More networks, registered hosts, domain names and individuals linking up through work, school and at home will increase.

The international composition of the network will make an even larger impact on the network as businesses, educational institutions and individuals in countries outside of the U.S. join the Internet. The views or concerns about whether the use of the Internet for business will change the Internet is answered as follows: the Internet has already changed. Business needs on the Internet are reflected in the following patterns of usage - increase in the number of *.com* domains; the development of new hardware and software resources - dedicated Web hardware servers, software browsers and Web page authoring tools, text search engines; growth of security and privacy

services and the increasing number of publications and services that are geared to the commercial sector.

The ability of the business community to pay for services means that the business Internet community will have greater influence on configuring those services to meet their needs, while not creating a negative environment for the rest of the global community. The business use of the Internet will be compatible with the applications and other work in research, education or other community-based groups. As an example, the software tools such as commerce and communications servers that are developed for business transactions will be available for all network users.

The changes in telecommunications policies and the introduction of new communications modems for the end-user will bring high-speed access to the Internet to the home within five years. Over the same period, the performance demands of home-based Web clients in the U.S. will boost the installed base of ADSL- and ISDN-type modems from 300,000 in 1994 to several million. These two types of modems will allow transmission speeds up to 50 Mbps on a pair of copper wires which today make up the entire U.S. infrastructure. This means that homes by 1998 will have the installed gear to receive full-motion video, stereo-quality CD audio and animation. Such services and applications will allow the Internet to grow at an unprecedented rate over the next five years.

The World Wide Web applications on the Internet in addition to opening the doors for many commercial services has also made secure financial transactions a reality. Companies now have a choice of secure Web vendors and Internet storefront services.

The Internet will continue to grow globally at a high rate. More importantly, the commercial domain - *.com* of the Internet will continue to outpace the other domains in number of registrations.

The U.S. is the leader in the number of networks connected to the Internet. For the 12-month period ending December 1994, the U.S. led with a 75% growth rate in the total number of networks connected to the Internet - increasing from 8,635 to 15,255. The next largest growth rate was recorded by Canada.

Internet users in the US also effect more byte and packet transfers over the NFSnet than any other country, followed by users in Canada, Australia, U.K., and the Netherlands. In Europe, the top five users that transmit the most packet traffic over the Internet are the U.K., Netherlands, Germany, Sweden and France in that order.

4.4 Other Business Developments

Of the many Internet developments that are expected in the near future, the most significant will be the introduction of the Microsoft Network, scheduled to be launched during 1995. The Microsoft Network which will be an integral part of Windows '95, will be a combination of a public access or conferencing network and an Internet gateway.

Microsoft's recent financial interest in UUNET Technologies will allow it to provide end-to-end TCP-IP network services to a very large installed base of Window's users. Specifically, an estimated 40 to 50 million existing Windows customers who will upgrade to Windows '95 over a 12-month period will obtain full Internet access with a few mouse clicks via the UUNET network. In addition to the expected GUI browsers, the Microsoft Network will offer a new pricing model for both content providers and end-users.

For software developers, the entry of Microsoft as a Internet service provider will see the introduction of a range of Internet-type application software that will combine mature business-office technologies such as object linking and embedding (OLE) and macro-language programming languages. Such software advances will enable the creation of compound documents that combine text, graphics, audio, and real-time video for Internet distribution. These developments will have a profound impact on extending the already powerful hypertext capabilities of the World Wide Web.

4.5 The Impact of Microsoft's On-line Services Business Model on Global Commerce

Microsoft while not the largest software manufacturer in the world, has immense influence over the direction of the computer/networking industry. The Microsoft Windows product is installed in over 60 million PCs worldwide. This statistic alone and the development support behind it make it important that Microsoft's strategy, especially as it affects the Jamaican networking and Internet strategy, be understood.

The five main elements embraced by the Microsoft business model are as follows:

1. Market Expansion - the current on-line services market of 5-9 million subscribers must be expanded to several tens of million users to ensure a profitable and sustained on-line business. Microsoft will assure this by providing a software interface and environment that is easy to use and setup; will make it a global phenomenon; and will apply the economies of scale to make it an affordable two-tiered service - a low-cost base service and a "a la carte" service that provides custom extensions.

2. Delivery of Compelling Content - Software technologies will be provided to make content not only attractive but also of high performance. New software technologies will allow rich content to be browsed at high performance levels over standard 9600 bps phone lines

3. Integration with the Everyday Use of the PC - On-line services which will be fully integrated with software applications will allow all information to be retrieved even when using application software.

4. A Strong Managed Community - The use of virtual tours will allow the user to perceive that he/she is part of a community and that in turn will create strong user attachment to the on-line service and community.

5. Full Support of the Internet - By supporting all of Internet's services - Gopher, WAIS, Finger etc. the user will be able to share and transfer documents between the Internet and the applications software, and will provide controls to sensitive portions of the Internet.

In summary, the Microsoft strategy as summarised by Russel Siegelman, Microsoft's General Manager of On-line Services

> "... Microsoft expects the Microsoft Network to raise the bar for ease of use; to attract content providers with its platform and tools approach and favourable business model; to be well integrated into everyday PC tasks; to be a premier on-line managed community; and to provide superior support for the Internet. ..."

4.6 How Jamaica Can Use the Internet Effectively for Marketing and Sales

To put the Internet to use effectively, one must match the organisation needs and priorities with the network's capabilities. The Internet network has demonstrated without a doubt its ability to enhance support services in major US-based organisations. Marketing departments have been and are using the Internet to elicit customer response and to provide new information to a new base of networked customers. It is now becoming the mechanism for sales and product distribution. As more users and organisations sign on, the number of products that are available over the network will increase. Beyond the two key uses for the Internet - electronic mail/newsgroup participation, and data exchange, the majority of US-based companies and organisations use the Internet for the following functions:

- Publishing and marketing via the World Wide Web
- Obtaining support from vendors
- Participating in joint development
- Collaborative research projects
- Providing customer support
- On-line sales
- Product distribution

The following paragraphs briefly outline how two representative organisations could use the Internet effectively. For each of these and similar organisations, an effective strategy must combine the immediate communications needs of the organisation with its long-term goals for Internet participation. Whether the organisation is connecting for the first time or wants to make an existing connection more effective, planning strategies should be based on the following topics:

1. What is the Internet?
   - Is there a specific need for global connectivity?
   - What benefits are expected after one year of Internet use?
   - How does the Internet fit company priorities and existing communications schemes?

2. Who will be responsible?
    - Where does Internet management fall within the organisational structure?
    - Who will provide the administrative coordination, support, training, and departmental or individual connections?
    - Who evaluates the effectiveness of Internet use and decides about expansion or upgrading the connection?

3. How is it working?
    - Are there criteria for selecting a service provider ?
    - Have security and privacy issues been addressed?
    - Are internal use policies and documentation in place?
    - Are use statistics for various applications captured and analysed regularly?
    - Is there an evaluation process to determine how well the Internet is meeting company needs?

Two organisations, the Jamaica Tourist Board and JAMPRO, identified as two organisations that could benefit the most from the Internet World Wide Web, are now discussed in more detail:

Jamaica Tourist Board (JTB)

The Jamaica Tourist Board, an organisation whose charter is to promote the tourism product to its maximum, could benefit substantially from a Web presence. A tastefully designed and informative JTB Web server should be set up to offer the following:

- Visitor information
- Calendar of events
- Tours and attractions
- Transportation
- Resorts and accommodation
- Descriptions of properties with full colour displays of all types of accommodation
- Recreation and sports activities
    - Golf
    - Fishing
    - Polo
    - Athletics
    - Horse racing
    - Cricket
    - Soccer
- Shopping
- Eco-tourism
- Historic sites and points of interest
- Arts, crafts, museums and galleries
- Dining
- Entertainment

In addition, this site could offer detailed information on each of the main resort destinations - Kingston, Port Antonio, Ocho Rios, Runaway Bay, Falmouth, Montego Bay, Negril and the Mandeville and South Coast areas.

This site could be designed to complement the array of print material and TV advertisements and would allow the browser to take a "virtual" vacation to Jamaica. In doing so, the "visitor" through a compelling and interactive display could be sold on the merit of the information provided. The visitor additionally would be more comfortable with his or her decision because of the "virtual vacation experience" that combines rich colour graphics, authentic sound clips and even full motion video.

Jamaica Promotions Corporation (JAMPRO)

Jamaica Promotions Corporation, Jamaica's Economic Development Agency is charged with encouraging and facilitating increased investment and production, and in the modernisation of Jamaican industries and export promotion of Jamaica-made products. This agency is also heavily involved in the promotion of Jamaican products in Europe through its Target Europe programme.

As in the case of the JTB, JAMPRO would benefit significantly by having a presence on the Internet World Wide Web. In addition to providing information about Jamaica, the Web services could augment the communications now implemented via overseas contacts and representatives. More importantly, if the services are well maintained and updated, the information could provide vital information in a timely way.

The following is an example of the type of information that could be provided using the World Wide Web services:

- Calendar of events - questions and answers
- General information
- Investment updates
- Information focus on:
  - Agri-business
  - Mining and natural resources
  - Information Technology
  - Apparel and other manufacturing
  - Tourism
  - Horticulture
- On-line forms for prospective investors, buyers and others

For Jamaican businesses seeking information, the following information should be put on the Internet:

- Market research
- Buyer identification
- Product development
- Trade promotion/mission activities
- Marketing and investment projects
- Information on loans, financing arrangements etc.

The other types of information that could be supplied seeking information that normally is sent by the postal services or by facsimile. In providing this type of on-line information to prospective investors globally and local Jamaican business-persons, it is possible to circumvent delays and JAMPRO could become a much more efficient and productive organisation.

5.0 Situation Analysis for Jamaica

4.1 Introduction

Information technology in Jamaica, even before the advent of the personal computer, has lagged the world market. More recently however, the gap has been reduced due to a number of factors including:

- Heightened awareness on the part of individuals and businesses that the personal computer (PC) is an essential component of modern business
- Increased availability of PCs due to a reduction of tariffs in the early 1990's

5.2 Status of Existing Information Technology Infrastructure in Jamaica

The following sections describe the current status in Jamaica of each of the main technologies that constitute information technology as described in Chapter 3.

5.2.1 Data Communications

As the number of personal computers, and the installed base of open and networked systems in Jamaica continue to grow, there is a heightened realization among both businesses and the education sectors that networked computers comprise a very important step in adopting the computer as a tool in business, education and government. For example, the University of the West Indies (UWI) Mona campus, which has had the first large-scale implementation of a fibre-distributed data interface (FDDI)-based LAN in Jamaica, is now extending its campus-wide network to include more departments under a UWI/IDB development program. Similarly, many financial institutions, among them Telecommunications of Jamaica (TOJ), bauxite companies and sugar estates have embarked on networking their computers at various locations. The Jamaica Computer Society Educational Foundation (JCSEF) has initiated a project to provide each school with a network of at least 15 computers by the year 2000. This project has recently received approximately US$1 million in assistance from the IDB.

The public sector, that is, government departments, are lagging however and this needs to be addressed as quickly as possible.

In the financial services sector, the drivers for the increased use of computers have been the growth of the stock market in the 1990's and the need to provide quick responses to changing market conditions. For example, the Jamaica Stock Market recently received assistance from the IDB to modernise its computerised stock market transactions and to interconnect it with the other regional stock exchanges in Barbados and Trinidad.

5.2.2 Telecommunications

Two companies provide telecommunications services within Jamaica - Telecommunications of Jamaica (TOJ) and Jamaica Digiport Ltd. (JDI).

Telecommunications of Jamaica (TOJ)

In 1987, the telecommunications utility was privatised in an effort to attract the type and quantity of investments required to support a modern telecommunications infrastructure. Telecommunications of Jamaica was formed as a holding company for two other companies. Jamaica Telephone Company (JTC), charged with maintaining internal communications, and the Jamaica International Telephone (JAMINTEL) with responsibility for external connections except for those originating from the Jamaica Digiport Inc. facilities in the Montego Bay Free Zone. Essentially, over a period of five years and several transactions, the Government of Jamaica transferred its majority position in TOJ to Cable and Wireless[1]. TOJ operates a monopoly under various telecommunications licenses including:

- The All-Island Telephone License, 1988
- The Telecommunications of Jamaica Limited (Wireless Telephony) Special License, 1988
- The Telecommunications of Jamaica Limited (Telegraphic Services) Special License, 1988
- The Telecommunications of Jamaica Limited (Telex and Teleprinter) Special License, 1988

The licenses which are valid to the year 2013, allow TOJ to operate a domestic and international telecommunications service, with several rights including the right to charge rates consistent with post-tax consolidated minimum earnings of 17.5% and a maximum consolidated shareholder's equity of 20%. In 1993, new negotiations were begun with TOJ to take into account global telecommunications developments to ensure a competitive telephone system.

Since the privatisation of the Jamaican telecommunications sector, over US$400 million has been invested in plant equipment. This has allowed the network exchanges and the major trunk lines to be all digital. Work is in progress to bring fiber-optic telecommunication links to most major cities

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[1] Cable and Wireless now owns 89% of TOJ. Cable and Wireless, a global international telecommunications company established in 1874, provides telecommunications service to over 50 countries. Its turnover in 1993/94 was £4.7 billion with pre-tax profits of £1,088 million. Cable & Wireless' marketing strategy is to build on its three regional hubs - Asia, Western Europe and the Caribbean, through regional visibility and control of several complementary businesses. In Europe, it controls 39.9% of Tele2, Sweden's second largest telecommunications network in addition to businesses in France, Germany, Italy and Ireland. In Asia, its' flagship subsidiary, Hong Kong Telecommunications has an established reputation for quality communications and has unquestionably been a catalyst for making Hong Kong a major business centre in Asia. In addition, Cable and Wireless is a leading shareholder in IDC, one of Japan's international telecommunications carriers as well as Optus, an Australian carrier. In the Caribbean, Cable and Wireless is a telecommunications provider in fourteen (14) countries.

Cable and Wireless is firmly entrenched in the business of providing undersea cables that link the world's continents and also has a growing interest in providing wireless communications through personal communications network (PCN) technology. These PCN services were initially available in the UK through Mercury Communications in a joint venture with US West. PCN services are slated to be introduced to France soon.

and homes. Several standard features such as call-waiting, call-forwarding are now available to the end-user. More importantly, the quality of the service is significantly better - immediate dial tone, noise-free circuits and fully-integrated seven-digit dialling.

Jamaica Digiport Inc., (JDI)

The Jamaica Digiport Inc. is a joint venture between American Telephone and Telegraph (AT&T), TOJ and Cable and Wireless. It offers a variety of high-speed communications services via Intelsat C-band satellite to North America and Europe. These services include switched and leased 56 kb/s lines, dial-up telephony, and 1.544 mb/sec (T1) circuits. The primary satellite is based over the east coast of Africa, and links are made to Intelsat ground stations in Etam, West Virginia, Bermuda, and Eastern Canada for traffic having destinations in the US, UK and Canada respectively. All value-added services such as call-waiting, call-forwarding, conferencing and 800-numbers that are offered in North America by AT&T are also available out the JDI facility. The core of the facility are redundant AT&T 5ESS digital switches which are compatible with both analog and integrated services digital network (ISDN) telephony. Enhancements to be made in 1995 include asynchronous transfer mode (ATM) technologies.

Telecommunications Summary

Jamaica's telecommunications network in 1995 has almost 246,000 telephone lines compared to 89,000 in 1990. The data in Table 5.1 lists this growth. The number of cellular telephones has also increased from 2,447 units in August 1991 to over 25,000 in 1995.

Region	1989/90	1990/91	1991/92	1992/93	1993/94	Feby. '95 to date
Kingston	58,224	65,878	77,466	91,183	105,758	120,263
South-East	7,609	10,546	15,724	24,104	34,296	43,593
Central	6,598	8,916	12,559	17,350	22,807	27,819
North-East	6,906	7,927	10,379	14,098	18.641	22,142
Western	9,754	12,018	15,438	20,516	26,778	32,032
Total	**89,091**	**105,285**	**131,566**	**167,251**	**208,480**	**245,849**

Table 5.1 Historical Growth of Telephone Connections in Jamaica

The present inter-city telecommunications service is based on a microwave radio system. In addition, there is packet-switched network which links Kingston with four major towns. This packet-switched network will be significantly expanded by 1997. More importantly, the inter-city radio network will be augmented by a fibre-optic network which will cover all major towns. At present the central offices in the Kingston metropolitan area are completely interconnected with fiber optic trunk lines. A SONET network is used in the South-East region of the island.

TOJ has made an effort over the last ten years to provide modern telecommunication services to its clients. It has been looking at the applicability of new technologies such as ADSL (Asymmetric Duplex Subscriber Loop) and CDMA (Code Division Multiple Access) technologies. At present, TOJ has no plans to introduce ATM in Jamaica in the near future.

The telecommunications services offered by both TOJ and JDI have unquestionably been improved over the last decade. These mandatory improvements are essential if Jamaica is to remain competitive with its trading partners and more importantly allow the timely development of an IT sector which is closely coupled to the telecommunications infrastructure. Many basic contradictions still exist between the issues of providing low-cost access and inter-connectivity (by the customer to other customer-owned sub-systems), and the guidelines which tie the implementation of minimum enhancements to the telecommunications infrastructure to TOJ's rate of return.

In summary, the following points must be considered:

1. Enhancements that have been incorporated so far are not enough to take Jamaica into the 21st century.

2. The legislative administrative framework developed in the 1980's may not be sufficient for the future.

3. The telecommunications industry should be open to competition in order to make its services more widely available and at costs determined by market dynamics.

4. The telecommunications companies should be critically aware of the massive and irreversible changes that are taking place in telecommunications technology; consequently the TOJ's market and monopoly strategies will impact the survival and success of a national effort to develop an information technology-based industry. The ability to launch and sustain a viable IT-based industry may well be determined not by the present telecommunications infrastructure, but by the particular monopolistic licensing arrangements to which the future of the country is tied.

5.2.3 Semiconductor Very Large-Scale Integrated (VLSI) Electronics

No activity in this area - the obvious reasons are that there is no infrastructure to support it. Although there was a concerted effort in the 1970's and '80's to attract semiconductor electronics support operations (manufacturing, assembly and test) to Jamaica, this did not materialise for a number of reasons.

5.2.4 Consumer Electronics

Products such as intelligent kitchen appliances, televisions and other light electronics assembly has had a history of spotted success. At present, there is only one large-scale TV assembly manufacturing operation in Jamaica. Consumer electronics has not been as large-scale as hoped due to the lack of infrastructure to support this sophisticated industry including packaging, chip design, assembly and technological know-how.

5.2.5 Computers

A considerable number of large and small businesses have adopted computers for their operations in such areas as accounting, project management, administration and business office applications. The trends in computer adoption closely follow trends in the U.S. since most of the technology is from the U.S. As in the U.S., client-server architectures using PCs based on the IBM standard, are well established in Jamaica. There are however a large number of UNIX installations in organisations such as Fiscal Services, financial organisations and academic institutions. There is also one supercomputer in the island at UWI Mona. This supercomputer can be accessed by campus and non-campus users from the Internet.

In the area of computing, two national organisations have significant computing resources that could be utilised much more than at present: Mona Informatix Ltd., UWI, Mona and Fiscal Services.

