UNIT-IV

LESSON 14 GROWTH OF KNOWLEDGE ECONOMY

STRUCTURE

14.1 INTRODUCTION

The knowledge economyand the growth of knowledge management, as an essential

competency of organisations, provides new opportunities for librarians and information specialists to expand existing roles and utilise the skills they have honed to meet corporate objectives. The keyinformation management role of both internal and external information, alongside the contribution to information competence and the ability to contextualise information, contributes to organisational excellence, customer benefit and competitive advantage which can be achieved more effectively through collaboration and partnership.

The new Knowledge Economy is a period of rapid change – a paradigm shift – for librarians and libraries. It can be viewed as either the beginning of a new "golden age" for the profession, or the point when librarians and information professionals became marginalized, and perhaps made irrelevant, by the rapid advances in digital computer and telecommunication technologies and the networking power of the Internet, intranets, and extra Librarians and information professionals are in a position to transform themselves into value-adding knowledge professionals. However, this will require a radical change in how they view their roles and jobs within knowledge-based organizations. It will require them to visualize a world of rapid change, instantaneous communications, and the transformation of organizations from those based on identifiable boundaries to networks of business relationships. This is the challenge facing the profession.

The term "*knowledge-based economy*" results from a fuller recognition of the role of knowledge and technologyin economic growth. Knowledge, as embodied in human beings (as *"human capital"*) and in technology, has always been central to economic development. But only over the last few years has its relative importance been recognised, just as that importance is growing. The OECD economies are more strongly dependent on the production, distribution and use of knowledge than ever before. Output and employment are expanding fastest in high-technology industries, such as computers, electronics and aerospace.

14.2 OBJECTIVES

The objectives of this lesson are:

- To understand the steps for developing knowledge economy
- To explain the constraints to the growth of K-economy

14.3 STEPS FOR DEVELOPING KNOWLEDGE ECONOMY

14.3.1 Learning from Others

To understand how to build knowledge-based economies, it is useful to look at countries that have succeeded in setting their growth processes on a knowledge and innovation-based track-even if the relevant policyactions were part of broader development strategies and an explicit knowledge economy (KE) approach was onlyrecently identified and named. Several cases throughout the world deserve particular attention. Finland is considered by many to be the world's most competitive country. Canada and Australia also enjoy competitive economies. The Republic of Korea and Ireland initiated explicit KE strategies in the past few decades, starting from a low-income base to achieve leading positions in the world economy.

i. *Middle-income economies*- A few decades ago, the nations of Chile and Costa Rica in Latin America, Malaysia in East Asia, Tunisia in the Middle East, and Mauritius and Botswana in Africa, instituted multi sector reforms to attract foreign investment and create a KE-oriented environment. Transitional economies. The Baltic countries, notably Estonia, have instituted KE reforms over the past decades that are now paying off. Low-income economies. Vietnam has developed rapidly by taking advantage of globalization. The African countries of Mauritania, Mozambique, Uganda, and Rwanda are also active in instituting KE reforms (if in a fragmented way) and have enjoyed some economic success. China and India. Finally, there are the examples of China and India. These are the two *emerging giants* of our time, and their ascendance has benefited from the selective use of the KE approach. The experiences of these countries offer answers to the questions of *what to do* to build a knowledge economy and *how to do it.* The examples of the Republic of Korea, Ireland, and Finland are examined in detail in this chapter. Although their economies are now fairly advanced, they offer useful and generally applicable lessons. To resolve the crisis and put the economy back on solid footing, the government enacted remedial financial and economic measures, while at the same time launching a nationwide, multi sector KE plan (box 3.5) promoted through an awareness campaign in the nation's main business newspaper. Coordinated bythe Ministry of Finance, the plan included reforms across all levels

of the education system, incentives to stimulate R&D (to compensate for the business sector slowdown), the promotion of venture businesses, and the building of a dynamic information society. This last phase, the most successful of the plan, resulted in the creation of an advanced information infrastructure (as measured by Internet access, e-applications, and so on) supported bya verydynamic information technology (IT) industry.

Inspired by these examples, the following sections set out principles for implementing KE (knowledge economy) strategies, including:

- the change of mindset needed for KE strategies
- the general attitudes that should inspire KE strategies
- the adaptation of policy measures to development levels
- the management of reform
- the exploitation of entry points such as driving sectors and cities
- the need to deal with contextual specifics of various types.

14.3.2 Adopting Conducive Attitudes

i. *A New Mindset for Government Action*- The KE development calls for government action beyond the familiar programs of market liberalisation and selective, modernizing interventions. The new approach complements, rather than replaces, the liberalisation and modernisation views.

ii. *Key Attitudes*- The general attitudes that should guide knowledge-based strategies: determination, vision, openness, and pragmatism. The same attitudes underpin the successful efforts of other countries as well: *Determination*- A KE-based approach requires determination. Adherence to the so-called Washington Consensus on policy reform-which calls for macroeconomic stability, deregulation, trade liberalization, and privatisation-is not sufficient in itself. Policies need to address all intangible assets and sources of growth-education, research, information, communication, and entrepreneurship-in order to foster and apply knowledge throughout the economy. Determination requires thinkingbig. Successful knowledge-based strategies require determined action across sectors and fields.

