UNIT 1 EVOLUTION AND GROWTH OF ICT

Structure

1.1 INTRODUCTION

ICT deals with how digital information passes between the devices. The most prolific example is the Internet, a worldwide network of computers linked together by telephone lines. There are however, other examples, like mobile phones, interactive televisions and personal organizers. It is a cross cutting theme in the objective of the programme because of the recognition by the European Commission and UK Government that ICT has the potential to have a major impact on the prosperity of Merseyside. When ICT is applied to business, it can Lower Costs, raise productivity and improve customer and supplier relationship. In learning, ICT widens participation and raises attainment. In public services, ICT engages people with services more effectively and in communities, ICT links people to economic opportunity and brings together those with common agendas.

1.2 OBJECTIVES

After going through this unit, you should be able to:

- describe the meaning and different forms of ICT;
- explain the evolution of ICT;
- list the advantages of ICT;
- state the E-readiness assessment of States/UTs;
- discuss the global scenario of ICT; and
- discuss the role of ICT in economic growth.

1.3 EVOLUTION OF ICT

The first major use of Information Technology (IT) could be said to have started with the introduction of early mainframe computers to respond to the needs of scientific research and the Government's statistical data gathering and processing, where the technology helped to speed up research and forecasting. These techniques were later applied to the business environment where mainframe computers and robotics were used to automate business processes and number crunching functions. From automation of business processes, IT was then applied to higher value-adding, functions such as design, resource planning, sophisticated manufacturing and mission critical functions the developments and applications of IT have stretched beyond imagination. Together with the rapid development and innovation in telecommunication technology and the Internet, this evolution has ushered in many new business models and applications.

ICT is robust that it can be harnessed in many ways, but its true potential is limited only to the human mind. With ICT, the physical boarder dissipates as information moves freely through the digital medium which is less controlled as compared to other existing mass media. Globalisation is said to accelerate, and enabled by ICT, making market bigger and more accessible by business with strong capital, management and technology. Business or E-commerce has started to be done virtually and transaction occurs at a click of a mouse anywhere and any time. Scientific findings churn faster and newer discoveries and inventions through the journal and reports are made available through ICT. The technology that began life as a faster way to process data and compute statistics has become pervasive in almost all parts of our life today. So ICT has become the backbone of Techsavvy Society, having combined both information technology and communication through digital environment today.

Please answer the following Self Assessment Question.

Self Assessment Question 1 *Spend 2 Min.*

i) ICT has become the backbone of _____.

ii) _____, _____, interactive televisions are few examples of ICT.

1.4 MEANING OF ICT

ICT is an acronym that stands for Information Communications Technology

However, apart from explaining an acronym, there is not a universally accepted definition of ICT Why? Because the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis. It is difficult to keep up with the changes because they happen very fast.

Let us focus on the three words behind ICT:

- INFORMATION,
- COMMUNICATIONS, and
- TECHNOLOGY

A good way to think about ICT is to consider all the uses of digital technology that already exist to help individuals, businesses and organizations also use information.

ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. For example, personal computers, digital television, email and robots.

ICT is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data. Importantly, it is also concerned with the way these different uses can work with each other.

In business, ICT is often categorised into two broad types of product: -

1) The traditional computer-based technologies (things you can typically do on a personal computer or using computers at home or at work); and

2) The more recent and fast growing range of digital communication technologies (which allow people and organizations to communicate and share information digitally)

Let us have a brief look at these two categories to demonstrate the kinds of products and ideas that are covered by ICT:

Traditional Computer Based Technologies

These types of ICT include:

Application Use

Standard Office Applications - Main Examples are as below:

Word processing, e.g. Microsoft Word: Write letters, reports etc;

Spreadsheets, e.g. Microsoft Excel, Analyse financial information, calculations, create forecasting models etc.

Database software, e.g. Oracle, Microsoft SQL Server, Access, Managing data in many forms, from basic lists (e.g. customer contacts to complex material like catalogue).