Mona Informatix Ltd., UWI

Mona Informatix Ltd., a company formed by the Mona Campus of the University of the West Indies, offers information technology-based services to local as well as foreign companies. The Convex 3440 supercomputer which is the core of Mona Informatix' operation is connected to the Internet. It is not fully utilised, and more importantly the skilled resources there could be used to manage the National Data Network on behalf of the government.

Recently a one-year contract[1] worth J$30 million was signed with the Boeing Commercial Airplane Group of Seattle, Washington for information technology services. The work to be done on the Mona campus involves the precision scanning of J-size (3 feet by 10 feet) engineering drawings at 500 dots per inch. The scanned images are then stored on the Convex supercomputer and subsequently individually processed by one of several Sun SPARC workstations that are networked to the supercomputer. Through the use of sophisticated drawing conversion and editing software, the drawings are converted to vector graphics and stored in digital form with accuracies of plus or minus 0.005 inches or 0.13 mm. within the dimensions of the original engineering drawings. This breakthrough achievement at Mona Informatix in providing sophisticated information technology services to the largest aerospace company in the world[2], could serve as a catalyst for other similar and related higher-end IT services by the local IT companies.

Fiscal Services Ltd.

Fiscal Services Ltd., is a large data processing centre that employs high-end Digital VAX and Alpha servers already connected to the Inland Revenue Departments and relevant ministries. This resource, like Mona Informatix, is ideally suited for playing a dominant role in the National Data Network[3]. It also has the advantage of already working with sensitive and highly-confidential data.

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[1] Jamaica Herald, April 8, 1995. Also see "*Mona Informatix Lands Boeing Imaging Contract*", ROM Magazine, September 1994, page 6.

[2] Reported 1993 sales of US25.29 billion.

[3] See Appendix E.

5.2.6 Software

In addition to standard off-the-shelf application software packages produced by leading US-based software companies such as Microsoft, Lotus Development and Computer Associates, and distributed through dealer channels in Jamaica, there are a few companies that produce customised software applications. These locally developed application software packages tend to serve human resources management, financial services, accounting, hotel and travel management, and point-of-sale needs. The software that is developed falls into the following two main classes:

1. Applications developed from scratch which tend not to be full-featured
2. Applications that are customised versions of accepted, mainstream software application packages

There is at least one division of a large US-based software firm with branch operations in Jamaica. This firm, Computer Sciences Corporation (CSC) is a leader in providing outsourced software development services to US corporations. Additionally, subsidiaries of leading foreign computer system companies such as IBM, Fujitsu/ICL and Digital Equipment Corp. (DEC) provide custom as well as standard software solutions to vertical applications market sectors such as financial services and geographic information systems (GIS).

The current software methodologies in use in the Jamaican software community have not kept pace with the latest techniques that are practised world-wide. Software design and programming using object-oriented programming is not fully developed.

5.2.7 Information Technology Services

Information Technology services are a result of the re-engineering and downsizing of corporations and medium-sized businesses that is currently in progress. This re-engineering has caused the displacement of internal data processing departments, and their services have been outsourced to "back-office operations" in remote locations such as Ireland, Barbados or Jamaica. These back offices perform remote services such as data entry, telemarketing - in-bound and out-bound, geographic information systems (GIS) processing, intelligent database creation, maintenance and support of traditional functions of the internal data processing departments. The changes in the business environment - more streamlined processes, flatter and leaner organizations and the distributed computing technologies as shown in Fig. 5.1 have been accelerated by the shift from the computing environment of mainframe and attached terminals to client server architectures. In turn,

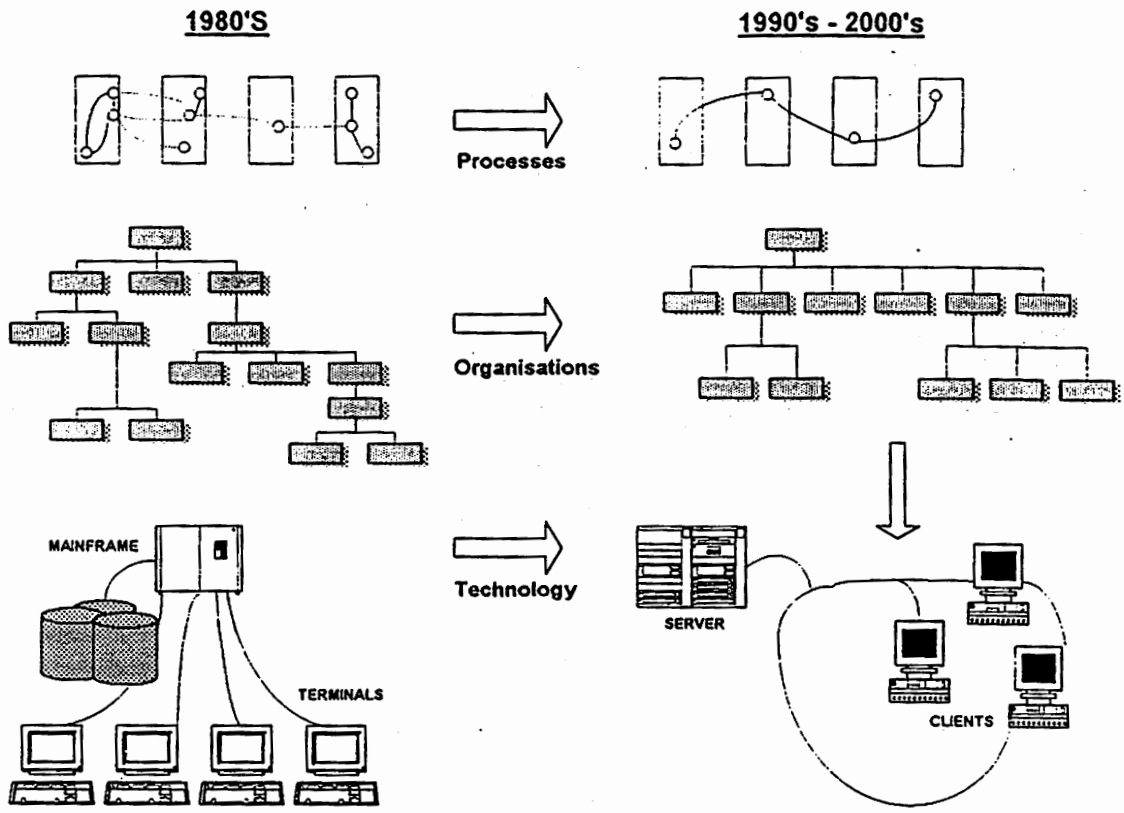

Fig. 5.1 Changes in the Business Environment, 1980 - 1995 and Beyond

these fundamental changes in the business environment have fuelled the creation and demand for out-sourced information technology services. It is expected for the period 1995 to 2000, that this demand for IT services will grow at a higher rate and will be more cost-effective due to the use of the Internet (Information Superhighway) as data will be able to move more freely and cheaply. It is therefore very important that the policy design for critical infrastructure components such as telecommunications be sufficiently flexible to accommodate the expected changes in the information technology that will occur in the coming years.

In the mid 1980's, the Government initially participated in the development of an export-driven information technology processing industry. This began as part of the structural adjustment programme where it was perceived that information technology-based industries could contribute to the foreign exchange earnings. The 1990-1995 five-year development plan outlined a strategy to ensure that information technology would contribute to the domestic economic growth of the country[1]. The plan envisioned a number of information sector projects and programmes such as the establishment of an Information Technology Authority (ITA), public education programmes, learning resource centres and training centres among others.

[1] "... *An Information Technology Authority (ITA) will be established, in order to ensure that IT contributes optimally to the economic growth of the country. The ITA will be responsible for planning and evaluating the implementation programmes and projects involving the use of IT for economic growth* ....." - Five Year Development Plan, 1990-1995, Planning Institute of Jamaica, page 74, May 1990.

In 1990, the government realised the importance of the contribution of information technology services to the economy[2] . This was underscored by the fact that the number of companies at that time had grown from 2 to 29, 25 of which were Jamaican owned and located outside the Free Zones. The three key reasons for promoting IT services as a growth industry were: Jamaica's proximity to the North American market; the proposed enhancements to the telecommunications infrastructure and air transportation links which would facilitate greater efficiency in data transfer to and from the United States; and the availability of a large trainable labour pool.

In general, the two major objectives then were to attract local and overseas firms to establish operations in Jamaica, and to secure long-term contracts with data-entry and other information service companies such as telemarketing and desktop publishing firms.

Specifically, the government provided the following incentives and support:

1. Incentives -- Fiscal incentives for local private sector investors in the export information processing industry were provided through three pieces of legislation - the Export Industry Encouragement Act, the Industrial Incentives Act and the Jamaica Export Free Zone Act. In addition to tax holidays, there were customs and excise duty remissions for periods of three to five years. Other incentives such as minimal custom procedures were provided to investors who located in free zone areas.

2. Technological Support -- In addition to the fiscal incentives, companies that occupied the free zone had access to the telecommunication services of the Jamaica Digiport Inc. The Digiport was set up in 1989 primarily to provide low-cost telecommunications services including switched 56 kbit/sec leased lines, dedicated private lines with speeds between 56 kbps and 1.5 Mbps, international long distance and advanced 800 services.

3. Marketing -- The Jamaica Promotions (JAMPRO), an agency for attracting investment to Jamaica is charged with marketing Jamaica's IT's potential to overseas investors. At present, a division - Information Technology Division, is specifically responsible for the promotion of IT. Through the Target Europe programme this division particularly focusses on export marketing opportunities in Europe and seeks to highlight development and trends affecting trade with, and investment from the European Economic Community.

[2] " ... *The export of information services is seen as an area for immediate action by Government. In the last 5 years the industry has grown from 2 to 29 companies. 25 of which are Jamaican owned and operated and located outside the Free Zones...* " Planning Institute of Jamaica Report, 1990, page 84.

5.3 Human Resources

Overview

Tertiary-level technical and management training is provided by the following public and private institutions:

- University of the West Indies (UWI)
- College of Arts, Science and Technology (CAST)
- National Tool and Engineering Institute (NTEI)
- Maritime Training Institute
- Institute of Management and Production,
- Jamaica Institute of Management
- West Indies College
- Others

The most important issue that confronts tertiary-level institutions is the amount of resources consumed to provide remedial programs at these tertiary-level institutions in which students spend a year or more to upgrade their entry requirements in the core subjects such as English and mathematics.

Most if not all of the above institutions face the pressing need for upgrading and strengthening their respective curricula, laboratories and workshops. Although, there has been support from international agencies and governments[1] to assist in several upgrading projects, these projects tend to take a long time to be completed[2] . The net result then is that by the time such projects are eventually completed, technologies have advanced another round, thus nullifying the benefits of the newly-completed enhancements. The bureaucracy needs to foster the timely completion of projects rather than the current practice of slowing them down.

University of the West Indies (UWI), Mona Campus

UWI offers traditional undergraduate and graduate instruction in Computer Science and Management Sciences with a computer option in conjunction with the Dept. of Management Studies. The UWI computer science curriculum, revised two years ago using the American Society for Computing Machinery (ACM) recommendations for the teaching of Computer Science, is claimed to be comparable to the curriculum offered by many North American universities.

The present laboratory facilities and the availability of software tools do not allow UWI students to be as well prepared for a career in Computer Science as a typical graduate from a well-equipped

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[1] Recent assistance to CAST includes:
USAID support for strengthening the Building Department
EEC and ODA aid to establish the Caribbean School of Architecture
CIDA aid to strengthening the Business Education, Computing, Hospitality and Tourism programs
Kellogg Foundation support for establishing a B.S. in Health Science
Netherlands government support for establishing a B.S. program in Physical Planning and a post-graduate program in Urban and Rural Development Planning

[2] The UWI development program co-financed by the Inter-American Development Bank (IDB) and the Caribbean Development Bank (CDB) provides loans to strengthen the science, technology programs and distance-education facilities. CIDA is also providing assistance for improving management systems, and the EEC provides assistance to strengthen agricultural training and expand dormitory facilities

North American university. More importantly, the typical UWI computer science graduate is not fully equipped with the marketable skills and software methodologies that are required in the current computing environments.

The College of Arts, Science and Technology (CAST)

The College of Arts, Science and Technology trains students to the certificate, diploma and degree levels in Computer Science as well as many students in the evening programme who do not achieve any qualification or certification. Typically the evening courses run for 48 to 60 hours compared to 24 to 30 hours in other institutions, except UWI. In excess of 2000 students are enrolled in the evening programme and another 150 are enrolled in the full time diploma programme. Some thirty (30) students each year may enter the B.Sc degree programme in Computer and Management Studies after at least one year's work experience which covers two summers (June to September) with seminars, and assignments directed between summers. In all of these programs - daytime, evening and degree, students are trained in computer methodologies and programming languages such as COBOL, RPG, IBM PC assembler, and C.

There is however one hidden issue: on one hand a significant number of the students enrolled in the evening program do not complete the full computer studies requirements, and thus are not available to the job market. On the other hand, employers have complained that there are not enough computer graduates coming out of CAST. In this regard, CAST is not fulfilling the needs of the workplace. Serious consideration needs to be given to the fact that such a large percentage of enrollees do not complete the full program to become certified.

Creative Production and Training Centre (CPTC)

The Creative Production and Training Centre is an institution offering multi-media courses in voice, speech, broadcast presentation techniques, radio production, radio and TV script writing, film and TV production, and audio-visual techniques. CPTC will have college-level accreditation in about two years. It currently offers credit courses in the above fields.

CPTC was created in 1985 with two main objectives:

1. To produce for local and overseas presentation, top-quality radio and TV programmes which reflect the mores, values and culture of Jamaica and the larger Caribbean region.

2. To enhance the skills of media workers in Jamaica and the Caribbean at large.

To carry out the first mission, the CPTC has been involved in the production and co-production of high-quality entertainment, educational, cultural and community programmes. It also produces promotional, training and advertising videos and radio programmes for public and private clients.

To carry out the second, the CPTC provides "hands-on" training mainly in television and video production techniques, and also in the use of audiovisual aids, in programme presentation and in radio-broadcast techniques.

CPTC has developed an enviable reputation in the video and film field. Its staff represents the best in the field and recently has been aggressively pursuing revenue-producing opportunities in North America.

Non-formal Training

Employment-related training is provided by a number of public and private institutions including:

- Human Employment and Resource Training Trust/National Training Agency (HEART/NTA) and its seven (7) academies
- Vocational Training Development Institute
- NTEI, a division of the National Tool and Engineering Company
- Numerous private and non-government-operated programs

The HEART programmes in addition to the seven academies, run the School Leaver's and Apprenticeship Programmes, the Vocational Training Centers, the Jamaican-German Automotive School (JGAS) and over forty (40) community projects.

The effectiveness of these various non-formal training programs is impaired and by the weak academic preparation and the poor work attitudes of the trainees. Most programs suffer from a chronic shortage of trained instructors with relevant industrial experience and from a lack of well-equipped and technologically-relevant workshops.

Specific recommendations for the training issues will be offered in Chapter 8.

5.4 Industry Profile

Several studies have examined the IT market in Jamaica. The most recent study[1], commissioned by the Planning Institute of Jamaica (PIOJ), reported on the responses to questionnaires of 80 companies from an estimated 120 IT providers. Among the total number of companies covered, of most interest are those companies with export earnings through information technology processing.

A 1993 survey by Mullings[2] indicates that 49 companies were involved in the export of information services from Jamaica. Of this number 53% were located in Kingston, 33% in Montego Bay and the remainder (14%) in the rural parishes of St. Thomas, Manchester and St. Elizabeth.

Of all the information technology processing firms located in Kingston, only three were branches of foreign-owned firms. The reminder were locally owned companies that performed specific data conversion jobs. Companies located in the Jamaica Digiport were mainly foreign-owned companies that sub-contracted work from other US-based companies or from service bureaus.

According to JAMPRO, the contribution to foreign exchange earnings from the information processing services sector grew from US$1.5 million in 1986 to over US$17 million in 1991.

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[1] "*National Industrial Policy - Draft Report to the Government of Jamaica/United Nations Development Program*", Sezvin Hamilton, March 1, 1995.

[2] "*Export Information Processing in Jamaica: Current Issues and Future Prospects*", B. Mullings, Industry report of interviews conducted with Export Information Processors, Department of Geography, McGill University, 1994.

Correspondingly, the number of companies and the employment grew from three firms employing three hundred people to over twenty firms employing over 3,000 people. While the size of the average firm is small - typically 100 persons, this average size was no smaller than similar firms in the Dominican Republic or Barbados.

The majority - 82%, of information technology processing firms were involved in data-entry services such as text entry and geographic information systems (GIS); another 10% were involved in sales, training and marketing services; and 4% were engaged in telemarketing services.

Most the companies performed outsourced work for clients in the US while a few performed it for clients in Canada and the United Kingdom.

5.4.1 - Market Structure

Marcelles' 1991 study[1] classifies the Jamaica IT market as follows:

1. Hardware Distributors and Dealers
2. Software Distributors and Dealers
3. Professional Services - system consultancies, technical support and software development
4. Full-service or Total-solution Companies
5. Related Service Companies, e.g. computer rental, computer repair
6. Computer Training Companies
7. Information Technology Service Providers - Data entry, Telemarketing, Geographic Information Systems (GIS) and Image Processing, CAD/CAM etc.
8. Data Communication Equipment/Service Companies

Rather than discussing each of the above market segments, we will concentrate in this report on the Information Technology Service Providers

Information Technology Service Providers

Information technology service providers are companies that provide services in a number of areas such as data entry, telemarketing, GIS and CAD/CAM and custom software programming.

Jamaica has had some experience with IT-based services such as data-entry, programming and more recently with computer-aided design and manufacturing (CAD/CAM) and geographic information systems (GIS), telemarketing and imaging. Since the early 1960's, Jamaican firms have been involved in software programming primarily for local companies. More recently, some larger companies have divisions that develop custom application software for vertical application areas such as financial services and human resources.

The GIS and CAD/CAM are relatively new segments of the IT services that are offered. Mona Informatix's work in the area of CAD/CAM is an example of the capability that exists for this type of the IT service industry.

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[1] "*Industry Profile of the Jamaican Computer Services Industry*", Gillian Marcelle, Consortium Graduate School and Institute of Social and Economic Research, UWI Mona, Jamaica, September 1991.

Table 5.2 shows the segmentation of information technology service companies in 1993 by type and by location.

			Regional Distribution		
Type	Number	%	Kingston	Montego Bay	Other
Data-entry & Related Services	37	76	21	11	5
Telemarketing	4	8	0	4	0
GIS	3	6	2	1	0
Sales, Training & Marketing	5	10	3	0	2
Total	49	100	26	16	7
% of Total			53	33	14

Table 5.2 Information Technology Service Companies in Jamaica, 1993[1]

A. Data Entry

Data entry is the process of capturing data by keying in, scanning, or converting information to digital computer data. Increasingly, digitised computer data is the accepted or preferred form of storing small and large amounts of information. The trend to the all out use of the computer for digital storage of information ranging from private customer data to public on-line databases, is being accelerated because database technology and information retrieval has become a vital part of all forms of commerce and government.

The size[2] of the data entry segment of the US information technology processing market is estimated to be approximately US$400 million and growing at a rate of approximately 20% per year. The health care, financial, government, and manufacturing segments account for a total of 64% of all the data-entry expenditures, and these expenditures[2] are distributed over 1000 firms in the U.S. and others in China, Philippines, India, Eastern Europe and Latin America.