Restricting efforts to a specific policyplank is thinking small. Determination involves the ways and means used to accomplish the basic policy actions needed at a nation's stage of development. While it is difficult to make the transition to a stage of higher development, it is possible to apply modern means to achieve the objectives applicable within a stage. For instance, the use of advanced communication tools and distance learning can facilitate the meeting of education objectives even in the poorest countries. Similarly, the use of basic telephone and Internet facilities in countries at a higher stage of development can rapidly and radically transform the conditions within which entrepreneurs-including farmers and fishermen-do business. The application of these means can be effectively supported by government efforts. Determination is demonstrated by clearly structured industrial policies set to facilitate the development of a strong manufacturing sector. These measures improve the overall environment in which businesses evolve. *Vision*- Countries that advance have started with a vision that, in one way or another, points to a goal and gives a sense of identity. Aclear vision gives expression to determination. Avision generally takes the long view, sometimes with the fruition of goals 20 years out. Vision arises from small groups of people, from community or regional leaders, and sometimes even from the head of state. Visionaries need to look for resources in various sectors of society, such as business and education. This is necessary to anchor the vision in reality and to obtain the commitment of the populace. It is crucial to realize a vision in concrete terms quickly-in tangible projects, even if of modest size. The vision thus becomes credible and reinforces national investment and self-confidence. Openness. Another lesson from the Korean, Irish, and Finnish experiences-and from other successful transitions to a KE approach-is the need for openness to the outside world. *Globalization* offers considerable opportunities; chief among them is the opportunity to attract FDI and employit appropriately. Each countrymust organise instruments and channels to systematically monitor technologies and knowledge abroad that might be relevant to its activities and goals.

A successful knowledge economy relies on policy exposure, which can be gained through international exchange, study tours, and pilot programs based on policy measures that have proven successful abroad. Pragmatism, Determination, vision, and openness

must be grounded in reality.

Policymakers need to clearly understand the needs and constraints of their economy and temper their ambitions and goals, adapting their efforts to their country's capacities and resources. They must make the best use of their country' s competitive advantage, whether in agriculture, tourism, or natural resources, and to direct their attention first to the areas with the highest leverage to position the country on a successful KE track. As the experiences of the Republic of Korea, Finland, and Ireland demonstrate, building a knowledge economy is a gradual process in which efforts, investments, and policy actions are adapted at each stage of development, accompanied byan understanding of the country's specific needs, capabilities, and comparative advantages.

14.3.3 Adapting Policy Actions to Development Levels

The three examples of the Republic of Korea, Ireland, and Finland suggest policy actions appropriate for various stages of development. Progress toward a knowledge economy is measured in relation to the stages of development as defined by the World Bank, and by respective levels of advancement. Low-income countries are at an *early* KE stage and need to build foundations; lower-middle-income countries are at an *upgrading* KE stage and need to raise their KE assets before they can embark on a broad KE strategy for growth; upper-middle-income countries are at an *emerging* KE stage; and high-income countries are ready for a *full-fledged* KE strategy.

Low-Income Countries

Low-income countries at an early KE stage need to establish solid foundations in governance and the business environment. Governments may choose to establish special economic zones (SEZs) with few bureaucratic entanglements and transaction costs. This attracts foreign investment, which introduces new technology and management and creates jobs. Large but vital tasks are (a) the reduction of illiteracy through basic education and (b) the strengthening of a few technical and tertiary institutions to build core competency in advanced technology, engineering, and science. For ICT advancement, low-income countries should first build a minimal telephone infrastructure that takes advantage of mobile technology and then establish fixed-line connections for the Internet (at least 10 percent of the population must be connected in order for the knowledge economy to take off). For educational and cultural advancement, they should also make good use of TV and radio

networks, notably to reach rural areas. In terms of innovation, they should make the best possible use of national and global knowledge to serve the basic needs of the population (for food, healthcare, and housing), and develop basic infrastructure for quality control, metrology, and other services essential for supporting technology diffusion and adaptation throughout the nation, particularly in rural areas. Investments may be directed to selected IT niches if it is possible to take advantage of a literate labour force and entrepreneurial individuals well connected to international markets.

Lower-Middle-Income Countries

Lower-middle-income countries that are upgrading toward a knowledge economy should further improve their business environment by focusing on financial and labour markets and by facilitating the reallocation of both financial and human resources toward an emerging formal private sector. Bureaucratic and regulatory obstacles that prevent expansion should be removed. SEZs should be developed across the economy, and more FDI attracted through targeted strategies and incentives. To achieve full literacy and expand the higher education base by joining networks of advanced institutions worldwide, there must be full access to primary education and increased standards of quality as well as access to secondary and vocational education. Internet access should be expanded to improve governance, logistics, business services, and the delivery of social services. Innovation requires an increased awareness of global developments to identify and import relevant technologies. Extension services designed to increase productivity in agriculture and manufacturingshould be increased. While private R&D maybe encouraged, the existing public R&D infrastructure should be strengthened. Both must be supported by measures to increase technological and managerial competence. University-industryinteraction should be encouraged on a selective basis through appropriate support and incentives.