Presentation software, e.g. Microsoft PowerPoint, make presentations, either directly using a computer screen or data projector, publish in digital format via email or over the Internet

Desktop publishing, e.g. Adobe In design, Quark Express, Microsoft Publisher, produce newsletters, magazines and other complex documents; and

Graphics software, e.g. Adobe PhotoShop and Illustrator, Macromedia Freehand and Fireworks, create and edit images such as logos, drawings or pictures for use in DTP, web sites or other publications

Specialist Applications - Examples

Accounting packages, e.g. Sage, Oracle, manage an organization's accounts including revenues/sales, purchases, bank accounts etc. A wide range of systems are available ranging from basic packages suitable for small businesses to sophisticated ones aimed at multinational companies.

Computer Aided Design (CAD) is the use of computers to assist the design process. Specialized CAD programs exist for many types of design like architectural, engineering, electronics and roadways.

Customer Relations Management (CRM) is a software that allows businesses to better understand their customers, by collecting and analysing data, such as their product preferences, buying habits etc. Often linked to software applications that run call centers and loyalty cards, for example, traditional computer based technologies.

The C part of ICT refers to the communication of data by electronic means, usually over some distance. This is often achieved via networks of sending and receiving equipment, wires and satellite links. The technologies involved in communication tend to be complex. You certainly do not need to understand them for your ICT course. However, there are certain aspects of digital communications that you need to be aware of. These relate primarily to the types of network and the ways of connecting to the Internet. Let us look at these two briefly (further revision notes provide the details to support your study).

i) Internal networks

Network which used to share information between a specific group or peoples of an entity. Internal network is also known as private network. In corporate world internal network mean the entire employ realm login to one common domain "not Microsoft OS domain" to access the enterprise's shareable application like payroll, health insurance, or emergency services or business development services. This type of applications are proprietary to the particular organization. To share the information between employees or different groups of organization, it requires its own network which is also called as private network or internal network.

This is also usually referred to as a local area network (LAN), this involves linking a number of hardware items (input and output devices plus computer processing) together within an office or building. The aim of a LAN is to be able to share hardware facilities such as printers or scanners, software applications and data. This type of network is invaluable in the office environment where the colleagues need to have access to common data or programs.

ii) External networks

Like we discussed the internal network is the private network and restricted from the outer world. External network is also called public network. A business entity or the corporate provide the information and business solution on the www form or web page to the public on external network of the company, so all the individuals can go the external network and fetch the information from anywhere according to their requirement. External network is provided by the service provider or also called backbone carrier. For example, AT& T "the mother bell" is also known as the backbone carrier or service provider world wide. It means when two remote business entity like to share the private information they can use any service provider network i.e. "External network" to complete their communication path.

Often you need to communicate with someone outside your internal network; in this case you will need to be a part of a Wide Area Network (WAN). The Internet is the ultimate WAN - it is a vast network of networks.

ICT in a Broader Context

ICT will almost certainly cover the above examples of ICT in action, perhaps focusing on the use of the key applications such as spreadsheets, databases, presentations, graphics and web design software.

It will also consider the following important topics that deal with the way ICT is used and managed in an organization:

– The nature of information (the "I" in ICT): this covers topics such as the meaning and value of information, how information is controlled, the limitations of ICT, legal considerations;

– Management of information: this covers how data is captured, verified and stored for effective use the manipulation, processing and distribution of information, keeping information secure, designing networks to share information; and

– Information systems strategy: this considers how ICT can be used within a business or organization as part of achieving goals and objectives.

Thus, ICT is a broad and fast-changing subject.

A new generation of computer network software aims at building virtual communities: permanent (or at least recurring) online meeting places where people can work and play, buy and sell, gossip and govern, flirt and fight and generally seek their fortunes. The first such places are being built more or less ad hoc. Their builders are mostly innocent of the history of human efforts to shape the spaces where people live so that these might better serve people's needs and express their dreams. Construction tools appropriate to the physical (i.e. electronic) constraints of shared online environments are rapidly becoming available. But there is no generally accepted conceptual framework for their design, nobody of validated experience to guide their construction. There is not yet any architecture for cyberspace.