As early as the 1960's, Jamaican-based firms were involved in the importation, processing and export of information from the United States. At that time the information was in the form of cards which were shipped to Jamaica by trailer where they were processed and stored on magnetic tape and then shipped back to the US.

The logistics of the data-entry services has not changed substantially over the years. Although high-speed telecommunications resources are available, most of the firms import data in the form of paper documents, magnetic tape, discs, or tape. After processing, the data is stored on magnetic tape, or disc and shipped back via courier or air freight to the US. This form of transport of data is the preferred method by many data entry firms in Jamaica because of the prohibitively high cost to access and use the digital telecommunications network facilities at the Jamaica Digiport.
Some of the companies outside the Montego Bay Free Zone transmit data through the TOJ gateways, and only two data entry companies transmit data directly to off-shore computers via the

[1] "*Telecommunications Restructuring and the Development of Export Information Processing Services in Jamaica*" by Beverley Mullings in "*Globalization, Communication and Caribbean Identity*", Hopeton Dunn et al, Ian Randle Publishers, Box 686, Kingston 6, Jamaica, 1995.

[2] "*Framework Paper of Determining Guidelines for Industrial Policy in the Jamaican Information Processing Industry*", JAMPRO, Information Processing Unit, January 1993.

JDI gateway. In 1995, the base cost of a 56 Kbps half-channel service to the US is US$1,750 per month which makes it prohibitive for many companies in this sector to use these facilities.

The Prospects for Data Entry as a Viable IT Services Sector for Jamaica

Between 1986 and 1989, the data entry services sector in Jamaica grew rapidly from two firms to twenty-nine, the majority of which were locally owned. Not long after this rapid growth, the industry developed into a dual industry with foreign-based firms having key advantages over local firms for access to the benefits of the advanced telecommunications facilities, while the local firms experienced a withdrawal of their fiscal incentives under the Industrial Incentives Act. A shaktives under the Ind of the industry began with a subsequent decrease in the number of data entry firms.

The viability of data entry service companies in Jamaica is strongly affected by the following issues:

1. There is an absence of financial capital required to sustain many of the new entrant firms over the long haul. For example, many of the new firms did not have the marketing resources to maintain effective marketing programmes so that they could maintain a steady flow of out-sourced contracted work from a number of different US-based companies.

2. Many of these new entrants were not prepared for the competition from countries such as the Phillipines, India, China and Bangladesh.

3. The collaborative marketing schemes developed by the local firms to give them a collective marketing thrust were nullified by the removal of the import and custom duty concessions under the Export Industry Encouragement Act.

4. The evolutionary changes in data collection and data entry technologies such as the adoption of optical character recognition (OCR), bar-code systems and on-line transaction processing (OLTP), and the lower telecommunications costs of competitors has eroded the advantages of low-cost labour and quick turn-around times based on courier-based transport.

5. Continuing advances in automated computer/telephony software technologies; client-server personal computer architectures; the elimination of paper in the business office and reliance on on-line systems; and the lowering of Jamaica's competitors' telecommunications costs threaten the survival of the traditional data-entry market as it is practised currently in Jamaica.

6. Because of the overall comparative advantages of firms located in the Free Zone compared to companies in other countries, there has been an increase in occupancy in the JDI facilities and a corresponding decrease in the number of data-entry firms in other areas outside of the Free Zone. Increasingly, more incentives and concessions must be provided to companies who require access the JDI facilities through the TOJ telecommunications infrastructure. For example, the adoption and passage of single-entity free-zone status to companies outside the Free Zone would greatly increase the attractiveness and viability of companies to locate outside the Free Zone.

The other factors that affect this segment include training and transportation.

B. Telemarketing

Telemarketing has a short history in Jamaica. Telemarketing operations can be segmented into two categories:

1. In-bound Telemarketing - operations are mainly the receipt of incoming calls. These operation are generally less complex, since the customer already has some knowledge of the product or service and the call is primarily to satisfy a service based on queries such as dealer location, warranty, catalogue order or banking/brokerage service.

2. Out-bound Telemarketing - these operations involve outward calls by the operator to prospective customers for products or services that involve product or market research surveys, direct marketing, credit card add-on services, travel services or product recalls.

JAMPRO estimates the size[1] of the total telemarketing market for the US to be US$75 billion in 1993, with in-bound telemarketing being one-third or $25 billion. This publication also suggests that Jamaica is most suited for in-bound telemarketing based on business-to-business in-bound support and sales, as well as business-to-consumer in-bound sales. It also lists the following seven factors which favour Jamaica in the telemarketing market:

- Availability of an educated work force
- Low labour costs
- A devalued Jamaican currency which compensates for higher telecommunication rates
- The largest English speaking country south of the USA - the largest market in the Western Hemisphere
- A modern telecommunications infrastructure with digital switching; and support for remote monitoring of telemarketing operations
- Close proximity to the US to ensure reasonable telecommunications charges
- Well developed communications infrastructure to allow for active linkages between businesses in the US and telemarketing operations in Jamaica
- Data up-links allow for free movement of information to clients
- Location in the same time zone affords access to several US-based service agencies

As in the case of the data entry market segment, the threat to the survival of the telemarketing will come mainly from the evolutionary advances in computer/telephony software which can and will displace the traditional human interface.

[1] *"Framework Paper of Determining Guidelines for Industrial Policy in the Jamaican Information Processing Industry"*, JAMPRO, Information Processing Unit, January 1993.

C. Geographic Information Systems (GIS) and Image Processing

Geographic Information Systems typically is an application-specific software program that runs on a personal computer. This software allows information in the form of databases to be spatially linked to geographic maps and other graphic representations of geography. For example, the population density of a parish can be displayed in high resolution text and colour graphics and overlaid on top of a detailed topological physical map. The ability of GIS software and hardware to model and represent this type of information has created many diverse applications for these systems. Some typical applications for GIS include:

- Census and other population statistics
- Demographic databases
- Environmental planning
- Navigation systems for land-based vehicles, ships and other ocean craft
- Navigation systems for recreation - yachting, eco-tourism, fishing
- Urban planning

The scope and type of GIS work that could be out-sourced to Jamaica would include the creation of GIS content. This GIS-specific content would be the result of combining textual data bases with spatial information in the form of maps, topographical surveys or other graphics-oriented pictorial information. The size of the GIS market in the US is estimated to be US$5 billion with the services sector accounting for the largest segment of this market - 75% or $3.75 billion; hardware and software make up the remaining 25%. The annual growth rate for the entire market is estimated to be 22%.

The users of GIS technologies in the U.S. include the Federal Government - Departments of Energy, Human Resources, Education, Agriculture, Mines, Bureau of Reclamation and Land Management, utility companies - gas, water, electricity, sales professionals. The US government is currently the largest user of GIS products. The other major customers include oil, utility, telephone, mining,.car rental and trucking companies.

The key issues regarding this technology as far as its potential contribution to Jamaica's export earnings are:

- The sensitivity of the data content is high especially since it relates to the government sector and its planning and monitoring functions

- In general, geographic proximity is an important out-sourcing consideration. In the case of Jamaica, this is an advantage especially when compared to some of its competitors.

- The minimum training requirements for a GIS operator or technician are a high school diploma and additional computer-based training.

- The hardware and software entry requirements are much higher than those required for standard data entry information processing out-sourcing contracts. Typical hardware costs can range from US$20,000 to US$100,000 and software from US$1,000 to US$60,000.

- The GIS market is expected to grow as technology evolves to create more low-cost consumer oriented applications. For example, the cost of a global positioning system (GPS) suitable for interfacing to a portable notebook computer system is now priced at less than US$1000. With the cost of such systems at that level, it is expected that more consumer applications will evolve and these applications in turn will spur the demand for more GIS content.

Presently at least three Jamaican companies are involved in the out-sourced GIS work. The most visible one is Mona Informatix which has already been discussed. Two or more companies across the island are involved in less-sophisticated GIS imaging applications.

D. Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM)

Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) is a technology which uses the computer as a design, simulation and verification tool. CAD/CAM software is used in all fields of engineering - electrical, mechanical, structural etc. architecture/construction and manufacturing. As a design and simulation tool, CAD is used extensively in the design of modern VLSI circuits which can contain as many as 5 million transistors as in the case of the Pentium chip. In other fields like structural engineering, CAD technology is used extensively to design, verify and test airplanes such as the Boeing 777.

The size of the US CAD/CAM market is estimated at $17.8 billion in 1993 with the hardware and software sectors accounting for 45% and 40% respectively, and the services sector accounting for 15%. The growth rate for the entire CAD/CAM market is estimated to be in excess of 20%.

The services segment of the CAD/CAM market is the sector which is ideal for out-sourcing to Jamaica as the requirements of this segment match the skills and attributes of the Jamaican labour force. Within this services segment, data conversion or translation of drawings and the drafting/layout of new drawings are the two most suitable services for Jamaica.

The key issues regarding CAD/CAM technology as far as its potential contribution to Jamaica's export earnings are:

- The sensitivity of CAD/CAM data is high because it usually represents the design core of a company's product or other sensitive information upon which the company's or customer's future is dependent. Because of this, the elements of trust and relationships play an important role in the out-sourcing of CAD/CAM projects.

- In general, geographic proximity is not an important consideration. The work that is out-sourced usually has a turn-around time of 2 weeks or less.

- The minimum educational requirements for a CAD/CAM operator or technician is a high school diploma and additionally - at least one year's training with the relevant CAD/CAM software.

- The hardware and software equipment entry requirements are much higher than those required for standard data entry information processing out-sourcing contracts.

Typical hardware costs can range from US$5,000 to US$10,000 per seat and software from US$3,000 to US$20,000. The wide range of hardware required includes sophisticated workstations, scanners, large-format plotters and printers.

- Competition for CAD/CAM out-sourcing is from US-based service bureaus as well as from countries such as India, Philippines, Ireland and Mexico. Most of Jamaica's competitors have a much more developed manufacturing base, and therefore have stronger and more developed engineering infrastructure.

- The GIS market is expected to grow as technology evolves to create more low-cost consumer oriented applications. For example, the cost of a global positioning system (GPS) suitable for interfacing to a portable notebook computer system is now priced at less than US$1000. With the cost of such systems at that level, it is expected that more consumer applications will evolve and these applications in turn will spur the demand for more GIS content.

- Quality of the end-product - drawings or conversion data, is the key issue in CAD/CAM out-sourced projects. Since the CAD/CAM drawing or data is used in manufacturing, the accuracy and attention to detail are the important parameters.

The Mona Informatix's work in the CAD/CAM area is an example of what can be achieved through the vision and hard work of a few individuals. The multi-million dollar contract with one of the largest aerospace companies in the world has proved that Jamaica can not only secure such contracts but can deliver product with exceedingly tight specifications.

5.4.2 - Incentives (Government)

Current government incentives for the information technology processing industry are not effective in assisting the entire industry. Because access to financial incentives depends on where the exporter is located, the industry is bifurcated so that those exporters who conduct their business in a foreign currency are entitled to locate in the Digiport, where they can also benefit from incentives such as a 100 percent tax-free holiday on profits, duty concessions on selected imports as well as full repatriation of profits. Through two pieces of legislation - the Export Industry Encouragement Act and the Industrial Incentives Act, that only were passed between 1986 and 1990, information processing companies owned by local investors benefited from tax holidays and customs and excise duty remissions for periods of three to ten years. However, these fiscal incentives have now been removed so that any firms located outside the Digiport do not enjoy the same fiscal incentives as similar companies located in the Digiport.

5.4.3 - Regulatory Framework

The structure and regulatory framework of the Jamaican telecommunications sector has been subject to massive restructuring since the late 1980's. As a result of regulatory reforms of 1987, the TOJ maintains a strong monopoly over both domestic and international segments of telecommunications. According to Spiller and Sampson[1]

[1] "*Regulation, Institutions and Commitment: The Jamaican Telecommunications Sector*", Pablo T. Spiller, Cezley I. Samson, Policy Research Working Paper 1362, The World Bank, Policy Research Department, October 1994.

"... the Jamaican regulatory system is based on a license which stipulates a price setting mechanism. Prices have to be such that the company (TOJ) achieves a particular rate of return ..."

They also state that

"... the 1987 regulatory change seemed to have erred in the preservation of a tight monopoly over all telecommunications segments. While allowing competition in some segments of the market would have required some realignment of rates with a possible short term political backlash, it could have had long-term benefits in the form of a more dynamic sector and lower prices in a quite elastic segment of the market. This to a large extent, represents the missing opportunity in the whole regulatory change/privatisation process ..."

In a recent survey of IT service company managers, Mullings[1] states:

"... Managers felt that in addition to the restriction placed on access to high speed telecommunications services, they were unable to make use of cost-cutting telecommunications technologies because to do so would contravene TOJ's license of telephone services in Jamaica. Some managers felt that TOJ's monopoly over the provision of telecommunications services, and in particular their prohibition of any form of inter-connectivity limits the efficiency of the industry because they were unable to make use of cost-saving technologies, such as those that facilitated the multiple use of a telephone line.

Managers within the Montego Bay Free Zone, also felt that the current regulations regarding access to the high-speed telecommunications services of the Digiport constrain the sector development. For example, one manager stated that he would prefer to be located outside the Montego Bay area where he would not be in competition with the Tourism industry for employees. He felt that it would be a cost effective locational strategy if he were able to put up his own satellite station to receive and send information to his clients. Under the terms of the licensing agreement between the government and TOJ, however, such proposals would not be possible ..."

More recently, these issues have become very evident. With the introduction of the Internet services to Jamaica and the growing acceptance by the Jamaican end-user community - businesses, educational and personal users, the control and limitations of access to Internet services due to high cost of local toll calls to the Internet service provider - UWI gateway, and others, will act as a barrier to the expansion of this service. More importantly, the recently enacted TOJ policy of charging Internet users extra for access to the Internet gateway is a disincentive to the use of the Internet. This policy restricts the use of the Internet and is not in the best interests of the Jamaican economy.

5.4.4 - International Competitiveness

Table 5.3 lists the comparative business factors for Jamaica and seven of its competitors. These factors include technical attributes, telecommunications, labour, incentives, tax, costs, foreign currency, financing, barriers among others. It should be emphasised that while some technical factors work to Jamaica's advantage, others need considerable work and enhancements. For example, Jamaica's telecommunication gateways - the Jamaica Digiport and the TOJ facilities, while technically satisfactory will see increasing competition as other countries build teleports to emulate the JDI facility. While the telecommunications rates offered by the TOJ and JDI gateways are competitive with other non-US-based teleports, their rates must be compared with rates offered to US-based competitors that have access to the lower charges offered by AT&T, Sprint, MCI, British Telecom and other carriers.

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[1] "*Export Information Processing in Jamaica: Current Issues and Future Prospects*", B. Mullings, Industry report of interviews conducted with Export Information Processors, Department of Geography, McGill University, 1994.

Factor/Country	Units	Jamaica	Barbados	Dominican Republic	Philippines	Bangladesh	India	Mexico	China
GDP per capita	ECU	1261	4704	563.0	692.45	173	258.47	1872	388.63
Population	millions	2.495	0.263	7.624	65	119	900	86	1.19
Technical Factors									
· 24 hr turnaround	y/n	Y (12-24 hrs)	Y		Y	N	Y		N
· Accuracy of data processing	% or (1-5)	99.98	5		99.7				n/a
· Industry average (# of keystrokes)	per hr.	10000			15000/hr				n/a
· Security			5		3		3		1
· # of data entry firms	years	30	31		75		238		1
· Data entry services experience		25	25		+10		20		1
· Other IT services									
· ISO 9000 certificate	y/n	Y	Y	N	Y	N	Y	Y	Y
· Familiarity/Access to latest technology	(1-5)	4	4		5		5	5	1
· Time difference with GMT	+/- hours	6 (-)	4(-)	4(-)	8(+)	6(+)	5.5(+)	6(-)	6-9 (-)
Telecommunications									
· High-speed facilities	y/n	Y	Y	Y	Y	N	Y	Y	Y
· Satellite Links									
· speeds	bps	9.6 kbps -2.04 Mbps	64 Kbps	56 Kbps	64 Kbps	n/a	64 Kbps	64 Kbps	
· Costs									
· International calls (to Europe)	ECU/min	1.44 av/min	2.32 av/min	2.47 av/min	10.5 av/min	5.2 av/min		16-2.42/min	1.83/min
· lease prices to satellite connections		US$1900/mo	ECU 5500/mo	$4118/mo					
· Quality of Telecommunications Network	(1-5)	5	5	5	4	2	3	4	2
· Future Upgrading of Telecom Network	Y/N	Y	Y	Y	Y	Y	Y	Y	Y
Labour									
· Language		English	English	Spanish + English	Filipino	Bangla + English	Hindi, Bengali, English	Spanish, English, Indian	Mandarin, English
· Wages (basic, unloaded)									
· Average skilled (e.g. Software professionals)	ECU/mo	1025	1800		700/mo	113-788/mo	2684/yr	1430/mo	110/mo
· Average semi-skilled (e.g. data-entry)	ECU/hr	0.7-0.9/hr	2.57	0.7-0.9/hr	3.60/hr	2.82/hr	5.5/hr	1.75/hr	.75/hr
· Minimum wage	ECU/hr	0.24/hr	None	4.4 ECU/day	0.65/hr	none			
· Social charges (health, sickness, contribution)	% of salary	2.5%	11.25%	7			up to 10%	30%-35%	up to 15%
· Employee benefits (pensions)	Y/N	Y	Large employers	Y				Y	
Education									
· literacy rates	% of pop	87	98	83	88	25	52	88	80
· secondary education	% enrollment	Y	98	Y	Y		43	Y	44.4
· tertiary education	% enrollment	Y	Y(1)	Y	Y (	160 CS grads/yr	9	Y	1.7
· Training - IT courses available	Y/N	Y (2)	Y			Y	Y	Y	Y
· Availability of -		Y							
· skilled workers	1-5	3	4	2	5 (20K IT Profns.)	160 CS grads/yr	5	3	2
· semi-skilled workers	1-5	3	4	4	4			5	5
Reliability - level of absenteeism	1-5	3	4						
Trainability of workforce	1-5	5	5		5		4	4	3
· Flexibility							3		
· ease of hiring and dismissal	1-5	3	3	4	4		4	2	4
· ease of obtaining foreign work permits	1-5	4	3	2	4			3	2
· average staff turnover	1-5	4	3					3	
		3							
Incentives									
· Tax holidays	Years	10-15	10	10	4-6		5	None	2
· Preferential Trade Agreements		Caribbean Basin, CARICOM, LOME IV, Caribcan	Caribbean Basin, CARICOM, San Jose, LOME IV, Caribcan	Caribbean Basin, Caribcan, Lome IV, San Jose Pact	ASEAN,GATT	SAPTA	SAPTA,GSTP, Bangkok Agreement,GATT	NAFTA, GATT, LAIA	GATT(Pending), APEC
· Quality of life	1-5	4	4		4		3	3	3
· Free trade zones	Y/N	Y	Y	Y	Y	Y	Y	Y	Y
· Investment climate	1-5	5	5		4	2	4	4	1
· Other (any other specific incentives)	Y/N	Y	Y	Y	N		y	N	N

Table 5.3 Comparison of Business Factors -- Jamaica vs Seven Competitors[1]