Upper-Middle-Income Countries

As they move closer to a solid knowledge economy, upper-middle-income countries should further strengthen their business environment. In particular, they must focus on financial and equity markets by facilitating the mobilisation of development and venture capital. The efficiency of government tax collection and expenditure should improve with an educated labour force and improved governance. Access to higher education should continue to widen and the qualityof education to improve. Lifelong learning systems

characterised by multiple pathways and providers should be developed. The application and use of Internet-based technology should be further developed, increased, and diversified to further reduce transaction costs and improve economic efficiency. Domestic innovative capacity should be encouraged through appropriate incentives (reimbursable subsidies, tax incentives, and so on), particularly for developing private sector R&D, with a goal of increasing R&D expenditure to 2 percent of GDP. Protection for intellectual property rights (IPR) should also be expanded, although this is less important for low-income countries.

Advanced Countries

For advanced economies, development and maintenance of a true knowledge economy require an immediately responsive and flexible environment. Incentives should be directed toward intangibles such as R&D, education, software, and marketing and should be adapted for a service-based economy. In the education sector, the priority should be to increase access to and quality of the higher education sector. This, in return, becomes part of a larger, seamless, lifelong learning system with a large number of tertiary students, including adults. ICT becomes the basic infrastructure of the economy with a broad development of special applications, including dedicated software and multimedia. Innovation becomes the key engine of growth. International strategic alliances for R&D, production, and marketing are encouraged by government support.

14.3.4 Managing Reform Processes

Timeline and Impact of Reforms

Knowledge Economy reforms can have a very significant impact in a relatively short time, even though their full effect requires sustained action across the four pillars. The effect of measures that improve the business environment may be felt in one or two years-sometimes in only a few month-in areas such as enterprise development and the attraction of FDI. Similarly, investments or actions relating to ICT may show tangible effects in only a few years- witness the rapid spread of cell phones. By contrast, innovation policy requires a minimum of five years to generate significant improvements in technology diffusion, job creation, enterprise growth, and international competitiveness.And education policyreforms will not take full effect until the passing of one to two decades at best. However, measures to retrain workers-and more generally to establish lifelong learning venues-should improve

employment opportunity for much of the population far more rapidly. KE development processes are nonlinear. Unexpected events-such as a crisis that demands immediate decisions or the restructuring of a sector or firm that leads to immediate and unanticipated industrial growth-can effect a major change in direction.

Knowledge Dynamics: Incremental Change

Determination and vision are necessary to build confidence that a new and better era in national development is at hand. However, the conditions for substantial change throughout the institutional system are often not fulfilled even in countries that have been affected bya deep crisis. When effective market mechanisms and government organisations are in their infancy, policy makers may face both market failure and government failure. Under such conditions, pragmatism-adopting and adapting what works-should inform knowledge strategies. The design of institutional solutions for knowledge-based growth does not require full-scale public sector reform. If resources are few and time is constrained, policies that establish institutional shortcuts maybe appropriate. Imperfect and idiosyncratic institutions may ensure a functional fit between a country's conditions and the challenges of reform.

For example, many observers have been puzzled by the remarkable success of town and village enterprises in China. These enterprises were owned and controlled by local governments. Standard theory cannot account for their comparative advantage over private enterprises. It seems that the public structure accommodates the particular features of the Chinese economy and society at this point in time. China is not the only country to employ incremental reform. Modest reforms appeared to account for economic growth in India, allowing the nation to exceed its traditional growth rate of 3 percent. In the 1980s, under Rajiv Gandhi, the government relaxed industrial regulations, encouraged imports of capital goods, and rationalised the tax system. Though the reforms were modest, they tipped the balance by encouraging rather than discouraging entrepreneurial pursuits. Entrepreneurship is both a principal route into global knowledge flows and a principal actor in transforming knowledge into wealth. The recent surge of growth in these emerging giants can be traced to their strategy of gaining knowledge that can then be transformed into wealth. The reforms in China and India illustrate incremental changes from the bottom up, offering a favourable balance of risks and returns by encouraging first steps at many and diverse entry points. This incremental process increases the chances of setting the

cycle of institutional reform and knowledge-based development into motion.

Sustaining Knowledge Dynamics: Bottom-Up and Top-Down Initiatives

Since most developing countries need to implement major reforms if they are to move ahead. Developing a consensus for reform agendas can be as challenging as removing the institutional impediments to reform. Finland and the Republic of Korea are good examples of concerted consensus building efforts to engineer successful transitions to knowledge-based economies. In both cases, a national economic crisis compelled the affected actors to define and implement a new agenda through explicit or implicit national consensus on goals and mechanisms for moving forward. Policy makers and private sector leaders extended the time horizon for results from the adopted policies. In both cases, mechanisms already in place anticipated change and the need to undertake or adjust appropriate reforms. These cases show that to overcome institutional rigidities and bottlenecks, a combination of top-down and bottom-up policies is necessary.