In a world so new that its most fundamental properties are still being created (gravity, for example), cyberspace designers confront - consciously or unconsciously – many of the classic architectural challenges which may be classified as:

i) Selecting from alternative construction approaches and materials: The "native" medium of cyberspace, a finely woven mesh of polygons with subtly refractive polychrome surfaces, demands more machine resources than most visitors can currently afford to. A richly realised environment is thus, in cyberspace as elsewhere, inevitably an elitist one. Buildings based on simple cubes covered with low-resolution bitmaps are accessible to all, but are also banal and dispiriting. How can we build virtual villages that are at once idiomatic, pleasant to be in and socially inclusive?

ii) Using pre-fabricated elements to reduce costs and speed up construction. Cyberspace is made of software; and software engineers have been wrestling for decades with a problem that is also central to modern architecture – how systems can be modularly designed to make them more economic and more reliable. Here, however, the issues are more complex, since cyberspace communities are built on a constantly shifting infrastructure. In fact, the relationship between structure and infrastructure is all but reversed; how can

we design places for human community that can survive a continual re-design of the foundations on which they are built?

iii) Supporting sensible patterns of traffic flow: In most virtual settings, people can fly. In some, they can also "beam" instantly from one point to the next, ignoring all barriers. People may be present without taking up any visible space, or alternatively their virtual representative ("avatar") may be so huge or so resource-intensive that it fills a space intended to hold a hundred visitors. What is "traffic" when the users of a space are themselves constructs produced by other (perhaps even antagonistic) designers?

iv) Designing to human scale: In the virtual world, the role of "size" as a design factor is disconcertingly variable. It depends on the visitor's/user's field of view and functional reach, which in turn depends on the power of the user's display and controls. It is like the shift to electronic music, where timbre, volume and tonal range, once given by the physical nature of instrument, become variables, which the composer/performer must learn to control. Issues of appropriate scale do not go away, but must be redefined in relative terms: what is the ratio of sizes that must be maintained to support different experiences?

v) Designing new structures (or re-purposing the old ones) to enhance existing settings: The Musee D'Orsay and the new subterranean entrance arcade created for the Louvre will soon have their analogues in cyberspace; perhaps a conference room smuggled into the design model of an automobile engine, or an entire city whose "streets" are the circuit diagrams of a computer processor. Current work to build a database of 3D mages (the "Digital Human") to serve as an explorable setting for medical education suggests part of the challenge; how can virtual reality help making physical/natural structures more accessible? The far broader issue is: how can we connect the various virtual environments we build to one another? What design criteria can be established to aid the process of linking new worlds to the old?

There would-be cyber-architect navigating this maze of conflicting constraints in search of more than just the solution to a puzzle. In cyberspace as in the physical world, the goal of architectural design is always a place which, while fulfilling its various functions, also communicates something to (and about) the people.

Please answer the following Self Assessment Question.

Self Assessment Question 2 *Spend 3 Min.*

Discuss the meaning of the term information and communication technology?

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1.5 BENEFITS OF ICT

Obviously, there are significant tangible and intangible benefits of ICT:

- Can be a powerful enabler of development goals because its unique characteristics dramatically improve communication and the exchange of information to strengthen and create new economic and social networks;
- Is pervasive and cross cutting as it can be applied to the full range of human activity from personal use to business and government. It is multifunctional and flexible, allowing for tailored solutions — based on personalisation and localisation — to meet diverse needs; and
- Facilitates disintermediation, as it makes it possible for users to acquire products and services directly from the original provider, reducing the need for intermediaries. This not only become a considerable source of efficiency, but has in fact been one of the factors leading to the creation of an alternative development paradigm that skips the formation of Co-operatives and self-help groups.

It is, thus, evident that ICT has the potential to bring in multiple benefits in the areas of governance, integration of marginalized sections, development of rural areas profitability, and productive improvement in major sectors of the economy. This would provide the much-needed forward linkage by adding value to information for using it as an enabler that has been discussed widely in literature. What needs to be tested are the various hypotheses that evaluate the role of ICT and its contribution and impact on the Indian economy.

1.6 E-READINESS ASSESSMENT OF STATES/UTs

It is defined as the degree to which a country/state is prepared to participate in the networked world. It would demand the adoption of important applications of ICTs in offering interconnection between government, business and citizens.

In this context, it has become important to regularly take stock of e-readiness at the country level, states/UTs level and in major verticals to ascertain the status of underlying infrastructure, human resources, policy regimes, investments climate etc and arrive at what steps need to be taken to optimize investment and reach free potential. In that sense, "India: E-readiness Assessment Reports 2003 & 2004" which carry out the assessments at the disaggregated level of states/UTs throw up some useful and valuable insights.