[1] *Source: Communications with JAMPRO*

Factor/Country	Units	Jamaica	Barbados	Dominican Republic	Philippines	Bangladesh	India	Mexico	China
Tax									
· Corporate tax rates	%	33.3	40	26	35	37.5/42.5	40	34	30
· Local tax	%	no tax	no tax	petrol & stamp	1-35	no tax			3
· Personal tax rates	% of wage	25	25	0%-26%		15-30	20-40	3-35	0-45
· National insurance contributions	% of wage	2	10.25	2.5			2.5	8.75	0.19
· Repatriation of profits	%	no tax	Y	30		100	no tax	no tax	Y
· Other taxes	%	none	Property transfer & land	Construction	Capital gains		sales tax % varies	special federal	5% commerce
· Tariff on hardware	%	5	10	10	10	7.5	112.75	20	0.09-0.3
· Tariff on software	%	20	0		10-40	7.5	85	0	15
· Tariff on manuals	%	0	0	0	0	0	0	0	0
· Withholding taxes	%	25	5	26	unknown	unknown	unknown	unknown	unknown
Costs									
· Electricity	ECU/kW hr	0.11	0.1+fixed+fuel	0.018 + fixed	0.06		0.035/KwH	0.035/KwH	0.044/KwH
· Statutory business/other insurance costs	%/ECU 100	Annual registration	8-10/1000 ECU					None	
· Relative cost of hardware/software (std PC)	ECU	1264	1560					2685	not available
· Office space/land rentals in free zones	ECU/sq. m		90.21-202.97		2.29-3.74/yr			no free trade zones	2.175-6.2
Foreign Currency									
· Limits on holding bank accounts	Y/N	N	Y		N	N	Y	N	Y
· Exchange controls and restrictions	Y/N	N	Y	N	Y	N	N	N	Y (strict)
· Foreign exchange availability	1-5	3	5	5	4			4/5	
· Exchange rate stability	1-5	2	5	4	4	3	4	4	
Financing									
· Ease of accessing loans	1-5	3	3		3/4	1	3	2/3	3
Interest rates on loans	%	61	9-13	26.4	8.6	15	8.58	25-35	n/a
Additional overdraft costs	Y/N	60				N		Y	Y
Other sources of financing									
· venture capital	Y/N	Y		Y	Y	N	Y	Y	Y
· subsidies	Y/N	N	Subsidies	Y	N	N	N	Y	N
· restrictions	Y/N	Y		N	Y	N	Y	Y	Y
Barriers									
Import/export restrictions	1-5	5	4	2/3	3	5	4	4	
· Bureaucracy/red tape	1-5	4	4	3			3	3	3
· Company registering requirements	1-5	4	4	4	3		4	3	5
· Government policy towards FDI in theory	1-5	4	5	3	5	4	4	3	3
Government policy towards FDI in practice	1-5	3	5	3	4	3	4	2	3
· Existence of "one-stop" shops	Y/N	Y	Y	Y	Y	N		Y	N
Support									
· Auditing requirements	Y/N	Y	Y	Y	Y		Y	Y	Y
· Other support									
· availability of local consultants	Y/N	Y	Y	Y	Y		Y	Y	Y
· local availability of hardware/software	1-5		5		5		5	Y	
· level of support given from "one-stop" shops	1-5		5		5		5		
· Transportation - availability									
· # of international airports	number	2	1	5	2		6	45	40
· Public transport	1-5	3	3	4	3	2	3	3	1
· # of international harbours	number	3	1	6			11	85	9
		4							
Other Factors									
· Number/frequency of electric blackouts			Rare	Frequent	Regular	Frequent	Frequent	Rare	Many
· Political stability	(1-5)	4/5	5	3	3/4	2	2/3	2/3	3
· Ease of doing business	(1-5)	5		3/4	3	1	3	4	3
· Existing foreign investment	Comments	Y	Y	Y	Y		Y		
· Inflation over past four years	%	77.3	1.3	7.7	8.9	0.0	8	10.4	13
		61	6.1	7.0	19.2	4.6	13.4	11.9	8.7
		63	6.3	53.9	12-13-5	7.2	13.9	18.8	2.8
		22	3.1	37.3	10	0.5	8.2	29.9	2.2
		14.3							

Table 5.3 (contd.) Comparison of Business Factors -- Jamaica vs Seven Competitors

The factor of labour needs much attention and restructuring. Although Jamaica is often considered to have a large labour pool, it is not competitive in labour costs with countries such as China or the Philippines which has much larger labour resources and is making serious efforts in the area of training. The issue of training of the labour force as it relates to the information services sector is crucial if the information technology services sector is to be successful. It has been reported in detail by Ash et al[1] as follows:

> "... the primary source for data entry training is HEART. Reports from employers in the sector indicate this training is of poor quality and that graduates perform well below the industry standard. Training in programming is provided by UWI, CAST and several private institutions. CAST graduates enter the workforce with relevant skills, however, the supply of CAST graduates is not meeting existing demand. The training provided at UWI and private institutions is more relevant to work with information systems than in information (technology) service firms. No industry-specific management training for managers of information processing firms is available. The UWI graduate program in information systems management is designed for individuals who will manage information systems within a company rather than for managers in the information services sector. ..."

The capacity of the training system to meet the Jamaican labour force requirements in the key sectors such as information technology services has also been highlighted by Ash's study. This report states:

> "... the system is not doing an adequate job on training for the key sectors. The training system emphasises pre-employment training with little provision for upgrading the existing workforce. The vast majority of training resources are devoted to training for entry-level occupations as opposed to training skilled craftpersons, artisans and supervisory and management personnel. ..."

It continues with a discussion of the following six key training issues:

> "...
>
> Private Sector Linkages
>
> Traditionally, linkages between training institutions and the private sector have been weak, and few programs provide the work experience or cooperative programs of sufficient duration to enhance the relevance of training. ...
>
> Recent Training System Reform
>
> At the present time, the training system is in transition. The reforms being undertaken through HEART/NTA, including a legal entity to certify occupational skills in workers and accredit training institutions, developing occupational standards and modular curriculum based on these standards, and divesting training institutions and programs, are designed to enhance the quality and relevance of non-formal training. ...

[1] "*Jamaica Labour Force Assessment*" by Robert Ash et al, A Study by the Academy of Educational Development for the United States Agency for International Development (US AID), Bureau for Latin America and the Caribbean, June 1994, p. 61.

Management Training

A critical gap in the training system exists with respect to management training for the key sectors. There are no management training programs that provide industry-specific training or that focus on the needs of medium or small enterprises. When such programs exist, they tend to emphasise marketing strategies and not strategic planning, such as human resource development planning. This is a particularly critical gap given the management weakness in the four key sectors.

On-the-Job Training

Investment in on-the-job training, the most cost-effective vehicle for delivery of relevant skills training, is insufficient. Several factors constrain the effective provision of in-plant training in Jamaica, including the lack of orientation to human resource development by managers, the lack of training expertise within firms, and the reliance on obsolete technology within firms. Finally, the only tax incentive for training is the credit on the HEART three percent payroll tax granted to a firm that provides on-the-job training for a trainee in the HEART School Leaver's Program.

Training provided on-site by training institutions at the request of a firm or group of firms and tailored to the individual needs of the firm(s) is an effective vehicle for enhancing the quality of the on-the-job training. HEART, CAST, the Mona Institute of Business at UWI, and private management schools provide tailored programs for individual firms; however, all institutions report that only a limited number of requests from the private sector have been forthcoming.

Information Gaps

The training system suffers from a lack of information about the requirements of the labour market. As a result, programs are essentially supply-driven. In addition, there is very little information about the outcome of training and no information on the relative cost effectiveness of different training programs. This information vacuum inhibits the development of relevant, responsive, quality and cost-effective training.

Academic Foundation of the Workforce

The academic foundation of the workforce is poor and significant numbers of new labour force entrants and older workers are functionally illiterate. Non-formal vocational programs are constrained by the lack of basic academic skills in trainees. HEART programs do not attract sufficient numbers of trainees who function at a ninth grade reading and mathematics level; therefore HEART has, as result, introduced a remedial year for applicants who do not meet academic qualifications for entry. ..."

Several recommendations regarding the issues of training of the labour force required by the information technology service companies and other sectors will be made in Chapter 8.

Jamaica however does possess some strong advantages that can be used to effectively compete in the global IT market. These are discussed in the following section.

5.5 Competitive Advantages

Currently Jamaica offers the following competitive advantages:

Relatively Affordable Labour Rates -

As Table 5.4 indicates, the direct labour rates of Jamaica compare favourably with those of its immediate competitors. The hourly wage rates for data entry, secretaries and voice operators are 25% to 40% lower than the Eastern Caribbean countries listed.

High-quality Local/International Telecommunications Systems - The cost of leasing a half switched 56/64 telecommunications circuit is less than half the cost in any of the same territories. This together with the high-quality gives Jamaica a real communications advantage.

Linguistic and Cultural Affinities with the Largest Markets in the World - North America and European ties with Jamaica are strong - the result of a long history of shared values, common language and personal links and relationships.

Time Zone Affinities with Major North and Latin American Markets - many of the business centres of commerce that do business with Jamaica share the same time zone. Thus voice centre operations will be in sync with customers for a large percentage of the business day. This is an advantage in the telemarketing and other industries where customer contact is important.

Convenient and Rapid Transportation Links with the US - the frequency and availability of transportation links allow convenient and low-cost freight service compared to competitors.

Country	Hourly Wage - Data Entry (US$)	Hourly Wage - Secretary (US$)	Hourly wage - Voice Operator (US$)	Cost of Dedicated half-circuit - 56/64 Kbps to US (US$)	Length of Time for Incentive Notification
Jamaica	**0.80 - 1.00**	**1.75**	**1.10**	**1850/mo.**	**1 month**
Dominica	0.80 - 1.00	2.50 - 3.50	2.25 - 3.56	4118/mo.	3 months
Grenada	1.26 - 2.10	2.42	3.05	4118/mo.	1-2 months
St. Kitts	1.40	2.25	1.80	4118/mo.	3 months
St. Vincent	1.10 - 1.57	2.16	1.57	4118/mo.	1-2 months
St. Lucia	1.10- 1.70	2.10 - 2.50	1.70	4118/mo.	2 months
U.S.A	7.00 - 8.00	8.50 - 10.00	8.00 - 12.00	na	3-6 hours

Table 5.4 Comparisons between Jamaica and Competitors[1]

[1] *Source: World Bank*

Future Competitive Advantages

The continuing improvement in the telecommunications equipment and the increase in transportation links will help to improve the competitive position of Jamaica. Another advantage that Jamaica offers is the increasingly entrepreneurial environment that has developed over the last four years. The key support services are in place - venture capital institutions; entrepreneurial support centres such as the Entrepreneurial Centre at CAST; training courses sponsored by JAMPRO and most importantly, the attitude and mindset of the present Jamaican citizen towards entrepreneurial ventures.

5.6 Conclusions

The information technology processing industry has not become the dynamic foreign exchange earner that was envisaged when it was set up in 1986. The key reasons for this not having taken place are:

1. The preferential treatment given to investors with foreign currency created a dual industry consisting of a growing segment having access to financial incentives and advanced telecommunications technology for doing their daily business, and a second sector typically operated by local investors having little or no financial support or access to competitive telecommunications facilities.

2. Inadequate attention was paid to marketing resulting in a negative impact on the growth of the industry. Neither the companies themselves nor the government anticipated the large amount of investment that was required to market the industry and sustain its growth in spite of continuing advances in data entry technologies.

3. The issue of the development of human resources, specifically the issue of minimum training required so that an adequate, high-quality and productive workforce is available to meet the needs of the different sectors that make up the information technology sector, is critical to the present partially developed IT services sector. Training also will play a major role in the development of the other sectors. It cannot be overemphasised that without a suitably trained labour force in the relevant technologies, whether it be data entry or telemarketing skills or sophisticated Windows or C++ software programming for developing software products, it will be difficult to compete in a timely manner and profitably in the information technology opportunities.

4. With the advent of an new era in global commerce using on-line services, the present high rates for access to the Internet are prohibitive and are barriers to the logical growth to all of IT in Jamaica. In fact, these high rates will act as a significant barrier to what would otherwise be a natural and orderly development of IT. It adds another factor which will affect a range of infrastructure issues - development of human resources, commercial transactions, market research and the urgent development of cost-effective, Jamaican-based Internet services.

6.0 A Vision of the Future IT Industry in Jamaica

6.1 Overview

This chapter presents a vision of how Jamaica can develop and exploit opportunities in information technology. Key to this vision is an information-based economy integrated with a key support resource, the National Data Network. This data backbone will interconnect all the key government departments and agencies, educational institutions, and the private sector organisations, and create an environment in which income producing opportunities can be fostered. The development of this resource will be discussed in detail in Chapter 6.6 and Appendix E.

6.2 Overall Vision for an IT-based Sector within the Jamaican Economy

The overall vision for an IT based sector in the Jamaican national economy is shown in Figure 6.1.

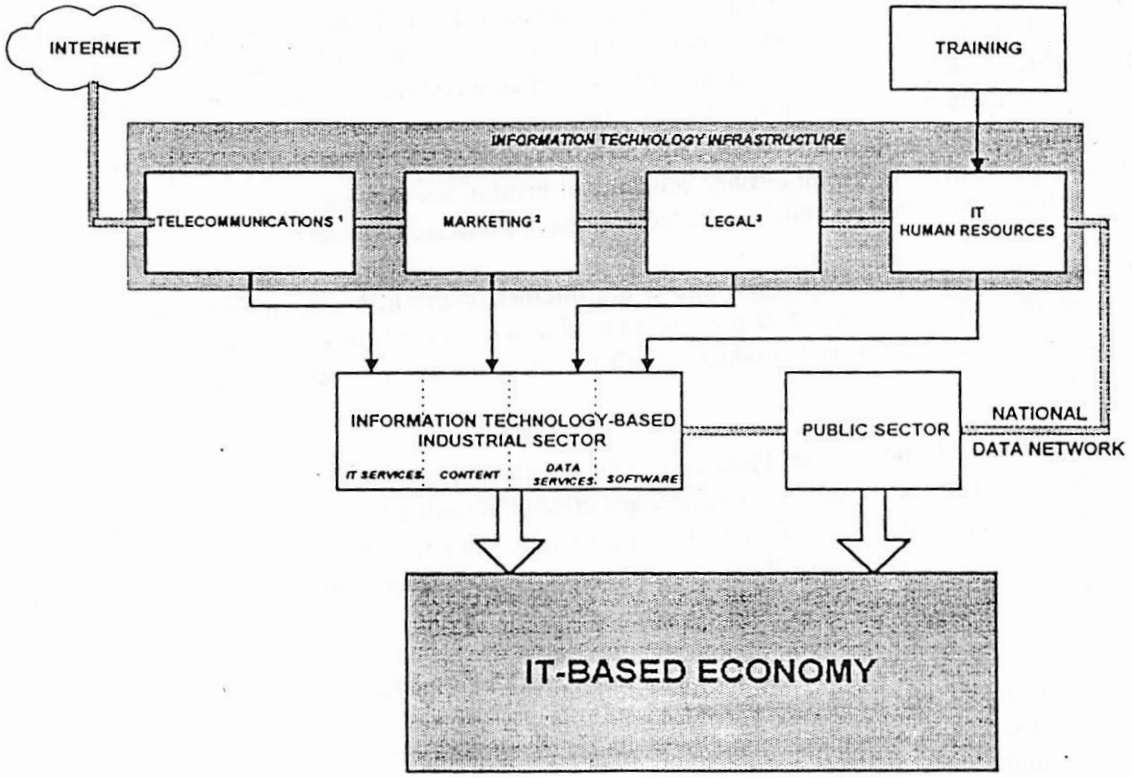

Fig. 6.1 IT-based Industrial Sector Showing the Support Infrastructure and the National Data Network. *[Notes: [1,2,3] See text in following paragraph]*

Figure 6.1 shows an IT-based industrial sector within the overall Jamaica economy and the linkages between the following specific components:

- An education and training system that can deliver a broadly literate computer workforce, IT specialists that meet market requirements and retraining and upgrading opportunities.
- An innovative and progressive telecommunications sector that creates a competitive advantage for the business sector by providing cost effective services.
- A legal framework that accommodates public and private interests in a modern IT economy.
- An IT-based product and services industry that generates export earnings and provides local products and services.
- An innovative marketing approach that uses the Internet in addition to the traditional marketing avenues.
- A public sector that is integrated with the IT-based economy.
- A national data network that integrates public, private and educational sectors.

The Jamaican IT-based industrial sector is comprised of IT-based companies providing information technology support services in data-entry, telemarketing, GIS/imaging and CAD/CAM; intelligent information data services; software companies; and "content-creation" and "content-distribution" companies. As shown, the support infrastructure must include telecommunications, legal and marketing and a trained pool of IT human resources. This IT human resource pool must be fed from tertiary educational institutions capable of supplying personnel of all types, from computer and multi-media technicians to software engineers.

The most visible evidence of the new age is the Internet or the Information Superhighway. This entity will allow Jamaica (and other nations) to exploit innovative forms of marketing and product delivery for new and traditional products. With this in mind, the potential is limited only by our imagination.

The vision of an IT industry in Jamaica is one which is fully integrated comprising training, development and productive sectors. The linkages created in such a scenario would allow sustained development and growth of the IT industry. Specifically, the key components of this approach to IT development would consist of three integrated institutions linked with the tertiary educational institutions -

1. A software institute with a fast-track software training facility for training software technologists and programmers.
2. A computer-enhanced multi-media centre capable of producing content suitable for multi-media environments.
3. A centre with foreign language capabilities for the purpose of producing globalised software.

These three institutions would operate to complement each other and on one hand would produce and support computer-aided training materials for use in schools and on the other they would produce content suitable for distribution from servers in Jamaica to global audiences over the Internet, and to supply software to the global market. More discussion of this follows in Section 6, **Training.**

There are wealth-producing opportunities for Jamaica in the new information age. This new information age is a result of the merging of three key sectors - telecommunications, networked computers and interactive entertainment into a single industry.

The opportunities presented are the result of radical changes in information technology as it relates to computers, computer networking and on-line services. These opportunities for the further development of IT in Jamaica are in the following four areas:

1. Internet-related products and services
2. Information technology-based services
3. On-line data services
4. Software

6.3 Internet-related Products and Services

The commercial use of the Internet began in earnest in 1994. The transition from its use by the academic and research community to business and commerce has created a wave of global opportunism. This explosion has in fact been due to the development of application software that now allows the Internet to be used to distribute all types of digital information.

Internet Infrastructure - Providers and Users

The Internet market is made up of providers for the hardware and software infrastructure as well as for services and content providers. A model for the types of vendors that supply such products and services into this Internet market is shown in Fig. 6.1. At the very bottom are the system platform vendors who are well established global hardware companies that supply servers, communications processors and inter-networking systems[1]. Above this group is the layer of Internet service providers such as UWI, InfoChannel or TOJ.

Then there are the providers of applications software such as browsers, Web page creation tools, text retrieval or search engines, databases and other Internet software tools[2]. Above this group are the content providers or publishers -- these vendors provide not only hosts for the content, but also provide the financial and security infrastructure for transaction processing. Supporting all of this are the telephone companies (Telcos) which provide the "wire" - the link between the end-user and the Internet.

[1] Companies such as Compaq Computer, Hewlett Packard, CISCO Systems.
[2] Companies such as NetScape Communications, Spry Technologies, UUNET Technologies.