14.3.5 Sequencing Reforms

Transitions are required to facilitate the concerted efforts that are crucial to successful reforms. Inspired by successful processes, one may propose a three-stage scheme:

- ***Immediate agenda.*** Through a top-down initiative, create awareness, develop rational indicators to monitor progress toward a knowledge economy, and evaluate ongoing pilot initiatives.
- ***Short- and medium-term agendas.*** Through top-down and bottom-up cooperation, institute a shared vision led by the private sector, institute a national monitoring system linked to budgetary priorities, and consolidate micro level "rapid results" projects and/or pilot projects in visible initiatives across regions and sectors. The priorities of a national monitoring system can be expected to result in significant changes in budgetary priorities.
- ***Longer-term agenda.*** Set a full-fl edged reform agenda that will eliminate or transform major vested interests and will introduce a new incentive structure for major agents.

14.3.6 Exploiting Entry Points: Driving Sectors and Cities

Innovation and growth often arise in specific sectors or locations following the accumulation of a critical mass of talent, resources, and entrepreneurship. There must be an adequate and functioning infrastructure (power, transportation) in place, and a permissive-if not supportive-environment for entrepreneurial initiatives. When these conditions coalesce, competitive industries emerge or clusters develop. There are many examples of this process in advanced countries; the Irish Shannon-Limerick area and Finnish cities are cases in point. There are many examples to be found in lower-income countries as well. The role of government is to facilitate innovation and growth by bringing together the elements and personnel that can make a difference. In its pragmatic approach, China intentionally created enclaves for growth known as export processing zones (EPZs) and technology parks within SEZs that offer financial and regulatory incentives to local and foreign enterprises willing to relocate, along with training facilities. Well-equipped government laboratories or state schools led by visionary leaders and accompanied by an active private sector provide an efficient nucleus for clustering processes.

The city of Bangalore in India offers an example. It began as an active IT service center, drawing on local IT schools and a few private enterprises that had contracts with U.S. firms located in Silicon Valley. With a well-trained and cheap labour force, it grew rapidly. Bangalore now seems to be reachingcertain limits, but its success has been emulated by other Indian cities. More generally, IT communities and sectors are plausible entry points throughout the world. They are led by entrepreneurs using new technologies and offering attractive opportunities for employment, for profit, and for exports within a relatively short time. In today's world, ICTs appeal to the public at large and offer an opening into the knowledge and information age.

14.3.7 Dealing with a Country's Context

Development Trajectories and Policy Agendas

The World Bank has recognised the need to adapt development strategies and policy measures to each country's specific context. When considering the development trajectory that is most appropriate for a country, it is crucial to consider different approaches in industrial strategies. Korea developed its industries with technology from abroad, through its licensing policy and systematic OEM agreements. The core *chaebol* industry groups

were family owned. For example, Korea should now expand its indigenous innovative capability and concurrently address the trends toward polarization of its economy and society. Ireland should build a larger research base and diversify its innovation clusters. Finland should maintain its position of technological pioneer and world competition leader by finding new niches. In recognition of the significant differences between countries, the World Bank recently tested a growth diagnostics methodology based on the identification of binding constraints. A government must focus its policy actions on removing these systemic obstacles rather than employing the usual laundry list of measures that touch all areas (trade, investment, finance, governance, labour, and so on). The growth process in Brazil is affected in the first instance by constraints on entrepreneurs-particularly the lack of development capital. The situations thus require very different policy approaches.

14.3.8 Socio-cultural Issues

Sociocultural considerations are of paramount importance in the development process. Whatever the policy actions and strategies for change, slowly changing socio cultural specificities will shape efforts, investments, and growth trajectories. Cultural influences on and implications for countries' economic systems and policies, particularly their knowledge and innovation dimensions, can be approached at the different levels of a "culture tree". There are striking differences between Eastern and Western civilizations. These can be imputed in part to different cognitive processes, with implications for relationships to the world, as well as societal organisation. Two different postures can be identified: in the West much thinking involves a distancing from reality, in the East an immersion in it. These different ways of thinking imply differences in various domains of human activity including medicine, law, science, human rights, and international relations. In science and technology, the Western approach to reality favours a scientific search for causality in understanding natural phenomena, while the Eastern mind favours holistic combinations of existing elements as the basis for technological development. With regard to the legal and institutional environment, Western societies are concerned with the establishment and observance of the rule of law as the basic means of protecting the individual, while Eastern societies tend to emphasize informal relationships regulating collective groupings, such as the Chinese *guanxi*. This leads to two clearly different economic systems with some contrasting features.