Encouraged by the overwhelming response and positive feedback received on the E-readiness Assessments 2003 & 2004, Department of Information Technology (DIT), Govt. of India (GOI) has initiated E-readiness Assessment 2005 for the states and UTs. National Council of Applied Economic Research (NCAER), which is a premier research agency has once again been entrusted the task of state government and ranking based on the fair selection process.

States have used e-readiness assessment reports to carry out the road map of improving their network readiness as well as increasing the penetration of ICT for economic development; in fact the states are engaged in policy competition for improving the e-readiness.

E-readiness Assessment 2005

In the current report, effort has been given to analyse the time series data to understand how states have adopted strategies/action plan to improve the network-readiness. The section on case studies in the current report would not only confine to appearing projects but also would examine e-governance initiatives undertaken, general governance changes, policy changes initiated as per the act of increased penetration of ICT etc.

E-readiness Framework 2005

The network readiness index framework will be used for the e-readiness study 2005 and is based on the following broad parameters, which are further classified into sub indication:

- Environment for ICT offered by agent country or community:
  - Market; Political/regulating; and Infrastructure;
- Readiness of the community's key stakeholder to use ICT:
  - Individual readiness; Business readiness; and Government readiness;
- Usage of ICT among the stakeholders:
  - Individual usage; Business usage; and Government usage. The chosen framework is based upon the following premium.
  - There are 3 stakeholders to consider in the development and use of ICT: Individual, Business & Government.
  - The degree of usage of ICT by (and hence the impact of ICT on) the three stakeholders is linked to their degrees of readiness (or capability) to use and benefit from ICT.
  - There is a general macro economic and regulatory environment for ICT in which the stakeholders play out their respective rules.

E-readiness Index 2005

A factor analytic technique will be used to construct the e-readiness index and based on this, the states will be classified into following six categories:

- Leaders
- Aspiring Leaders
- Encepeatants
- Average Achievers
- Below Average Achievers
- Leant Achievers

Please answer the following Self Assessment Auestion.

Self Assessment Question 3 *Spend 3 Min.*

True or False:

i) E-readiness is the degree to which a country/state is prepared to participate in the networked world. ( )

ii) States have used e-readiness assessment reports to carry out the road map of improving their network readiness as well as increasing the penetration of ICT for economic development. ( )

iii) A factor analytic technique will be used to deconstruct the e-readiness index. ( )

1.7 THE GLOBAL SCENARIO

All the countries are making serious efforts to participate in the digital economy. Asia has become an emblem of the borderless economy. India's famed IT-enabled service (ITES) sector, which now contributes an estimated US$17bn to the economy annually, is a Shining example to the emerging markets. India's success story has been replicated throughout the region — there are booming call centres surrounding Manila, customer help desk centres in Malaysia, and Korean and Japanese language software production houses in China. It is ironic that India hardly appears on the e-ready radar screen, though it is starting to push ahead. Many countries are reaping benefits from being at least partially e-ready, even if they do not have all the components that support digital services (Complete technology infrastructure, favourable policy, business and social environments) in place. But it is also clear that having one or more of the basics in place can go a long way, as a country leverages what e-assets it has to generate competitive advantage. In the Indian context, it would be helpful to look at the level of e- preparedness of the Indian states, as this would be helpful in assessing the strengths and weaknesses in the e-readiness environment and consequently appropriate remedies can be planned.

During 1991, the twin programs of macro economic stabilisation and structural reforms were initiated. It has been argued that reforms carried out till date are not enough for the Indian economy if the country wishes to ensure the quality and sustainability of growth on a long-term basis. This, the policy planners argue, would be accomplished through second-generation reforms. The second-generation reforms simply aim at improving government efficiency through a reduction in the fiscal deficit. They aim to bring about increased private sector participation in developmental activities and sustaining high growth through appropriate institutional mechanisms. It can be observed from factors that indicate the health of the state (debt to GSDP, levels of fiscal deficit, primary deficit and revenue deficits to GSDP) that the objective of the second-generation reforms is to improve the governance and observe the requisite fiscal discipline. It is here that one can see a major role for ICT and e-governance. In practice, state reform and government modernisation nowadays can hardly proceed without calling upon ICTs. In fact, from long-term perspective the second-generation reforms are needed to sustain the ICT revolution. The second-generation reforms in general suggest that increased

involvement of the private sector in development activities and promotion of private investment in the industry and infrastructure segments of the state is required. Hence, reforms, particularly in the areas of right institutions, administrative, legal and regulatory functions of the state coupled with the restructuring of the incentives and actions that are required for greater participation of the private sector in developmental activities has become imperative.