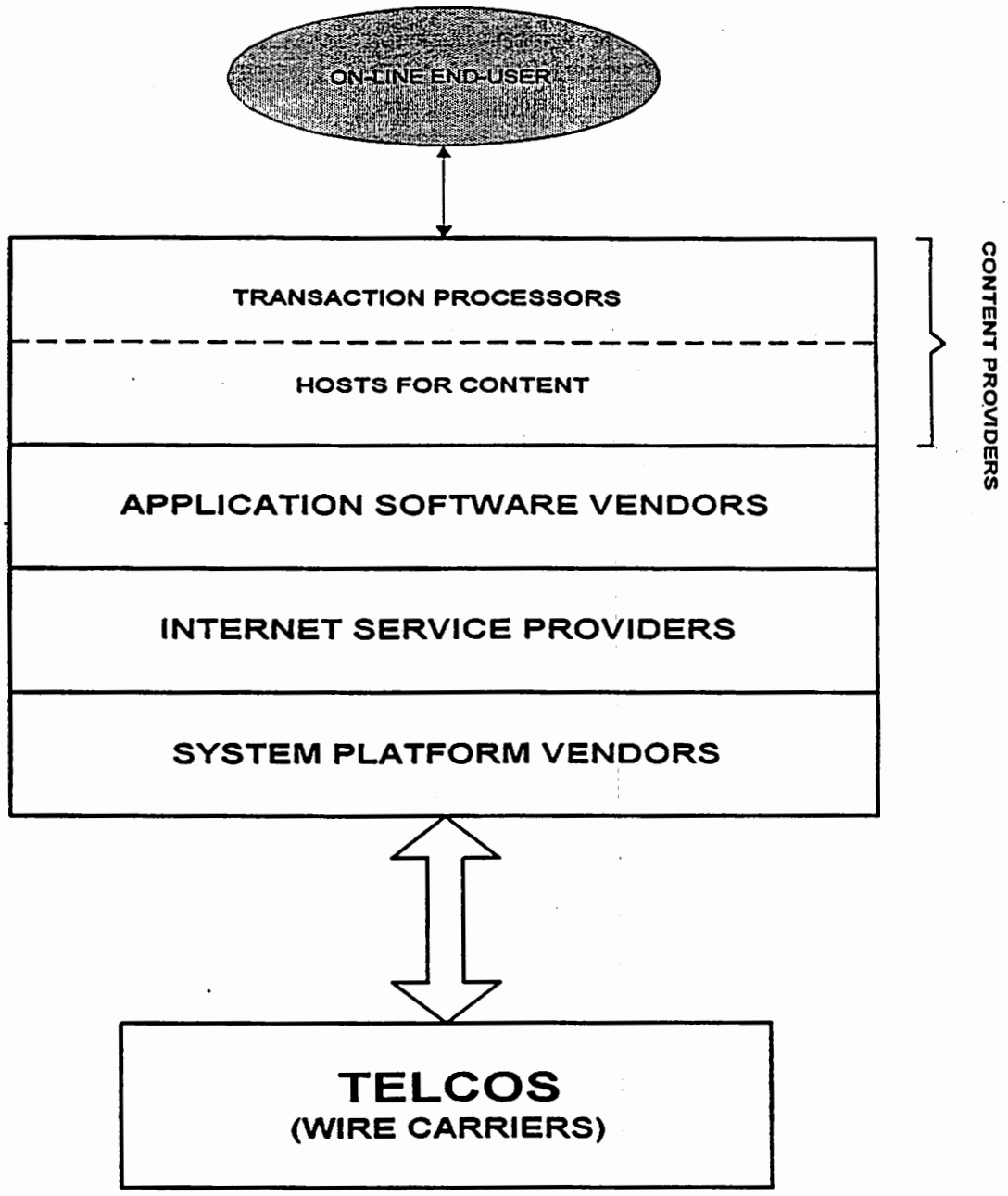

Fig. 6.2 Model for Internet Products and Services

Based on the model of Fig. 6.2, a matrix of Internet opportunities as a function of time is shown in Fig. 6.3.

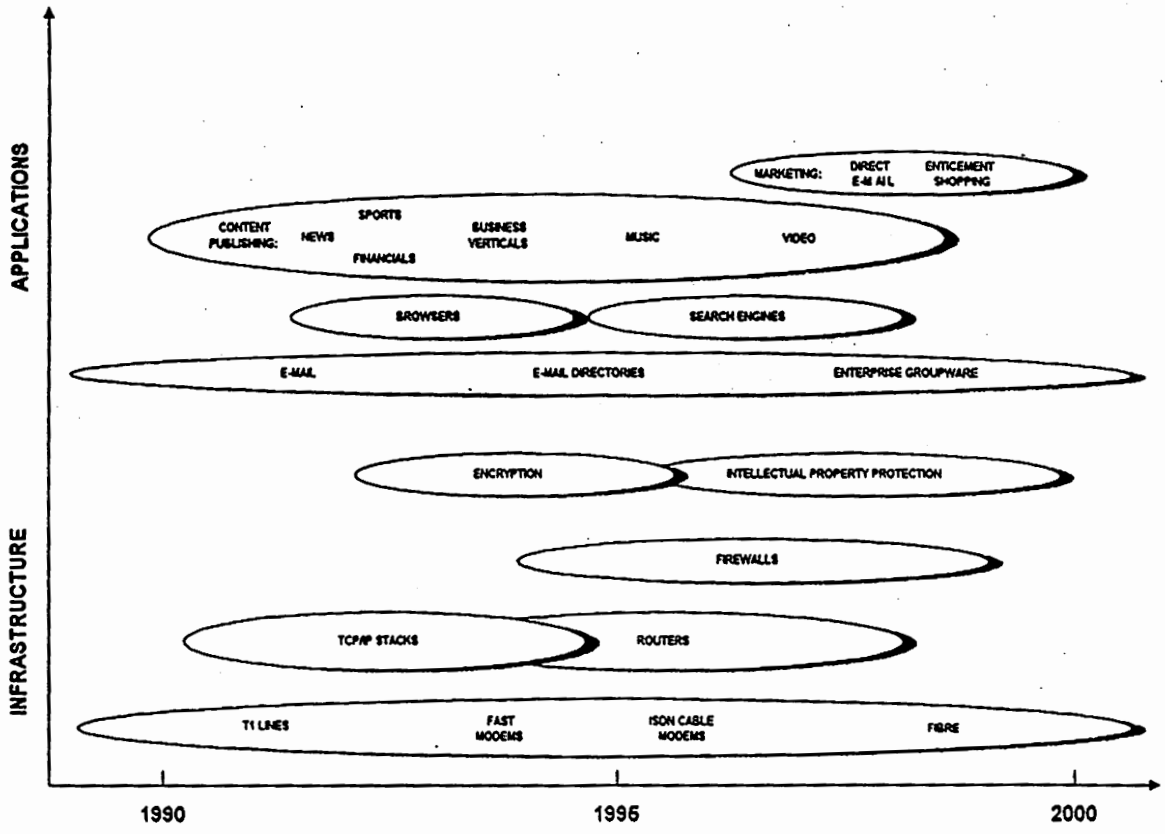

Fig. 6.3 Internet Opportunities

The building of the infrastructure for the Internet will continue well past the year 2000. These building blocks include hardware - inter-networking components, ISDN modems, fibre interfaces; networking software - security firewalls, encryption software; application software - browsers, Web page tools; messaging software.

Above the infrastructure is the application layer - this layer consists of software tools and content creation tools which are used to create interfaces and warehouses or repositories for content. Content providers or publishers provide content that is distributed. This content includes news, data, financial information, music, videos or business to business technical information in the form of application notes, demonstrations, data sheets and educational material[1]. Then there are marketing applications through which traditional or new products may be marketed and sold.

[1] Content also includes educational lecture material as is now being done within the Stanford University School of Engineering.

Target Internet Opportunities for Jamaica's Participation

The use of the Internet to distribute all forms of digital information -- text, audio, and video, represents a huge opportunity for Jamaica to participate in. These forms of digital information include electronic versions of magazines, newspapers and databases, interactive entertainment, music, video, games and mini-series or other content, and other consumer-oriented information and services[1] .

The target Internet opportunities for Jamaica are:

1. Content Publishing - the creation of content and the direct distribution of this material through its own on-line transactional services using secure commerce and merchant servers. This content includes all forms of Jamaican-based and ethnic music and other forms of packaged culture; TV mini-series, documentaries; art reviews; among the many possible opportunities limited only by the imagination.

2. Marketing of Jamaican Products and Services - traditional and non-traditional products and services such as such as tourism, real-estate.

As shown in Fig. 6.2, the Content Publishing opportunities are applications that fall well within the scope of the application layer of the Internet. Such applications are now in a virgin state, and since there is a finite window of opportunity, these applications should be exploited as quickly as possible.

Similarly, marketing and providing sales information is another opportunity that is possible using the Internet services. Compared to other forms of advertising such as TV, the content has to be tailored for this new medium to emphasise the informational content.

6.4 Content Publishing - Packaged Culture as Content

The Market for Content

The total U.S. retail sales in 1993 was approximately US$790 billion. A small but growing percentage of these sales is being transacted through new distribution channels: one is through home shopping services that are available through cable television channels such as QVC and the Home Shopping Network with total current sales of approximately US$3 billion. The other channel is through interactive electronic shopping which represents as yet only a small portion of the total, but will soon surpass the home shopping services via cable television.

The value of products and services for communications in the U.S. was US$224 billion in 1993. These products and services include television, filmed entertainment, radio, recorded music,

[1] In the US and elsewhere, hundreds of companies are staking claims to new opportunities specifically in Internet software applications, hardware solutions for networked computers and in interactive entertainment. Perhaps the most visible and interesting example of this is DreamWorks Interactive - a joint venture between Microsoft Corp. and DreamWorks. With funding of up to US$2 billion by Spielberg, Giffen, Allen and William Gates of Microsoft, this company will produce interactive content for the information superhighway and other on-line services.

newspapers, books, magazines, business information sources and interactive digital media. Only US$12.8 billion of these products are now distributed electronically through on-line services, on various media such as tape, floppy disk and CD-ROM. This segment is estimated to grow significantly over the next several years as content providers re-direct their communications products towards the new forms of interactive digital media.

Another indicator of the potential of the content market are the projections for the value of the U.S. multi-media authoring software and video products for the period 1993 to 2000. Frost and Sullivan, a Mountain View market research firm estimates that the total revenues from multi-media software and video products will increase from US$4.9 billion in 1993 to US$22 billion in 2000. These estimates as shown in Table 6.1, are another indicator that multi-media is a growth market that has obvious ramifications for the value and the distribution of content.

Year	Total Revenues (US$ Billion)	Growth Rate (%)
1993	4.9	25.8
1994	6.9	39.7
1995	9.8	42.4
1998	21.4	16.8
1999	24.8	15.6
2000	26.2	5.6

Table 6.1 U.S. Multi-media[1] Market Estimates, 1993 - 2000

These estimates are based on the projected increases in the multi-media market due to the increased use of graphical operating systems with built-in multi-media drivers, the proliferation of computers with CD-ROM drives and other multi-media peripherals such as JPEG and MPEG decoders, dropping CD-ROM drive prices and the increased user awareness of the benefits of multi-media for training applications, business presentations and home entertainment.

The Technology for Content Distribution

It is projected that much of the distribution of high-bandwidth content[2] such as CD-quality audio and real-time video to the home will be over the Internet. The technologies are already here to support these projections, however they are not widely installed. Currently, the telephone companies (Telcos) and the cable companies do not want to offer the consumer alternative low-cost delivery options to their high-cost, profit-bloated, high-bandwidth products such as T-1 switches. Three key technologies - Integrated Services Digital Network (ISDN)[3], Asymmetric Digital

[1] Multimedia authoring software and video products only.

[2] Content such as full-motion video and stereo-quality CD audio are high-bandwidth signals. Stereo-quality CD audio requires a bandwidth of up to 1.2 Mbps.

[3] ISDN - Integrated Services Digital Network is a digital telephone service that allows voice and data to be transported on a single line at speeds up to 56 Kbps. Approximately 70% of U.S. telephone lines are ISDN-ready. Pacific Bell currently offers full ISDN service for US22/month.

Subscriber Line (ADSL[3]), and cable modems[4] allow the delivery of high-bandwidth content at low-costs. While ISDN is a more expensive solution than ADSL, it has grown significantly in the US from 100,000 to over 300,000 users between 1992 and 1994 and the continued explosion of the Internet and video-conferencing applications will boost the total installed ISDN base. ADSL on the other hand will enable a single pair of copper wires to the home to provide the acceptable delivery and reception of the high-bandwidth content in images, audio, video at an extremely low cost thus boosting the explosion of Internet even more. The third technology - cable modems will allow cable networks to transport high-bandwidth content - data, sound, graphics and real-time video at up to 27 Mbps to the home thus providing a high-speed Internet gateway to a large number of households.

The Opportunity to Distribute Jamaican-based Content using the Internet

The convergence of the capability to distribute high-bandwidth content into the home using technologies such as ADSL and the commercialisation of the Internet has made it possible for Jamaica to participate effectively in the Internet content or publishing market. Within this new environment, namely the telecommunications infrastructure combined with the Internet and its software technologies, music and any associated content is well suited for delivery over the Internet.

Jamaican culture has many forms such as art, music, film and sports. Jamaican reggae has achieved worldwide recognition and is directly responsible for the name recognition that Jamaican music has achieved globally. Music is browseable, saleable, findable and most of all entertaining, and presents the most feasible and logical content area to begin publishing with. In much the same way, other products that incorporate Jamaican culture such as art, videos, documentaries and TV mini-series can be packaged and directly distributed to global audiences world-wide via the Internet. Of key importance is the fact that music and associated packaged forms of cultural content, will be free of the tyranny of record companies and charts so that the consumer will determine their true value.

The Creative Production and Training Centre (CPTC) with its considerable talent in fields that can be leveraged for the production of "culture products", could serve as a nucleus for the creation, and distribution of new Jamaican-based entertainment and educational products for global audiences.

6.5 Information Technology-based Services

A detailed analysis of the information technology-based service sector was provided in Chapter 5. Outsourcing contracts could prove to be another revenue source for Jamaica - such contracts would include data entry, telemarketing, geographic information systems (GIS) processing, database creation, maintenance and support of the traditional functions of internal data processing departments.

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[3] ADSL - Asymmetric Digital Subscriber Line is a compression modem technology that allows multi-media high-bandwidth signals to be transmitted to the home on plain old telephone service (POTS) lines at rates up to 51 Mbps. The prices of ADSL PC add-on cards should be less than US$500.

[4] CablePort cable modems - are adapters that connect a computer to a cable-TV outlet or high-speed telephone line. Intel Corp., Santa Clara, CA. has perfected the technologies for these modems and will manufacture them for AT&T, N.J. and Hybrid Networks, Cupertino, CA. These modems will transmit data to the home at over 27 Mbps to support video, sound in real-time.

An important issue in the information technology-based service segment is the absence of any backward linkages to the rest of the economy. The reason why this segment has not developed any backward linkages is due primarily to government policy. A JAMPRO document[1] clearly states it as follows

> " ... in order for a business in Jamaica to supply any product or service to an export processing company, it must be a registered exporter. Registration is a bewildering bureaucratic process filled with multiple forms and considerable administrative discretion. One requirement of exporters in Jamaica, for example, is that they obtain each month a tax compliance certificate that must be stamped by six different agencies.
>
> This red tape combined with taxes discourages the local purchase even of small items such as office supplies, despite the willingness of companies to source some of their inputs locally. Jamaican companies receive a tax rebate of 7.5 percent on "exports" to free zone companies, but this is not sufficient to overcome the competitive disadvantage caused by bureaucratic obstacles and by taxes on raw materials. ..."

Chapter 5 emphasises the bright future for the IT-based services segment in Jamaica if solutions can be found for the issues of government support and incentives, telecommunications costs, marketing, training and upgrading of skills to meet the expected evolution of computer and on-line technologies. More importantly however, it is critical that developments in the areas of automated software technologies that support human-intensive sub-sector services be scrutinized carefully since such technologies typically can displace occupations that seem immune to change.

6.6 On-line Data Services

Chapter 5, Situation Analysis for Jamaica, gave an assessment of the information technology services sector. This sector, comprising mainly companies engaged in data-entry, tele-marketing, GIS, image processing and CAD/CAM companies, must be revitalised in Jamaica so that there is significant growth and contribution to export markets. Most importantly, the existing experience and know-how should be used as a base from which to build. The most obvious extension of this sector is for it to become the base of a thriving and prosperous centre for intelligent data repositories and warehouses linked to on-line services of the Internet. These on-line services would create databases in a wide spectrum of fields - finance, health, science and engineering, entertainment, sports - and would then sell this data on-line to the global community in a number of languages.

This is the most logical extension of the existing knowledge base and labour pool. Certainly intensive training and learning ramps are required to create and sustain these new extensions to the existing base. However, the extension to a very large market for on-line services in the area of data for business and financial, legal, medical and other scientific fields is viable and productive.

6.7 Software

U.S. software dominates the global software industry. However, many overseas firms are producing software products which are as good or better than those produced by their U.S.

[1] *"Export Processing in the Caribbean: Lessons from Four Case Studies"*, JAMPRO document.

counterparts. Several U.S.-based companies[1] have outsourced software programming and development to companies in countries such as India, Singapore, Russia, Israel, Colombia and the Philippines among others.

The path to global outsourcing of software programming and development usually has three distinct stages:

1. Teams from third-world programming centres are first introduced to U.S.-based companies either through representatives or directly. Human resources for programming and other software development are offered locally or remotely. For very "hot" technologies - those technologies that have to be brought to market urgently, the cost of development is a secondary issue. The primary issue is the availability of competent talent.

2. Systems analyses are performed on-site while coding is done remotely. Program monitoring and joint project management is typically done using company proprietary telecommunications facilities or by the Internet.

3. For some development projects, it is possible that the overseas software development team develops spin-off products, generic or custom, which can be marketed in both the first and third-world countries. This is a good example of effective technology transfer.

Taking this scenario a bit further, the above three stages can not only provide the stimulus to strengthen the development of the local software sector by taking advantage of the unique expertise of the local software talent, but can also provide the basis for a successful export-driven software sector.

Using the Creative Production and Training Centre (CPTC) as a model in the development of high-quality entertainment, educational and cultural programmes for radio and TV as well as the training of media professionals, it is envisioned that a similar institution - the Software Production and Training Centre (SPTC) be created to develop and promote high-quality software for niche markets. The focus of this institution should be the training of professionals in relevant software technologies that can result in high-quality software products. This institution's resources should be allocated to production of software for export and local consumption.

The services of the Internet World Wide Web should be used as a mechanism for the marketing and promotion of these software products. The key notion of this vision is to develop a software-specific institution for the rapid, and cost-effective training of computer professionals. Such persons would be trained in current and relevant segments of information technology and hence would develop marketable skills to assist in the development and marketing of software products.

[1] Firms such as Apple Computer, Microsoft, Motorola, Hewlett Packard and others use off-shore software development groups in Bangalore, India for software development. Other companies, in order to complete a large scale software project in a timely manner, rotate the design and development effort within a twenty-four hour day among three or four global design centers, each separated by six- to eight-hour time zones.