The historical experience of nations, and their geographic location, also plays a

vital role in shaping collective mindsets and behaviours. At the level of nations, behaviour and thinking are strongly influenced by history. For the developing world, the impact of colonisation is particularly important. The situation is better when trauma has been limited or the contact has been well integrated. Japan, for example, has maintained its integrity throughout its history, and has thus been able to integrate modern features into its traditions. Botswana is another instance in more recent times, and on a particularly troubled continent. As far as geography is concerned, an island-in geographic and cultural terms-seems to possess a special sense of identity that helps to mobilise the available resources, provided that the countryis open enough to external pressures and opportunities.All value judgments should be eliminated. What matters is to understand how deeply rooted factors that have shaped mindsets and behaviours over time and created the true wealth of mankind in all its extraordinary diversity-influence development processes positively or negatively. Cultures and related mindsets and behaviours are very slow to change, and it may be that the globalisation process, instead of leading to uniformity, pushes civilisations and nations to intensify their specificities, thereby contributing to a healthy diversity. Cultural features present both strengths and weaknesses, and the policy implications are clear: build on one's natural strengths while being conscious of one's weaknesses.

14.4 CONSTRAINTS TO THE GROWTH OF KNOWLEDGE ECONOMY

14.4.1 Challenges and Opportunities

It is for all these reasons that the term *knowledge economy* (KE) has been coined. Its meaning is broader than that of *high technology* or the *new economy*, which are closely linked to the Internet, and even broader than the often-used *information society*. Its foundations are the creation, dissemination, and use of knowledge. A knowledge economy is one in which knowledge assets are deliberately accorded more importance than capital and labour assets, and where the quantity and sophistication of the knowledge pervading economic and societal activities reaches very high levels.

1. Coping with Knowledge-Based Economic Competition

Industrialised countries, for which the term *KE* was initially forged (OECD 1996), are coping unevenly with the new realities. The nations of North America seem to have benefited quickly from the new opportunities offered, with a higher growth rate and higher productivity performances over the last 15 years or so. Gaps in income per inhabitant

between North America and Europe have increased. In Europe, small, dynamic economies such as Finland and Ireland have become models of knowledge-based growth and competitiveness, while larger continental economies such as France and Germany-which led the technological and industrial race in past decades-have, had difficulty adjusting. Meanwhile, Japan has experienced a difficult decade, with slow growth caused bya variety of factors, but has continued to build KE assets (by increasing spending on basic research. There is a strong correlation between innovation performance, total factor productivity, and economic growth in OECD countries. Nordic and English-speaking countries have, as a whole, performed better than others. The transition economies of Eastern Europe have had difficulty coping with the new knowledge-based competition, although they benefited from considerable past investments in education and science. Smaller economies such as Hungary, Slovenia, and Estonia have coped well and taken advantage of European enlargement. Estonia, in particular, has adopted an aggressive KE approach. However, a number of other new EU members and candidates are undergoing a more painful adjustment process. The Russian Federation and other countries of the former Soviet Union have yet to demonstrate their capacity to make use of a knowledge potential that was considerable at the time when the Berlin wall fell but eroded rapidly owing to the emigration of highly educated people. Among medium- and low-income countries, Chile, Malaysia, and Tunisia have clearly taken a knowledge-based approach to increasing competitiveness and growth. According to a recent World Bank study on economic growth, countries with successful growth-defined as those that both caught up with advanced countries and sustained growth over time-did so by combining three important factors: capital accumulation, efficient resource allocation, and technological catch-up. The 18 successful countries were China, Vietnam, Republic of Korea, Chile, Mauritius, Malaysia, Lao People's Democratic Republic, India, Thailand, Bhutan, Sri Lanka, Bangladesh, Tunisia, Botswana, Indonesia, Arab Republic of Egypt, Nepal, and Lesotho. The report underscores the importance of technological catch-up and its translation into economic growth through increases in total factor productivity, which accounted for between one-half and three-quarters of economic growth in all countries listed.

The report also confirms that productivity gains should be considered in a wide Sense-not onlyin terms of technological change, but also including institutional innovations, which are just as important for productivity as breakthroughs in science and technology. Such gains are also stimulated by internal competition, openness to external markets, and

the role of foreign direct investment (FDI) in particular. Each government among the 18 countries listed played a unique role in the growth process. China embarked on a knowledge-based growth track by attracting massive FDI and then building an indigenous knowledge base through huge investments in education and research. India has succeeded by making the best use of its elite institutions and exploiting international IT-related opportunities, in part through the deft use of knowledge assets. There is a distinct KE model and process for countries at all levels of development.

Globalisation and the knowledge revolution present both challenges and opportunities to developing countries. On the one hand, there is the threat of a widening in the existing knowledge gap with industrialised countries. Indeed, research and innovation capabilities-measured by the usual indicators of R&D investments (expenditures, researchers) and outputs (scientific articles, patents) tend to be more concentrated in industrialised countries.

On the other hand, the digital gap-differences in telephone and Internet use- is being gradually reduced, although this does not reflect the considerable inequalities in Internet access among the poor and the rich in developing countries, or the mediocre quality of Internet infrastructures (in terms of bandwidth and soon).