E-governance: ICT has made the development of a new service delivery model possible, which can bring about a major shift in the way the government does business. Anywhere anytime access brings in incredible opportunities, but there is a downslide for state and local governments.

First, the public sector is held to a higher standard than the private sector particularly in terms of risk. Second, with new technologies come whole new levels of competition. Digital government is all about using technology to improve the access to and delivery of public services. The goal is to create a network that builds closer relationships with all stakeholders – citizens, businesses, governments and the workforce – while maintaining security. With the expansion of e-governance, there are increasing concerns about the security of transactions, which also need to be addressed. Specific e-governance initiatives that provide particular solutions to some governmental problems which are associated with ICT components, can contribute to one or more of these valued functions:

- increasing the efficiency of government operations: economists and social scientists call this "greater efficiency of the public administration by the automation/digitization of administrative functions"—in other words, simplifying processes and improving service delivery. Resources are used more effectively, and better tools are made available to both staff and agencies, as well as to the clients' interaction with the service. Efficiency gains are the first quoted arguments for ICT infusion. It is usually the first step, which started decades ago when automation was brought in, but the process is a long, continuous one.

1.8 ICT AND ECONOMIC GROWTH

According to NASSCOM data, the IT industry's contribution to the Indian GDP has also increased from approximately 1.4 per cent in 1998-99 to more than 3 per cent in 2002-03 and is estimated to grow further to 3.8 per cent, highlighting its increasing importance to the Indian economy. Contrast this share of ICT around 3.8 per cent of GDP with the combined share of all registered manufacturing in various industry segments ranging from food processing, beverages, textiles, leather, basic chemicals, petrochemicals, iron and steel, basic metals such as aluminum, copper, rubber and petroleum, machinery, both electrical and mechanical which is just around 11 per cent of GDP. This combined share had marginally declined during the 1990's while the ICT sector in the national income is increasing at a brisk pace now . Obviously the importance of this sector needs no further emphasis. Apart from the indirect contribution that IT makes to the Indian Economy through e-governance etc the direct contribution of IT exports is becoming increasingly important. The sectors that exhibit strong backward-linkages with other sectors of the economy are presumed to have a higher output multiplier. Sectors, which have an output multiplier of two or more, can be treated as key sectors for economic growth. The ICT sector which reveals an output multiplier that is higher than the average– contrary

to the popular perception that this sector may not have strong backward linkages– can be an eye-opener for the Indian policy planners. The ICT sector, in context of the output multiplier, has a rank of 30 of a total 115 sectors and the Software Sector corresponds to a rank of 80 out of 115 sectors. The increase in ICT output does have a significant output multiplier effect and should thus be encouraged. The employment multiplier for the ICT industry has been estimated at 0.183 man-years per lakh of output in 2000-01 prices. In other words, an additional output of the ICT sector to the tune of Rs 1 lakh would ensure 0.183 man-years of jobs created. For the software sector alone, which is the sector of interest, the output multiplier is 1.78 and the employment multiplier is 0.2096. In other words, increased output of one lakh in the software sector creates an additional employment of 0.2096 man-years. The rank for both the ICT and the software sector in terms of the employment multiplier is 110 out of total 115 sectors.