6.8 The National Data Network

The National Data Network is envisioned to be a government-sponsored data network that would allow Jamaican citizens, government departments, educational institutions and businesses to obtain access to all public-accessible data and information. The National Data Network would be the main data backbone that interconnects all the key government departments and agencies, educational institutions, and the private sector organisations. This network in turn, should be inter-connected with the Internet.

For the above mentioned IT opportunities to be exploited, this key support resource must be put in place as quickly as possible.

The list of key government departments, institutions and organisations that should be linked to this network include:

- **Government Departments**
  - Planning Institute of Jamaica (PIOJ) - The Statistical Office
  - Prime Minister's Office
  - Ministry of Finance & Planning
  - Ministry of Labour, Social Security & Sport
  - Ministry of Industry, Investments & Commerce
  - Minister of Legal Affairs & Attorney General
  - Ministry of Water & Transport
  - Ministry of Public Utilities, Transport & Energy
  - Ministry of Health
  - Ministry of Tourism
  - Ministry of Education, Youth & Culture
  - Ministry of Local Government, Youth and Community Development
  - Minister of National Security & Justice
  - Minister of the Environment, Land & Shelter
  - Minister of Local Government & Works
  - Ministry of Foreign Affairs and Foreign Trade
  - Ministry of Agriculture & Mining
- **Educational Institutions**
  - University of the West Indies
  - College of Arts, Science and Technology
  - Community Colleges
  - Teacher Training Colleges
  - Secondary schools
  - Links to all schools having JCSEF networks
  - Heart Academies and related organisations
- **Libraries**
  - All major branches of the Jamaica Library Service
  - Institute of Jamaica
- **Public Sector Organisations**
  - Jamaica Tourist Board (JTB)
  - Jamaica Promotions Corporation (JAMPRO)
  - National Development Bank
- **Private Sector Organisations**
  - Financial Institutions
  - Business Houses

The above list is not exhaustive. The benefits to the entire Jamaican community are that it will allow:

- Fuller and better planned participation of all the sectors of the economy
- A more informed public and business community
- Better and joint planning by government and private sector
- Feedback to the government and interaction with the public
- Incorporation of private sector needs
- More efficient product development
- More accurate local and international market research

The National Data Network should be inter-connected with the Jamaica Electronic Network (JAMNet) - a network that now links UWI, CAST and the Scientific Research Council (SRC). JAMNet which serves the academic, scientific and research sector was setup in September 1994, and provides connectivity to the Internet through an up-link to the National Science Foundation Network (NFSNet) in Washington, D.C.

In order to allow public access, data terminals or kiosks should be established at satellite centres in major towns and cities throughout the country so that each and every individual has access to national databases and other information at nominal costs.

See Appendix E for further discussion of the National Data Network.

6.9 Training

Major emphasis must be given to education and training at the secondary and tertiary levels as discussed in Chapter 5. Thus a major part of the vision for a viable information technology-based sector must be a vastly improved and enlarged technical training component to provide the skilled workers for employment in software development, on-line data services and multi-media production.

In addition, the Mona Institute of Business should coordinate its curriculum with the development of information technology in order to have graduates who understand both the business and the technical aspects of the information technology industry.

The curricula of the already existing tertiary institutions such as University of the West Indies, College of Arts Science and Technology and others, should be coordinated with the Creative Production and Training Centre (CPTC). CPTC would expand its present operations to become the producer of a wide range of multi-media materials as described in Chapter 5. It would be both a training site as well as a production enterprise with apprenticeships built into the program.

In addition, a new institution must be established:

1. A Software Institute - (suggested name - Software Production and Training Centre (SPTC).

This institute would work in conjunction with two other institutions - the Creative Production and Training Centre (CPTC) and the Language Training Centre, to produce:

1. Software for both English and non-English speaking markets, especially the Spanish and Portuguese markets of Latin America and the Caribbean.
2. Training software for local trainees preparing for the local IT sector.
3. Software for primary and secondary schools throughout Jamaica and the Caribbean.

Fig. 6.4 presents this in diagram form.

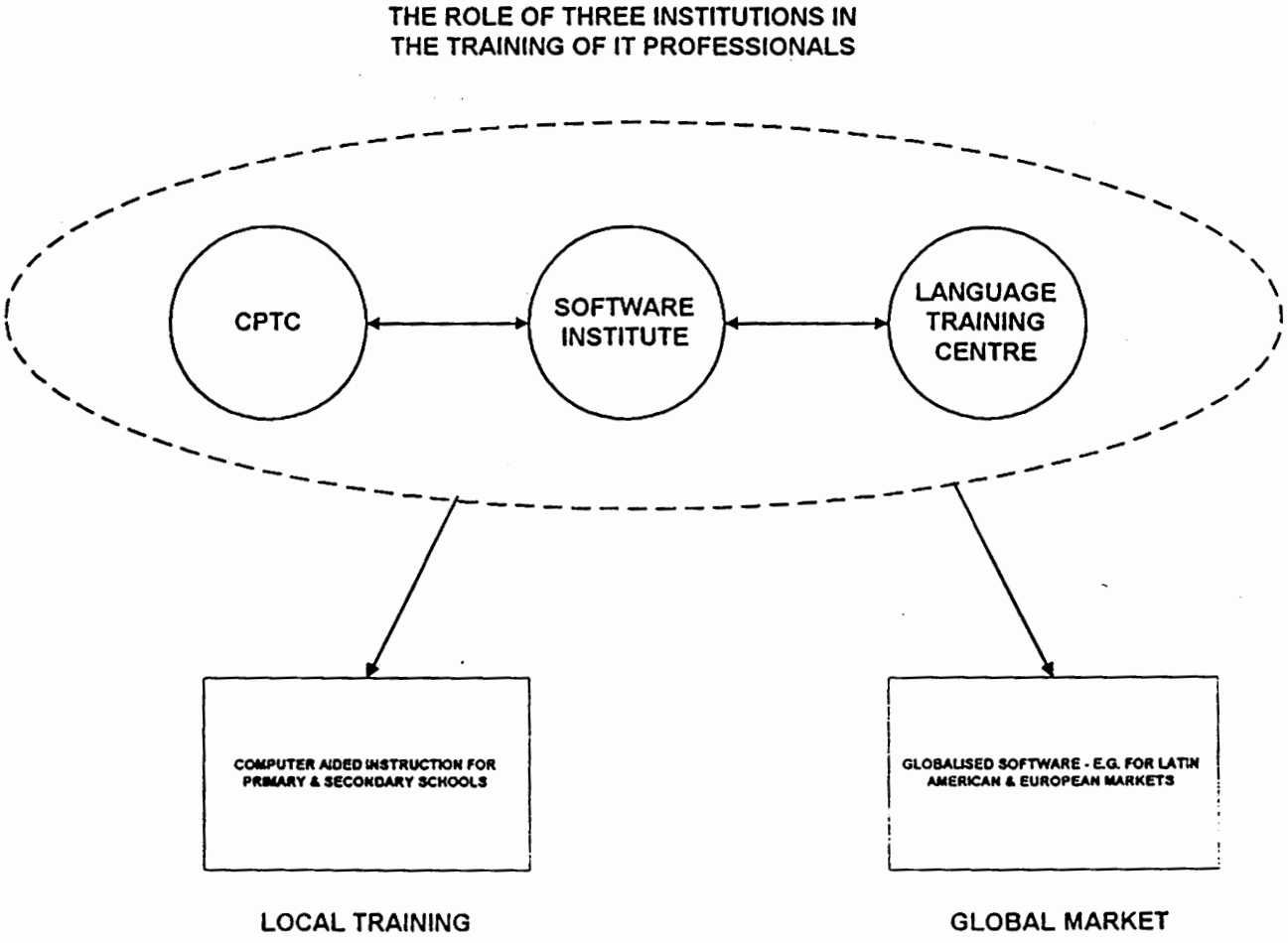

Fig. 6.4 Diagram of Inter-relationship between the CPTC, Language Training Centre and the Proposed Software Institute

- banking
- insurance
- consumer and manufactured goods (Bureau of Standards)
- consumer services such as telecommunication, water, electricity (Fair Trade Commission)

7. Allow related information to be cross-checked and verified to reduce the cost of government
8. Up to date information would be available for more efficient and timely decision making processes
9. Creation of national data bases for:
    - Education
    - Registration of births and deaths
    - Immigration statistics
    - Economic statistics
    - Daily financial information
    - Disaster preparedness

Implementing the National Data Network

By using and interconnecting existing computer hardware equipment already installed at locations such as the Jamaica Information Service and at various ministries.

A pilot project to interconnect one core Ministry such as the Ministry of Finance with the Prime Minister's Office would test the feasibility and would serve as an important learning tool for the other locations. When this project reaches maturity, other departments should be connected gradually in a similar way until all major government ministries are fully interconnected to each other.

Timing

The project should be initiated as early as possible. The project should have the modest initial goal of interconnecting at least two Ministries of Government. This interconnection should use existing equipment and the lessons learned there should be applied to the other departments.

Colophon

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6.10 Summary

The development of an information technology industry in Jamaica requires the following:

1. Development of a supporting infrastructure composed of:
   a) National Data Network - integration of public sector and IT based economy.
   b) Training programmes for personnel in software programming, data processing, multimedia production, marketing
   c) Coordination of technical curricula at all tertiary-level institutions. [See pages 5-9 and 5-11].
   d) Legal frame work.
   e) Open telecommunications market which fosters competitiveness in response to demand.
   f) Marketing strategies for the Internet.

2. Development of Information Technology-based Industrial Sector comprising:

   a) IT services - information database repositories and warehouses;
      - outsourced "back-office" programming services
      - other high-end IT services for example technical support, business enterprise network customisation, support and maintenance
      - telemarketing
      - GIS/ imaging and CAD/CAM services
   b) Content materials - packaged culture - art, music, film, mini-series, sports, documentaries
   c) Revitalisation of existing information technology processing services
   d) Software development
   e) Marketing of all traditional products and services using the Internet resources and services such as the World Wide Web (WWW or Web), Gopher, WAIS etc.

All of these issues will be further discussed and expanded on in **Chapter 8 - Conclusions and Recommendations.**

7.0 Strategies for Implementing the Options for the Information Technology Sector

7.1 Overview

Advanced economies have become very specialised in the production, distribution and use of information. This continuing production and dissemination of information will increase further as the global use of the Internet accelerates. Information, like fuel, is a vital resource that feeds the engine of economic growth.

As the demand for information grows, the structure and occupational profile of advanced economies undergoes significant changes. The information sector itself - media, communications, consulting services and the production of information technology systems and tools - computers, networking components, software - has all grown very fast and has become very specialised. Because of this specialisation, there are now significant opportunities that await exploitation by country states such as Jamaica, where previously such opportunities could not be exploited. Now, with the convergence of low cost, very powerful hardware computer systems, extremely powerful software application tools, the availability of accessing a global market through the Internet, there is a real window of opportunity for developing a viable IT sector that can contribute significantly to the economy through export earnings.

As the world enters this new age of information sharing and access through the use of on-line services, it is critical that strategies be devised for implementing policy options for the development of an information technology sector as part of Jamaica's industrial development plan.

The following paragraphs detail the policy objectives, status and proposed strategies for the development of a viable IT sector.

7.2 Policy Objectives, Status and Proposed Strategies

In Table 7.1 for each policy proposed, a corresponding commentary on its current status and list of proposed strategies are shown. The priority[1] for each policy is also indicated.

[1] *Priority: 1 corresponds to the highest priority.*

7.2 Policy Objectives, Status and Proposed Strategies

POLICY OBJECTIVES	STATUS	PROPOSED STRATEGIES
SUPPORT SOFTWARE DEVELOPMENT *Priority: 6*	1. No developed software sector 2. Software consumption mainly U.S. packaged products 3. Small custom software effort based on relational database management software (RDBMS) extensions 4. Little Windows expertise 3. Lack of standards 4. Lack of unified curriculum 5. Human resource constraints	1. **Set up Software Institute** - Integrate with CPTC and with the existing Language Training Centre [see Section 6.2, p. 6-2] - establish charter to train in productive and relevant software technologies - couple software with audio, video and other multi-media technologies - set product standards and quality control standards for software
INCREASE HIGH-SKILLED INFORMATION WORKFORCE *Priority: 3*	1. Small supply of IT specialists 2. Tertiary system not responding adequately 3. Private training not consistent 4. Lack of general IT skills	1. **Strengthen tertiary education performance** - Focus the course content and relevance of CAST and UWI computer science departments to national needs and global trends - Company sponsored computing facilities - Curriculum reform (long-term) - Integration of IT across all disciplines - Form UWI/business councils - Management training - On-the-job training 2. **Strengthen secondary levels of proficiency in English grammar, reading and basic skills in mathematics** 3. **Foster private training industry** - Certification and accreditation - Labour market information - establish training pool with matching funds - in-house training for current company employees

ESTABLISH A COMPETITIVE TELECOMMUNICATIONS INFRASTRUCTURE *Priority: 2*	1. Single telecommunications provider 2. Private sector monopoly 3. Unjustifiably high rates to Internet gateway inhibiting growth 4. Recent digital technology 5. Barriers to cross-inter-connectivity 5. High prices with cross subsidies 6. Barriers to private entry	**1. Establish broad-based legislation to support IT sector** **2. Establish independent regulatory body for telecommunications** - Set interconnection rules and tariffs - Radio spectrum allocation - Coordination of telecommunications, radio, TV regulation - Monitoring and set guidelines for value-added services **3. Allow free enterprise in IT sector - break monopoly** **4. Lower rates to Internet gateway**
PROVIDE MORE SUPPORT FOR THE INFORMATION-TECHNOLOGY-BASED SERVICES SECTOR *Priority: 4*	1. Small foreign investment in IT service industry	**1. Implement single-entity free-zone law**
DEVELOP CONTENT PUBLISHING SECTOR *Priority: 5*	1. Present content focussed on local radio and TV market 2. High quality product 3. Large pool of trained specialists in audio, film and speech	**1. Extend CPTC charter to include computer-based multi-media training and production** **2. Provide funding for computer multimedia training and production equipment** **3. Focus on content publishing for global on-line distribution by Internet to North America, Europe, Asia and Africa**
ESTABLISH NATIONAL DATA NETWORK *Priority: 1*	1. No data network existent 2. Government is main source of data; but dissemination restricted and uneven quality 3. Inadequate information standards 4. Information sources mainly newspapers and small number of magazines with irregular publishing schedules	**1. Draft national database and dissemination policy** **2. Strengthen Information and Data Standards** - financial accounting and disclosure - private citizen data and disclosure laws - define acceptable use policy (AUP) for national data network

LEGAL FRAMEWORK FOR PROTECTION OF SOFTWARE, MULTI-MEDIA CONTENT FOR ON-LINE DISTRIBUTION *Priority: 2*	1. No clear legal protection of software. 2. No legislation on computer crime - break-ins etc. 3. High-rate of software piracy 4. No clear intellectual property rights	**1. Strengthen legal protection against piracy of software and multi-media content** - Review international practice and ensure adequate protection in accordance with international standards contained in the Paris and Berne Conventions[1] as well as the World Trade Organisation (WTO) TRIPS agreement - Develop phased legislation - Extend copyright to multimedia content - Restrict the anti-competitive use of software - Ensure that legislation provides non-discriminatory protection to nationals and non-nationals - Ensure availability of intellectual property rights and rental rights[2] for authors of multi-media content and producers of sound recordings - Strengthen trademark protection **2. Introduce Data Protection legislation** - Guidelines for database management - Private rights of access and correction - Registration requirements - Determine primary ownership of personal data **3. Extend Computer Crime definition** - Un-authorized access - Computer security standards **4. Other** - Protection of encrypted program-carrying VHF/UHF signals - Integrated circuit layout and algorithm protection - Trade secret protection

[1] 1967 Paris Convention for the Protection of Industrial Property, and the 1971 Berne Convention for the Protection of Literary and Artistic Works

[2] Rental rights mean the right to authorize or prohibit commercial rental to the public of original or copies of a work with respect to software programs

PROVIDE EQUITABLE ACCESS TO THE INTERNET *Priority: 1*	1. Tariffs for inter-network access including access to the Internet gateway 2. Tariffs are restrictive due to high cost 3. Bandwidth capacity of gateway is insufficient	**1. Pass immediate legislation to repeal any inter-network tariffs required for access to the Internet gateway** **2. Provide funding or other support for a T-3 Internet gateway at UWI Mona.** **3. Make all educational institutions and libraries exempt from local long-distance tariffs or charges to Internet gateway or provide maximum rebates for such charges.**

7.3 Implementation: Overview and Framework

A detailed information technology implementation plan needs to be carried out as an extension to this report. Specifically, this extension would prioritize and concentrate on the tasks required to implement the National Data Network and the other higher priority tasks as outlined in the previous sections. In executing this detailed plan, discussions would be held with representatives from government, industry, education and other sectors.

The time schedule for the plan of action is shown in Fig. 7.1.

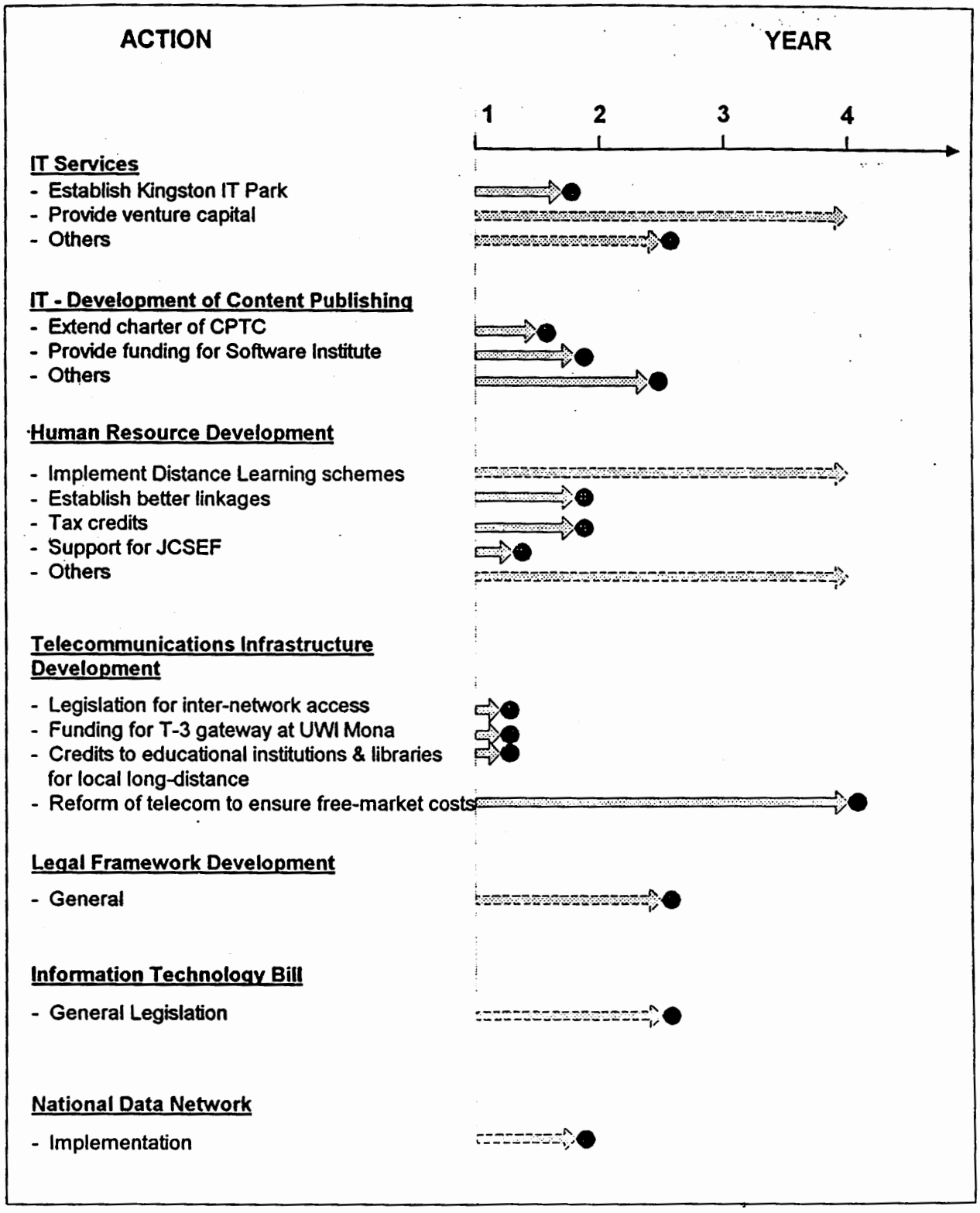

Fig. 7.1 Implementation Plan for Information Technology

8.0 Conclusions and Recommendations

8.1 Conclusions

The modernisation of Jamaica's industrial sector spurred by the restructuring of the telecommunications network, began in 1987 with the divestiture of the Government of Jamaica's holdings in Telecommunications of Jamaica. This set the stage for building an information technology based sector. Shortly before in 1986, the Government sought to promote the export processing segment of IT by passing laws to establish free zones and the establishment of the Jamaica Digiport telecommunications gateway. However, this segment of the industry has not become the growth industry that it was envisioned to be. Instead, this sector provides less than US$20 million in export earnings while employing substantially fewer workers than the garment industry which generates more than US$500 million in export earnings. A combination of inadequate financial support, poor marketing and an under-trained labour force has limited the potential of this industry. Furthermore there is no coordinated or organised plan or movement towards adapting to changes in the IT global markets.