For developing countries, easy access to global knowledge and technology is crucial. Relevantknowledge and modern technologycan be decisive in helping such countries reach several of the Millennium Development Goals 8 at a very low cost. Nonetheless, much is needed to become a vibrant knowledge economy-often more than what was needed to succeed among traditional economies. Then, competition was a matter of capital investments in natural resources or low-cost, unskilled labour. Now, facing world competition means climbing up the value chain.And success in the climb means upgrading the labor force and ensuring efficient telecommunications and logistics. A knowledge economy requires a significant segment of highly educated people, not simply a population with a basic education. While low labour costs alone can attract FDI and boost economic growth, on their own they also present the risk of trapping economies in the manufacturing part of the production process.

2. Global Issues

The number of major challenges facing the world's economies is mounting, in part

because of globalisation and the recent technological revolution. Among these challenges are growing fragility in the world community, widening global economic imbalances (all the more difficult to reduce as China and India become major economic players), unsustainable urbanisation, and increasinglyevident environmental and resource constraints on economic growth. Knowledge and innovation can help nations face these challenges, several of which are outlined below.

Fragility. Various factors make the world community more fragile, with greater risks of systemic propagation effects and paralysis. These include uncontrolled epidemics such as bird flu, global financial speculation in interconnected markets, terrorist attacks on sensitive points (such as major trade or oil routes), proliferation of weapons of mass destruction, and so on. Such risks result, in part, from the increased integration of economies and societies, which ICTs have accelerated. At the same time, however, these technologies help monitor and control potential dangers.

Imbalances. Economic globalisation has been accompanied by a redistribution of production through off shoring and outsourcing. FDI has tended to concentrate in a few regions, primarily China and Eastern Europe (following the fall of the Berlin wall). For lower-skill industries, this has led to drastic and permanent employment shifts worldwide. High-income countries have lost jobs, and low- to medium income countries have lost export and employment opportunities. This trend will likely increase in the coming years and continue to affect service industries, spurred bythe rapid growth of India. Consequences are considerable for regions in great need of employment, such as the Middle East, where it is estimated that some 90 million jobs will have to be created in the next 20 years in order to prevent a further increase in unemployment. At present, 15 percent of the total population-and more than 30 percent of the youth population-is unemployed.

Unsustainable urbanisation. The rapid and anarchic urbanisation that accompanies industrialisation affects developing countries in particular. In 2003, 48 percent of the world's population lived in urban areas- a 33 percent increase from 1990. It is projected that, by 2020, 4.1 billion people (55 percent of the world's population) will live in urban areas. Almost 94 percent of this increase will occur in developing countries. By 2015, there will be 22 megacities (cities or agglomerations with a population of more than 8 million) and 475 cities with populations exceeding 1 million. While urbanisation helps renew cultures and brings innovations into people's lives, it is accompanied by a loss of autonomy and by

violence, human trafficking, and so on. Coping with urbanization and its side effects is a serious challenge. It requires the capacityto conceive, produce, and disseminate technologies that favour autonomous local development processes. This can help prevent the excessive concentration of populations that can lead to dangerous fragmentation.

Environmental and resource constraints. Finally, it is important to recognise that the rapid emergence of China and India, coupled with global warming, means that the world economycannot continue to use energy and natural resources at the current rate. Production and consumption systems in both developingand industrialised countries will have to change profoundly. Global innovation is challenged-perhaps to a degree never before experienced-as caps on growth are approached.

To conclude Knowledge has always played a determining role in the development of societies. In the last two decades, however, a distinct Knowledge Economy model and process have been observable in successful economies worldwide, and among both industrialised and developing countries. Globalisation and the fast-moving digital age open new opportunities to developing countries to the extent that those countries follow successful economic models. It is urgent that developing countries proceed with the investments and reforms required to build knowledge-based economies. Chief among those requirements are creating jobs, facing competition from China and India, and meeting environmental challenges.

14.4.2 Future challenges for a knowledge-based economy

Not only has there been a general lack of progress towards reaching the Lisbon goals of Europe becoming a more dynamic and competitive knowledge-based economy, but challenges are actually increasing over time, due to demographic changes, increasing competition from China in high value-added goods and from India in services, and the continuing dominance of the United States in KBE sectors such as ICT and biotechnology. There are a number of major structural changes occurring on a global level that are relevant to knowledge-based economies and that will alter the environment for innovation and competition over the next few decades, and consequently, influence the types of indicators that European policy makers and academics will need to be able to effectively evaluate and respond to future challenges. These major structural changes include:

1. Increasingly global production chains for goods and services, leading to changes

in the location of comparative advantages.

2. The development of new centres of knowledge and innovative activities.
3. Demographic changes including increases in the average life span.
4. Changes in stocks and flows of skilled workers.
5. Technological shifts driven by new technology or environmental requirements.