It is important to look at the economic implications of the above observations. For instance, the CSO has estimated that the value of output at current prices for the software sector during 1999-2000 is at Rs 21,263. The linkages among different sections of an economy are of crucial significance in understanding the trajectory of any industry. The significance and potential of any industry can be observed by looking at three important indicators, i.e. the output multiplier, the employment multiplier and the degree of forward linkage. As elaborated earlier, the output multiplier can be defined as a total increase in output generation for one unit increase of final demand in a particular sector. The employment multiplier is specified as man-years of additional employment created for an increased unitary output of the sector. Both these measures spell out the backward linkages with the other sectors of the economy in terms of output and employment effect. Forward linkages refer to the inter relationship between a particular sector and all other sectors which demand the output of the former as inputs. To better understand the macroeconomics of the ICT sector we analyse these parameters. In the input-output table, the' Other Services Sector's'' employment and output multiplier coefficients were taken as output and employment multiplier of "ICT sector" in the first iteration. However, the importance of ICT sector cannot be clubbed with Other Services category. Thus, the NCAER research team looked at direct coefficients (employment/output and input/output) for ''Software Sector'' from the CSO and for ''Hardware Sector'' from the ASI data. Since the direct coefficients from input-output table and CSO table were available, we used two sets of direct coefficients; one from the 114th sector of the input - output table which corresponds to the "Other Services Sector" and the other for software and hardware clubbed together to obtain output and employment multiplier coefficient that is reflective of the entire ICT sector. For the ICT sector (software and hardware) output in 2000-01 is at Rs. 21,263 crores and at Rs. 50,302 crores in 2002-03. Within this short gap of 3 years, the output of the software sector has increased by 29,039 crores and in this period the economy has been able to create 6.8 lakh man-years of employment, or in simpler terms, this sector has been able to create jobs for 24,500 people who would be able to work in this sector for the next 25 years. Its contribution to GDP in 1999-2000 was Rs 14,619 crores and Rs. 34,584 crores in 2002-03 current prices. The contribution of the software sector alone out of the ICT sector, in GDP has increased from 0.83 per cent in 1999-2000 to 1.54 per cent in 2002-03 (all figures in current prices). Direct employment in the software sector in 1999-2000 was 322983 according to CSO (corresponding figures for the year 2002-03 are not available). The

contribution of the hardware sector to GDP in 1999-2000 was Rs 796 crores and employed around 16,800 persons. The output of the hardware sector in 1999-2000 was Rs. 4400 crores. Though the ICT industry in India is mainly export oriented, domestic consumption does show a forward linkage that is not high as on date but is expected to increase in the coming years as the economy and the using domestic sectors mature making greater use of ICT in business, governance and society.(Resource:CSO report 2005, NASSCOM MCKINSEY Report 2005)

Please answer the following Self Assessment Question.

Self Assessment Question 4 *Spend 3 Min.*

What are the indicators to determine the importance and potential of any industry?

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Let us now summarize the points covered in this unit.

1.9 SUMMARY

- ICT stands for information, communication and technology.
- ICT is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data. Importantly it is also concerned with the way these different uses can work with each other.
- ICT is very essential for businesses, individual and government.
- E-readiness is the degree to which a country/state is prepared to participate in the networked world and demand the adoption of important applications of ICTs in offering interconnection between the government, business and citizens.
- It is important to regularly take stock of e-readiness at the country level, states/UTs level and in major verticals to ascertain the status of under lying infrastructure, human resources, policy regimes, investments climate etc and arrive at what steps need to be taken to optimize investment and reach free potential.
- ICT has the potential to bring in multiple benefits in the areas of governance, integration of marginalized section, development of rural areas profitability and productive improvement in major sectors of the country's economy.
- In practice, state reforms and government modernisation can hardly proceed without calling upon ICT.

1.10 TERMINAL QUESTIONS

1) What are the advantages of ICT? Explain.

2) How does ICT help to grow the economy? Analyse it from Indian point of view.

3) Describe about the global status of ICT in brief.

4) Discuss E-readiness assessment of State/UTs?

1.11 ANSWERS AND HINTS

Self Assessment Questions

1) (i) Tech Savvy Society and (ii) the Internet, Mobile Phone

2) ICT stands for Information Communications Technology. ICT is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data.

3) (i) True, (ii) True (iii) False.

4) The significance and potential of any industry can be observed by looking at three important indicators, i.e. the output multiplier, the employment multiplier and the degree of forward linkage.

Terminal Questions

1) Refer to section 1.5 of the unit.

2) Refer to section 1.8 of the unit.

3) Refer to section 1.7of the unit.

4) Refer to section 1.6 of the unit.

1.12 REFERENCES AND SUGGESTED READINGS

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