Because of the importance of information technology and its rapid change, especially the growing convergence of telecommunications and computing, it is mandatory that Jamaica adopt and implement steps that will allow its citizens to share in the new business environment which will be dominated by on-line services and distributed client-server computing architectures based on powerful single- and multi-chip microprocessors.

These steps must be taken in the areas of:

- Human resource development
- Creation of a competitive telecommunications infrastructure
- Development of an information-based infrastructure
- Support for a revised legal framework

8.1.1 Human Resources Development

Building an information technology workforce is a challenge that can be surmounted in some innovative ways. There need to be two parallel paths - one path, the longer one which attempts to restructure the education process - (some projects are already in place); a second path should attempt to accelerate the training of key professionals and technicians in relevant software and multimedia technologies so that their contribution to marketable products is realised in six to twelve months.

Jamaica's population is its greatest asset. To create and harness the talent required for an information-based economy, action is needed to:

1. Enhance the crucial role of universities, technical colleges and vocational institutes.
2. Mobilise the private sector resources for the training system.
3. Create an environment where there is more emphasis on the formation of skills required for the information age.

UWI, CAST and other technical colleges are the primary sources of high-calibre professionals for the IT management and development sector. These leading institutions should pay attention to the trends in the global marketplace - so that their own graduates are equipped with the relevant and marketable skills required to develop and market content-rich multimedia products required by global markets. More importance and attention must be give to mainstream trends in personal computer operating systems, software tools and applications outside of Jamaica.

The Government should support the effort of diffusing computer skills to the younger generation. The JCSEF program needs to be supported at the state level especially with regard to:

a) Teacher training
b) Curriculum development
c) Relevant software availability

8.1.2 Creation of a Competitive Telecommunications Infrastructure

Jamaica's opportunity lies in quickly taking steps to modify and rectify the conditions that have allowed its high telecommunications rates and policies to strangle and limit the growth of what could be otherwise be a booming IT industry. Jamaica in order to participate fully in the new order of commerce must have competitive access to external telecommunications gateways.

8.1.3 Development of an Information Infrastructure

A National Data Network must be established to inter-connect Government Departments, Ministries and other public sector organisations, educational institutions, private sector organisations. [See Appendix E]. All citizens of Jamaica should have the opportunity to access the data network. This can be accomplished by providing public terminals at satellite centres in the main towns and cities across the island. In doing so, the other sectors of business and commerce will benefit by having accurate data in a timely manner to do better planning and administration.

Concurrent with the establishment of the National Data Network, a governing body or council should be appointed to take the lead in coordinating and monitoring the implementation of a national policy for public sector databases and public information dissemination. The following issues should be addressed:

1. Standards for data-format, content, confidentiality and communications in the public sector.
2. Procedures for inter-agency data sharing.
3. Coordination of database investments.
4. Decentralized data dissemination by public agencies.
5. Guidelines on data dissemination.
6. Private sector rights including resale of data of access to public information.
7. Pricing policy for public data.
8. Guidelines for value-added information supply by the public sector.

The first step should be an audit of all the data that is now available and to separate or identify the data that can be made public.

8.1.4 Support for Legal Framework for Information Technology

The transition to an information-based economy poses new legal challenges. A program must be developed to address the following issues:

1. The need for a stronger legal framework for information technology especially data confidentiality and computer crime.
2. A consistent regulatory framework on the issues of content and data.
3. Creation of standards for information technology products especially software.

8.2 Recommendations

The following recommendations should be adopted so that Jamaica is positioned to take advantage of the new opportunities created by the evolution and new developments in information technology, specifically telecommunications, data communications and computing.

For each of the following areas, it is recommended that the Government of Jamaica:

8.2.1 Information Technology Services

A1: *Establish an Information Technology Park and Free Zone in Kingston with Digiport and other support facilities comparable to or better than those of our international competitors.*

A2. *Provide venture capital and low-interest loans for the development of IT businesses geared to export sales, product innovation and development and which are operating at certain prescribed and measurable standards.*

8.2.2 Information Technology - Development of Content Publishing for On-line Distribution

B1. *Extend the charter of the Creative Production and Training Centre (CPTC) to include computer-based multimedia training and production.*

B2. *Provide funding for computer multimedia training and production.*

B3. *Provide funding for the establishment of Software Production and Training Centre (SPTC) to further the training, production and marketing of computer-based content using the Internet resources.*

8.2.3 Human Resource Development

C1. *Develop cost-effective distance learning telecommunications links to tap current and relevant technical and business training courses for software professionals, technicians, assembly workers and other operators. These on-line training courses assisted by local content, and suited for on-demand training and just-in-time learning of relevant and urgent technologies, could alleviate the cost and time required to send specialists away.*

C2. *Support better linkages between training institutions and the private sector and encourage more programs which provide work experience or cooperative programs.*

C3. *Provide incentives to the private sector to invest in high-level and relevant computer-based management training programs. The emphasis should be to provide industry-specific training that focuses on the needs of small and medium enterprises.*

C4. *Allow more liberalised tax credits for firms that provide on-the-job training within the HEART School Leaver's Program, CAST and the Mona Institute of Business.*

C5. *Encourage the Mona Institute of Business to coordinate its program of studies in IT with UWI, CAST and other technical institutions.*

C6. *Support and expand the private sector initiative by the Jamaica Computer Society Educational Foundation to implement computer networking and IT technologies in all public schools - primary, secondary and tertiary, in Jamaica by the year 2000. This will create the requisite learning environment for the younger generations and will assist in the teaching of the sciences, mathematics, languages and other technical subjects.*

C7. *Assist in improving the quality of the facilities of UWI and CAST in order for them to produce more highly trained IT graduates.*

C8. *Establish public databases that provide information about the requirements of the labour market.*

C9. *Allow tax-free status for the importation of computers for educational purposes.*

8.2.4 Telecommunications Infrastructure

D1. *Pass immediate legislation to repeal any inter-network tariffs required for access to the Internet gateway.*

D2. *Provide funding or other support for a T-1 or T-2 Internet gateway at UWI Mona.*

D3. *Provide legislation to ensure that all educational institutions and libraries are exempt from local long-distance tariffs or charges to the Internet gateway or provide capped rebates for such charges.*

D4. *A reform of present telecommunications structure which presently has control over all segments of the telecommunications network by allowing open competition, thus making access costs to external gateways be determined by market dynamics. In doing this, Jamaica's external telecommunications gateways will be able to support a whole array of competitive information-based products and services which in turn will provide the base for a competitive export-oriented information technology services sector and on-line services serving global customers.*

D5. *Allow competitive groups that would provide innovative and new telecommunications technologies for supplying mandatory data services to groups such as schools and farmers in rural areas.*

D6. *Establish an independent regulatory body that sets interconnections rules and tariffs; coordinate radio and TV regulations; monitor and set guidelines for value-added services; monitor and allocate radio frequency spectrum*

8.2.6 Legal Framework for Information Technology

E1. *Introduce data protection legislation to establish guidelines for private database management and dissemination; private rights of access and corrections; determination of primary ownership of personal data.*

E2. *Define computer crime to cover un-authorised access and to establish computer security standards.*

E3. *Strengthen legal protection against piracy of software and multimedia content*

E4. *Protection of encrypted program-carrying VHF/UHF signals, intellectual protection of integrated circuit layout and software- and hardware-implemented algorithm protection.*

8.2.7 Implementation of the National Data Network

F1. *Establish a National Data Network (NDN) to inter-connect all sections of government, educational institutions, libraries, public sector organisations; the NDN should also be inter-connected to the JAMNet, a network which now connects UWI, CAST and the Scientific Research Council (SRC).*

F2. *Establish National Data Network satellite centres in major towns and cities with public access terminals at a nominal cost.*

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Appendices

Appendix A: Glossary of Technical Terms and Acronyms

Appendix B: Key Events in Jamaica's Telecommunications Sector

Appendix C: Internet Working Bodies and Associated Working Groups

Appendix D: Setting Up Internet Services

Appendix E: The National Data Network

Appendix A: Glossary of Technical Terms and Acronyms

4.2BSD	Four.two Berkeley Software Distribution. A popular implementation of the UNIX operating system with full TCP/IP networking support.
Address	A symbol that uniquely identifies the interface of a host attached to a network.
anonymous FTP	A form of FTP that allows any user to access a restricted set of files without authentication.
archie	An Internet resource discovery protocol that finds files in anonymous FTP archives.
ARPA	Advanced Research Projects Agency - An agency of the U.S. Department of Defense.
AUP	Acceptable Use Policy - A policy for all types of traffic allowed on a specific network.
Authoring Tool	Software that creates any document or content. For example an HTML software authoring tool is used to create HTML documents for publication on the World Wide Web.
BITNET	Because It's Time Network - A network formed in May 1981 to interconnect educational and research institutions; merged with CSNET in CREN in 1989.
bridge	A device that forwards datalink layer frames.
cache	A high-speed memory that is located between a central processing unit (CPU) and the main memory. It holds the data and or instructions that the CPU is most likely to need soon.
CISC	Complex-Instruction-Set Computer. A computer whose processor is designed to sequentially run variable-length instructions, many of which require several clock cycles, that perform complex tasks and thereby simplify programming.

CCITT	International Consultative Committee on Telegraphy and Telephony. A committee for telecommunication standards.
CIX	Commercial Internet Exchange. A cooperative organization of a variety of networks that range from regional to global in extent.
Client-server computing	A computer architecture that allows any of the tasks requested by an entity to be done by one or more of the available hardware or software entities in the system.
connectionless	A protocol where the switching nodes of a network attempt to deliver the packets of data without any guarantees.
connection-oriented	A protocol that requires the setup of a complete path between two nodes before data can be exchanged.
Daemon	A program that runs in the background on a UNIX workstation, waiting to handle requests. Examples include e-mail programs, print spoolers, router software, and schedulers that initiate other programs at specified times. A daemon is similar to a terminate and stay resident (TSR) in the DOS environment.
DNS	Domain Naming System. The resource naming system for the Internet. A means by which numeric IP addresses are converted into character-based names and vice-versa.
DNS Mail System	All hosts that exchange mail using domain names
DOD	Department of Defense. The US Department of Defense.
DOE	Department of Energy. The US Department of Energy.
domain name	A unique identifier for a single node in the DNS naming tree.
EC	European Commission. The council of the European Community.
EARN	European Academic and Research Network. The European academic community NJE network; equivalent to BITNET in the United States.
electronic mail	See email.
Emacs	A text editor
e-mail	A short name for electronic mail

email	electronic mail. A computer network service that provides one-to-one communications by the exchange of synchronous protocol.
enterprise IP network	A TCP/IP network inside a corporation that is used for the business of the corporation
FDDI	Fiber distributed data interface. A network based on the use of optical fiber cable to transmit data in non-return to zero, invert-on-1s (NRZI) format at speeds up to 100 Mbits/sec.
Fido	A protocol suite used by FidoNet
FidoNet	A mostly dial-up network of predominantly DOS machines that use FidoNet protocols.
File Transfer Protocol	See FTP
finger	A simple protocol for obtaining information about users on the Internet.
Firewall	Software that restricts traffic to a particular area of a network by filtering all IP packets that pass through a given node.
FNC	Federal Networking Council. A council that coordinates networking activity among U.S. federal agencies.
ftp	The anonymous FTP username on most UNIX systems.
FTP	File Transfer Protocol. The remote file transfer protocol in the TCP/IP suite that defines the transfer of files between a host and a remote station on an IP-based network.
gateway	A generic term for a machine or software that transfers data between two entities at different layers in a protocol stack.
Gopher	A simple menu-oriented Internet that allows the user to organise and display information within a hierarchical menu system
host	A computer system used for applications processing on a network.

HTML	Hypertext Markup Language. A scripting language that is used to write World Wide Web documents. Hypertext allows a document to be linked to an unlimited number of other documents on the Web. There are currently four levels of HTML compliance that adhere to the SGML standard.
HTTP	Hypertext transfer Protocol. The protocol that is used to transfer data to and from World Wide Web browsers.
HTTP Server	A machine that makes the World Wide Web document available to Internet users.
IAB	Internet Architecture Board. The technical policy board of the Internet.
IETF	Internet Engineering Task Force. The IAB committee that oversees the development and deployment of TCP/IP protocols.
ISDN	Integrated Services Digital Network. A standard for digitally transmitting video, audio and electronic data over public telephone networks.
ISO	The International Standards Organisation. The international standards body.
ISP	Internet Service Provider. A commercial company that offers individual access to the Internet.
internet	A collection of networks perhaps suing different underlying network technology, but all tied into a virtual network by use of an internet protocol that provides a common address space and routing.
on the Internet	A host that has direct IP connectivity to any well-known Internet host.
the Internet	The worldwide interconnected collection of networks that predominantly use the TCP/IP protocol suite.
Internet Standards	Protocol specifications produced by the IAB Standards Process.
InterNIC	A NIC service sponsored by the U.S. National Science Foundation (NSF) to provide and coordinate services for the NSFNET community and to the Internet community at large.
IP	Internet Protocol. A network layer protocol that contains addressing information and some control information that allows packets to be routed.

leased line	A telephone line rented for dedicated access to the Internet
link	A communication path between two network nodes.
mail	The common name for electronic mail.
mailing list	A list of electronic mail addresses, accessed by mail to a single alias.
Matrix	All computer networks that exchange electronic mail.
MTA	Message Transfer Agent. A program that transfers mail to and from another electronic mailing list.
multi-session	the ability to record additional information, such as digitized photographs on a CD-ROM after a prior recording session has ended.
NASA	National Aeronautics and Space Administration. Agency that funded one of the early Internet backbone networks.
NCSA	National Center for Supercomputing Applications.
NCSA Mosaic	A World Wide Web client implementation.
NNTP	Network News Transport Protocol. A TCP/IP protocol that defines newsgroup messages are posted and transported between services.
NII	National Information Infrastructure. A proposed commercially-supported U.S. national networking infrastructure.
NIC	Network Information Center. An organization or service that provides information about networks.
NFS	Network File System. A transparent file access system from Sun Microsystems.
node	Any computer attached to a network.
NSF	National Science Foundation. The U.S. agency that took over the funding of the major U.S. Internet backbone, NSFNET. Also provided seed

	funding for a number of regional networks that are all connected to the backbone network.
NSFNET	The backbone network funded by the National Science Foundation.
packet	A discrete chunk of data, usually no more than a few thousand bytes long. Each packet is self-contained and holds all the information required to send it to its final destination.
packet switching	A method of data communications where one entity divides data sent to another entity into discrete chunks or packets, and each packet travels to its destination independently of all the other packets.
path	The route taken by a data packet through a network.
PPP	Point-to-Point protocol. The protocol that allows a machine to connect to the Internet via a standard phone line and a high-speed modem.
Physical address	A binary address that refers to the actual location of information stored in secondary storage
PSTN	Public switched telephone network.
RISC	Reduced-Instruction-Set Computer. A computer in which the instruction set of the processor is limited to constant-length instructions that can usually be executed in one clock cycle. The total number of instructions in a RISC processor is typically less than a CISC processor having the same performance.
RFC	Request for Comment. A document published by the IAB.
RIPE	Reseaux IP Européens. The coordinating body for the Internet activity in Europe.
secondary storage	Storage that is accessed relatively infrequently compared to primary storage such as cache. It is less costly. Sometimes referred to as a level 2 (L2) cache.
sendmail	The most common UNIX electronic mail message transfer agent
Serial Line IP	A standard protocol for encapsulating IP packets over low-speed serial interfaces

server	A process that offers a service to a client process, or an entire machine that offers a specific service, such as file sharing
Service provider	An organization that provides Internet connectivity and handles number registration requests.
SGML	Standard General Markup Language. A standard method of specifying keywords and other features of a document so that it may be "published" over the Internet. SGML separates a document into three components - the header file, which specifies how the document is to be run on a given system; the document type definition (DTD), which describes the layout of the documents components; and the instance, which contains the actual text. HTML is a subset of this standard.
SMTP	Simple Mail Transfer Protocol. The Internet standard protocol that defines the transfer of mail between nodes on an IP-based network
SLIP	Serial Line IP. A standard protocol for encapsulating IP packets low-speed serial interfaces.
SPECmarks	A normalised measure of performance, currently used for UNIX systems, based on the speed with which a system can perform a standard set of operations.
TCP	Transmission Control Protocol. The reliable two-way byte stream protocol in the TCP/IP protocol suite.
TCP/IP	Transmission Control Protocol/Internet Protocol. The name of the protocol suite that is the dominant protocol in the world-wide Internet.
Telnet	A terminal emulation protocol that allows an Internet user to log on to other stations remotely, also, a program based on this protocol.
Thick Ethernet (10-base-5)	An Ethernet in which the physical medium is a doubly shielded, 50 ohm coaxial cable capable of carrying data at 10 Mb/sec for a length of 500 metres. Often referred to as Thicknet.
Thin Ethernet (10-base-2)	An Ethernet in which the physical medium is a single-shielded, 50-ohm RG58A/U coaxial cable capable of carrying data at 10 Mb/sec for a length of 185 metres. Often referred to as AUI or Thinnet.
Twisted-pair Ethernet (10-base-T)	An Ethernet in which the physical medium is an unshielded pair of entwined wires capable of carrying data at 10 Mb/sec for a length of 185 meters.