This section examines these five challenges and the types of indicators that will be required to track structural changes over time. We also briefly discuss three related scenarios on demand for innovation, supply of skilled human resources and environmental. The goal of these scenarios is to assess the relevance of existing indicators and to suggest new indicators where necessary.

a. Global production chains: The first structural change consists of major shifts in the location of comparative advantage for the production of both manufactured goods and services. While China accounts for a growing share of manufactures, India is developing strengths in services such as software development, clinical trials, and call centres. Over the short to medium term of up to 20 years, firms in developed countries are likely to respond to cost competition from India and China by increased delocalisation of production, including the production of high technology products, such as ICT or aerospace equipment. Such shifts in the location of production have been made possible by ICT, innovation in organizational forms and logistics and low transportation costs. Innovative firms rely on cross-national production networks and create value from the efficient use of global supply chains, thanks to globalization and the increasing modularisation of standard components. New types of indicators to inform policy options and private investment decisions are needed. Although MNEs are important actors in the innovation process, their role needs to be better understood. Statistics related to MNEs are usually limited to the national level and country to country comparisons, creating incomplete data and unclear profiles on their activities, including the location of their innovation investments around the world. Due to a lack of official statistics, little is known about the extent and real impact of delocalisation of production. Further work is required to identify employment effects, including types of employment affected (e.g. knowledge creation vs. application); occupations most

affected (e.g. different skill levels and fields of specialisation), and wage differentials for the same occupation between the source country and the off-shored location, plus rates of salary growth abroad. Acrucial point about current changes in the location of comparative advantage is that it won't last. Sooner or later, increasing productivity and wealth in India, China and other developing countries will result in currency realignments that will reduce the disparities in wages and incomes that drive off-shoring strategies based on seeking lower wage costs in manufacturing and the provision of services. An often forgotten point is that the advantages of distant, low-cost production are slim. Even a 10% increase in shipping costs can reduce the cost advantage of producing some goods in China to zero. The rapid increase in the cost of petroleum products after 2006, if sustained, could lead to a shift in some manufacturing in China to locations closer to major markets.

b. The changing environment for innovation strategies: Outsourcing and delocalisation of production are not new phenomena. However, data suggest that countries such as India and China are likely to increasingly compete not only on the basis of low wages, but also on their innovation capabilities, including in knowledge intensive sectors, such as software, capital goods and ICT manufacturing. American FDI or suppliers to American firms in these two countries also appear to be increasingly responsible for developing patentable innovations for their parent firm, suggesting that both China and India are capable of turning FDI into a mechanism for developing innovative capabilities. One consequence is that it could be increasingly difficult for high-wage countries to compete on the basis of "continualinnovation". Thedevelopment of innovative capabilities in China and India could drive firms to increasingly develop R&D centres in these two countries. First, firms can take advantage of local pools of inexpensive but highly skilled labour; second, they can seek specialised expertise that is not available in their home countries and third, they can establish R&D labs in foreign markets to adapt current products to local tastes or develop new products that meet local demand. The OECD estimate that about 20% of total jobs in the EU could be off-shored, including many of the 'knowledge jobs' of the future gives pause for thought. This is already occurring in some sectors, such as software development in India, and the establishment of research centres in China by telecommunication and biotechnology firms. To date, we lack reliable statistics on both the extent to which

innovation activities such as R&D are being globalised, and more importantly, the innovation capabilities of the research centres that have beenestablished bymultinational firms in developing countries. We do not know if these centres are performing leading-edge research or largely adapting products to local markets. Competitive advantages provided by innovation could decline as an increasing share of firms base their competitive strategies on innovation, driven both by an increasing awareness of innovation by firms based in developed countries and by an increase in the use of innovation by firms based in developing countries. Greater competition could reduce the ability of innovative activities to provide the excess rents that drive profits and investment. This could produce a paradox whereby policy efforts to encourage more creative innovation, as with the 3% R&D intensity goal for Europe, result in declines to the private returns from innovation. However, three factors could mitigate the reduction in profits from increasing competitionover innovation. Thefirst factor concerns the location and costs of innovation activities. With R&D becoming more of a commodity, it can be purchased from universities, start ups and spin-offs, or from cheaper R&D centres in developing countries.29 The second factor is that firms can more aggressively manage intellectual property to profit from their investments in innovation, for example through patenting. The organisation of innovation itself is changing and these changes can improve the productivity of innovation. IT has driven down the costs of experimentation, and globalisation has reduced the cost of research collaboration and the cost of outsourcing. Firms have decreased the role of standalone central labs and increased their use of linkages such as networks, alliances and formal and informal relations. Such linkages could be producing basic structural changes that improve research productivity and allow innovation systems to adapt to new conditions, as well as reduce uncertainty, share costs and knowledge, and bring innovative products and services more quickly to the market. Indicators to track and understand these dynamics are important for policies that support this experimentation while retaining a competitive environment. The efficacy of these three counter strategies to improve the profitability of innovation depends on favourable technological opportunities, or the R&D and engineering costs ofdeveloping new innovations versus the expected earnings from these innovations. There are no reliable data for technological opportunity, but the opportunities are believed to be highest during the early years of a new technology,

lowest during its mid life, and to increase as the technology matures.

c. ***Demographic change and demand:*** The third major structural change is a demographic increase in the average age in many developed countries. This change has two impacts on a KBE: first, on the market demand for innovative products, and second, on the supply of highlyskilled individuals. Services is inverselyproportional to age and positivelycorrelated with income. Demographic change leading to large increase in the population share of older age cohorts could reduce aggregate domestic demand for innovative goods and services. Assuming that a sophisticated domestic market plays a role in national innovative capabilities, an aging population with low levels of interest in innovation could reduce the innovative capabilities of the home market. These factors could lead firms based in countries with aging populations to seek both markets and research facilities in more youthful countries. Another development that could be affected by changing demographics is user-centred innovation. The actual economic importance of user-centred demand in either lowering innovation costs for firms or influencing the direction of innovation is unknown, but insofar as user-centred innovation occurs through the internet, the low internet access rates among older age cohorts could be a concern. Conversely, the internet permits firms to get global feedback for their products and services. Because consumer demand can constitute an important incentive or constraint in shaping the innovative activity carried out by private firms, data on the value that innovation generates for customers is needed. Moreover, with a possible increase in user-centred innovation, the location where innovation takes place changes. This requires integrating customer requirements and ideas through organisational innovation (customer-related processes are integrated with sales, delivery, inventorymanagement and so forth). Attention needs to be given to the role of suppliers, customers and interactions among them. This means developingindicators of innovation processes that look at those interactions by using new technologies.

d. ***Scenario on innovation demand:*** In the KBE, productivity and economic growth are largely related to innovation. Not onlydoes competition drives innovation, enabling firms to reduce production costs, but there are other more complex factors driving product innovation, including both technology push and market demand factors. Firms invest in product innovation based on current or expected demand for innovative goods and services. Without a current or potential market, innovation activity may be

compromised. The market can be other firms (business to business), individual consumers, governments, or export markets. Demand is one of the two main drivers of innovation (the other is the supply of technological opportunities). Consequently, several policyactions, apart from the creation of a single European market, can influence innovation. The innovation demand scenario identifies indicators that could be used to evaluate national differences in demand factors and find out how policy could influence demand in a way that would stimulate innovative activity.

e. ***New technologies:*** Major technological shifts are difficult to predict. They could occur through the development of new generic technologies such as biotechnology or nanotechnology, in response to rapidly increasing demand for food, mineral, fibre, and energy resources, or from environmental imperatives to counteract unsustainable exploitation of the world's resources. Regardless of the cause, technological shifts can increase demand for investment in research and the skills to use new technology. For example, science and technology will need to move forward in several energy related fronts (mainly to counter climate change and growing demand for oil from countries such as China and India), which will require innovation in the resource sectors and in how energy is used across all sectors. Biotechnology is widely viewed as an emerging generic technology, although its economic impact is likely to be far less than that of ICT. Nevertheless, the application of biotechnology to agriculture and industry could have major economic effects, in addition to social and environmental benefits. Obtaining these benefits will require a long-term research strategy, which may increasingly take place in major developing countries, rather than in the original biotechnology leaders of the US and Europe. Shifts in technology can also result from changes in public support for research, such as the change occurring in the US through an increase in public support for life sciences, including biotechnology, and a decline in support for technology fields (engineering, physical sciences, maths and computer science). This shift in priorities is controversial, partly due to the long lag times before life sciences R&D results in commercial products.

The future growth of all types of economic activity will require materials and energy. Whereas developed countries are investing heavily in innovation, China has realised the importance of resources and is currently investing large amounts of money in the exploitation and purchase of natural resources worldwide. Growing resource scarcity

is likely to produce significant rents in the future for the owners of commodities.

14.4.3 Policies for a knowledge-based economy

For policymakers in industrialised economies, the development of a KBE is viewed as essential for economic growth in the face of increased competition from lower cost countries inboth basic manufacturing andin higher skilled services and production. European countries not only face the challenge posed by competition from these emerging countries (e.g. China and India), but also continue to face pressure from countries such as the United States and Japan, two countries identified as the major competitors in European policy documents since 1995.

In addition to existing policies to promote ICT use, R&D, and education, *a broad range of policies are relevant to the goal of supporting a KBE*. These include policies to promote organizational and "presentational" innovation and "soft" parameters such as human creativity and human resource management. The goal is to develop policy based on concrete evidence. The challenges include a lack of empirical evidence for present developments in the KBE, as well as the need to address future trends and uncertainty. Good policy making must also incorporate political, economic, and cultural contexts. *A few challenges for policy development need to be taken into account.*

1. First, policy tends to focus on goals and outcomes – such as the 3% R&D intensity goal agreed in Lisbon and Barcelona - that are easy to measure because adequate data and indicators are readily available. This contrasts with a lack of data and indicators for other KBE goals. This disparitybetween data and indicator availability could distract the policycommunity from pursuing other important policies for encouraging growth in a KBE.

2. Second challenge for evidence-based policy is to measure the effect of government programmes on policy goals when large number of factors can influence outcomes. Identifying the effect of factors requires a variety of indicators, many of which may be unavailable, except as one-off indicators collected in a single survey at a single point in time. Such problems can occur for measuring a number of policies relevant to a KBE, such as promotingthe use of patents and other IPR, public sector innovation or improved quality of human capital.