Unix	A multi-threaded, multi-tasking operating system that was originally developed by AT&T in the late 1960's. There are many versions of UNIX. Much of the Internet was established on UNIX systems, and UNIX is still often used as a base for large-scale Internet access.
UUCP	UNIX -to-UNIX Copy Program. A store and forward protocol used to link UNIX machines over low-speed serial lines.
WAIS	Wide Area Information Server. A distributed client/server protocol and implementations for searches of documents, with or without prior keyword markup.
WIDE	Widely Integrated Distributed Environment. A research and academic backbone network in Japan.
World-Wide Web	Web or WWW. A TCP/IP-based network of multimedia documents that are connected via hypertext links. All documents are authored using HTML.

Appendix B: Key Events in Jamaica's Telecommunications Sector

The following is a chronological list of the key regulatory and licensing events in the development of Jamaica's telecommunications infrastructure. (Adapted from Regulations, Institutions and Commitment: The Jamaican Telecommunications Sector, P.T. Spiller, C. I. Sampson, Policy Research Working Paper 1362, The World Bank, Policy Research Department, October 1994.)

Period	Regulatory Institution/Ownership/Event
Pre-1962	• ***Telecommunications Policy Under Colonial Rule*** • All Island License (domestic operations license) granted in 1945 to the Jamaican Telephone Company, with the Telephone & General Trust (T&GT), a British concern being the majority shareholder. • License requires: - Specific minimum returns - Use of *ad hoc* rate boards - Court enforcement of License • Private ownership of domestic and international companies • Modest but continued growth in service
Independence 1962 -1967	• ***Issuing of New Licenses to JTC and the Creation of the JPUC: 1962-1966*** • Requirement of Jamaicanisation of ownership • New license in 1966: - Specifies maximum rate of return - Regulation by a new independent, and permanent commission (the Jamaican Public Utilities Commission) - Promotes participation by interest groups - Requires Jamaicanisation by 1971 • ***The Takeover of JTC by Continental Telephone Company (CTC): 1967*** • CTC agrees to: - Terms of 1966 license - Specific expansion and financing plan - Extant pricing levels • Stagnation of service
1968 - 1975	• ***The JUPC and the Quasi-Expropriation of JTC's Assets*** - Absence of judicial review • ***Creation of JAMINTEL (1971)***: a joint-venture between Cable and Wireless (a British Government-owned company) and GOJ to take over C&W (West Indies) international communications facilities (and international communications operating license) in Jamaica.
1975 - 1976	• ***The Takeover of JTC (1975):*** **Transfer of Ownership of JTC to the Government** • Disbandment of the JPUC • Regulation by the Ministry of Public Utilities and Transport
1979 - 1985	• **Introduction of International Direct Dialling** • ***Boom in the Profitability of International Communications and the beginning of the Policy of Subsidization of the Domestic Network*** • Increase in the profitability of both the domestic and international companies
1987 - 1990	• ***Creation of Telecommunications of Jamaica and the Divestiture of GOJ's Holdings*** • ***Telecommunications of Jamaica (TOJ - a joint-venture of GOJ and C&W) to take over all of JTC and JAMINTEL's assets and licenses*** • New domestic and international telecomunnications licenses granted to TOJ • Guarantee real returns on equity in a narrow band equal to current levels • Restrict governmental discretion in approving rate increases • Introduce binding arbitration • Allow judicial review • Regulation by Ministry with no participation of interest groups • Boom in investment
April 1, 1995	• ***TOJ becomes single entity - assumes assets of JTC and JAMINTEL***

Appendix C: Internet Working Bodies and Associated Working Groups

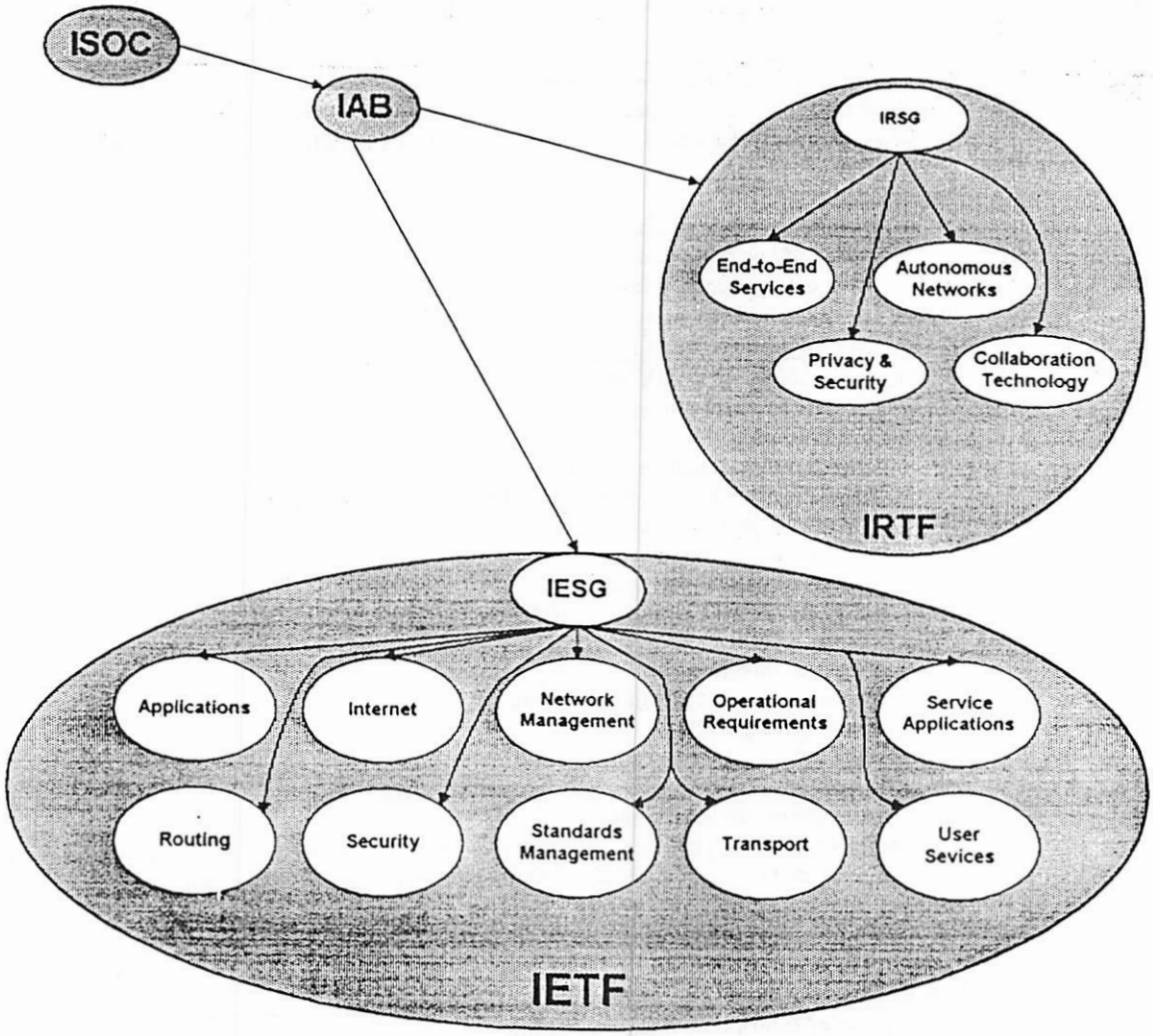

Fig. C.1 Internet Working Bodies, with Working Groups per IETF Area, May 3, 1993

From "*UNIX, POSIX, and Open Systems, The Open Standards Puzzle*" by Quarterman and Wilhelm, Reading, MA, Addison-Wesley Publishing Company, 1993.

Appendix D: Setting up Internet Services

What Is The Internet?

The Internet is an interconnection of computer networks that are connected via telephone and other telecommunication circuits. The protocols on the Internet are inter-networking protocols that enable all the different types and models of computers to talk to one another.

This discussion aims to briefly explain and define how the Internet can be used to provide information to clients on the Internet. The person or group on the Internet that provides this information is called an information provider. A server attached to the Internet is the equipment used to "serve" this information.

The services that are offered on the Internet are implemented using a client-server architecture. Client-server architecture is defined as follows:

- **The client** - workstation or a personal computer, is responsible for accepting data through the keyboard or mouse and displays data to the user on a screen.

- **A server** - another computer, usually more powerful, is responsible for performing tasks as directed by one or more clients - for example, accessing data on the behalf of a client, performing calculations and then providing this data to the client workstation.

Types of Internet Services

There are many types of services that are supported on the Internet. The most popular services are:

- **Mail-based services** such as mailing lists and archive servers - *listserv*, *Majordomo* and *listproc*.

- **Archive services** such as *ftpmail* - these services automatically handle user's requests to send files through electronic mail. *ftpmail* can not only retrieve files from the host they are running on, but can also transfer a file from another Internet-connected host and deliver the file to a designated address.

- **File-based services** such as *File Transfer Protocol (FTP)*, *Telnet* and *Finger*. *FTP* is one of the most popular file services. it allows Internet users to retrieve files from other Internet machines. It is similar to logging on to a machine, but it restricts the user to a limited set of commands, and for anonymous users to a limited set of files.

- **Information-based services** such as the *World-Wide Web, Gopher, WAIS*[1] - these services allow the Internet user to obtain information in the form of text and graphics. In the case of Gopher, Gopher client displays a menu of text-labelled choices and the user simply selects one, which may be the information requested or may be another menu.
  The following is an example of the display on the screen of a Gopher client:

```
                    Internet Gopher Information Client  v2. 0. 18

                          Home Gopher server:  wildlife.ora.com

--> 1.    Introduction and Cover
    2.    Foreword
    3.    Country Accounts/
    4.    Search Country data <?>
    5.    Wildlife FTP Site/

Press ? for Help, q to Quit                                    Page: 1/1
```

  The World Wide Web is the newest and most powerful service that is now available on the Internet. The Web for short, has a number of features including the ability to perform some of the functions of other information services such as Gopher, FTP and WAIS. So a Web browser on a client connected to the Internet can be used to access Gopher databases, FTP archives and the like.

  Web documents which are written in language called HyperText Markup Language (HTML) are transferred from machine to machine using a protocol called Hypertext Transfer Protocol. The HTML language because it supports linked documents, images and other objects, allows the user to click on a phrase, term or image and then pull up information about that phrase, term or image.

Setting Up a Typical Internet World-Wide Web Server

A Web server is the equipment that allows the information provider to serve the information stored on the server to other clients connected to the Internet. The typical configuration for a Internet server providing World Wide Web services to the Internet is shown in Fig. D1.

The server is a computer with the following characteristics:

  Operating System -- preferably a 32-bit multi-threaded, pre-emptive, multi-tasking operating system such as UNIX or Windows NT 3.51. the operating system should be solid and have many software tools available.

[1] WAIS = Wide Area Information Servers - is a service that searches for data but has minimal support for browsing. Gopher and the World Wide Web are basically user interfaces for browsing data and have minimal search capabilities

- **Storage** -- typically 3GB to 4GB of reliable storage such as RAID[1] hard disk technology

- **Processor Bus** -- should support high-speed I/O transfers. I/O busses such as PCI or the S-bus are capable of supporting a large number of I/O requests. The motherboard should also support a fast network interface card.

- **Memory** -- Requires at least 24 MB to 32 MB of RAM to operate efficiently

- **Processor** -- should be a high-performance processor such as a 120 MHz Pentium or UltraSparc

Fig. D.1 shows the Internet server attached to a local area network so that local users can access the Internet. The Internet server is attached to a router which in turn is connected to a service provider who essentially is responsible for the gateway to the Internet. In this way, the Internet server serves the entire Internet.

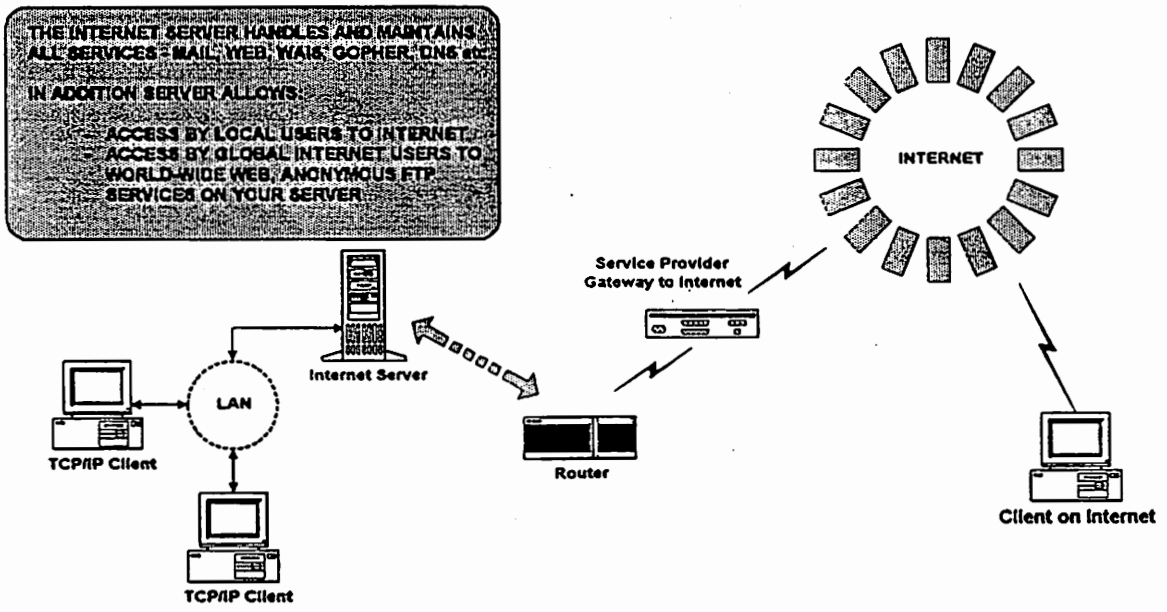

Fig. D.1 - Typical Configuration of Internet Server

Cost Comparison

The type of server chosen or configured for providing Web services will depend on the number of expected hits[1] per day. Table D.1 shows the configuration required depending on the number of

[1] RAID = Redundant Array of Inexpensive Hard Disks is a hard disk configuration that optimises the reliability and cost of secondary storage.

[1] Popularly adopted terminology meaning the number of times the Internet server is accessed.

hits expected. A cost comparison between four typical types of servers - two UNIX types and two non-UNIX types is shown in Table D.2.

Hits per Day	Server Size	Minimum Server Configuration	Software	WAN Link
250,000 +	High-end	SPARCstation 20 or Apollo 9000/75 with 128 MB RAM and 1GB HDD	NetSite or other UNIX -based Web servers	T3
100,000 - 250,00	Mid-range	SPARCstation with 32 MB RAM, 500 MB HDD or dual SMP Pentium 100 PC running Windows NT 3.51 with 64 MB RAM and 500 MB HDD	HTTP for Windows NT 3.51 or SCO Global Access	T1
10,000 - 100,00	Low-end	486 or Pentium 100 running Windows NT 3.51 with 32 MB RAM and 500 MB HDD or PowerPC Macintosh with 32MB RAM and 500 MB HDD	HTTP for Windows NT, HTTP for Macintosh	64 - 128 Kbps

Table D.1 - Typical Internet Server Requirements

	UNIX Type 1	UNIX Type 2	Non- UNIX Type 1	Non- UNIX Type 2
Operating System (OS)	Berkeley UNIX	Solaris (Sun)	Microsoft Windows NT 3.51	NextStep (Next)
Internet Capabilities in the OS	DNS, HTTP, Internet Mail, News	DNS, FTP, Internet Mail	FTP built-in, DNS, Gopher, HTTP	DNS, Internet Mail, TELNET, Gopher, HTTP, News
Hardware	Intel-based Pentium 120 with 32 MB RAM and 2 GB HDD	SPARCstation 5 with 32 MB RAM, 1.05GB HDD	Intel-based Pentium 100 with 32 MB RAM, 1 GB HDD	Intel-based DX/2-50 with 32 MB RAM, 1 GB HDD
Total Cost	**US$11,850**	**US$8,499**	**US$6,700**	**US$5,700**

Table D.2 - Typical Costs for Representative Hardware and Software of UNIX and Non-UNIX Internet Servers

Appendix E: The National Data Network

Why A National Data Network is Needed?

In this increasingly information-rich age, it is mandatory and timely for Jamaica to have its own national data network. The backbone of this network would link the following sectors:

1. Government
2. Education
3. Industry
4. Business

This network should be initiated with modest goals in the beginning by linking the highest priority departments of government. Concurrently, the Jamaica Library Service and the secondary and tertiary educational institutions should be linked to the network to take advantage of the vast resources that could be put on-line for access by everyone including those in rural areas. As this project gathers momentum, the other sectors of the country can be linked to it; and along the way the external access to the outside world by means of a gateway to the Internet can be implemented. Table E.1 shows a sample of the various departments, sectors and the corresponding type of databases and applications and respective advantages that can be derived.

Sector	Primary Content and Type of Database	Application
Education - Secondary - Community - Tertiary - Libraries (JLS)	• Library book catalogs and abstracts • Special collections • Reference materials • Various national and global databases • Other library services	• Research and making available libraries on demand in otherwise inaccessible locations. More cost-effective than mobile libraries; allows greater access • Connect JCSEF networks to National Network
Government Ministries	• Government publications • Vital statistics • Financial and economic statistics • Demographics • Housing • Tax information and returns on-line • Titling and cadastral Maps • Geographic Information Systems (GIS)	• Planning • Information for instant performance and decision making • Allows town planners and others to plan • Dissemination of public information • Obtain feedback from public in a timely and organised way • Enables joint planning between Govt. and private sector
Stock Market	• Capital markets data • Daily or weekly stock data	• Planning

Manufacturing - JMA	• Prices (current and fluctuation)	• Planning
Transportation	• Statistics	• Planning and scheduling
Construction	• Prices	• Planning and budgeting
Tourism	• Visitor statistics • Vendor information • Host country database	• Aids in performance planning, advertising scheduling and budgeting
Public	• STATIN primary database • STATIN secondary database • Vital statistics • Land titles, cadastral database • GIS database	• Enables informed decisions regarding small-business formation and product market research • Identification of business opportunities • Access to cadastral maps, titles, vital statistics • Access to timely information from STATIN
Health	• Epidemic and other health statistics	• Preventative medicine • Educational seminars • Lower the cost of health care

Table E.1 Relationship between Primary Content Type and Application by Sector

Reasons for Developing the National Data Network

There is a strong correlation between the productivity growth in a modern economy and the information resources that are available. This statement can be applied all sectors of the economy.

1. Competitive markets thrive on information and effective communication linkages. Governments can, therefore, be empowered through information to create competitive market conditions. This will promote productivity, employment, etc.
2. Businesses in the industry and agricultural sectors alike need strategic information for customer and competitive analysis, export and local production.
3. Information is a basic component of the delivery of efficient educational services.
4. Connect the following government ministries together:
   - Ministry of Finance - Income Tax (Inland Revenue), GCT
   - Housing - National Housing Trust - payments etc.
   - Education - statistics, teaching etc.
   - Health - Dissemination of information of local diseases, epidemics or other critical information such as AIDS
   - National Security - security, disaster
   - Transportation
5. Connect other government bodies such as the Tourist Board, JAMPRO, PIOJ etc.
6. Share critical information to foster growth in the following sectors:
   - small business sector
   - garment industry
   - agricultural sector