Transparency: Transparency is a basic pillar of the WTO. WTO members are required to publish their trade regulations, to establish and maintain institutions allowing for the review of administrative decisions affecting trade, to respond to requests for information by other members, and to notify changes in trade policies to the WTO. The regular surveillance of national trade policies through the **Trade Policy Review Mechanism** provides a means of encouraging transparency both domestically and at the multilateral level.

Under transparency principles, member countries are required to publish their trade regulations.

Binding and Enforceable Commitments: In the WTO, when countries agree to open their markets for goods and services, they 'bind' their commitments. In the case of goods, these bindings amount to ceilings on customs tariff rates. Often countries, particularly the developing ones, tax imports at rates lower than the bound rates. But in developed countries, the rates actually charged and the bound rates tend to be the same.

A country can change its bindings, but only after negotiating with its trading partners, which can mean compensating them for loss of trade.

Reciprocity: Reciprocity operates during negotiations among countries when governments negotiate in WTO rounds, they do so with the objective of obtaining mutually beneficial arrangements through reciprocal reductions in tariff bindings. In particular, governments approach negotiators seeking a "balance of concessions", whereby the tariff reduction offered by one country is balanced against an "equivalent" concession from its trading partner.

When a country seeks to renegotiate and withdraws a previous concession, the WTO rules provide that the affected trading partner may retaliate in a reciprocal manner by withdrawing an equal concession.

Safety Valves: A final principle embodied in the WTO is that, in specific circumstances, governments should be able to restrict trade. Four types of provisions exist in this connection:[2]

The principle of safety value permits a member country to restrict its trade under special conditions.

1. Goods and services meant for noneconomic objectives such as public health and national security.
2. Industries likely to be injured by competition from imports.
3. Articles aimed at ensuring fair competition. Measures in this situation include the right to impose countervailing duties on imports that have been subsidised and anti-dumping duties on imports that have been dumped.
4. Provisions permitting intervention in trade for economic reasons. Economic reasons include measures to correct a serious unfavourable balance of trade or the desire to protect an infant industry.

FUNCTIONS

WTO is based in Geneva, Switzerland. Its functions are:

- administering and implementing the multilateral and plurilateral trade agreements which together make up the WTO;

- acting as a forum for multilateral trade negotiations;
- seeking to resolve trade disputes;
- overseeing national trade policies; and
- cooperating with other international institutions involved in global economic policy-making.

The main function of the WTO is to act as a forum for international cooperation on trade related policies-the creation of codes of conduct for member governments. These codes emerge from the exchange of trade policy commitments in periodic negotiations. The WTO can also be seen as a market in the sense that countries come together to exchange market access commitments on a reciprocal basis. It is, in fact, a barter market. In contrast to the markets one finds in any city or town, countries do not have access to a medium of exchange: they do not have money with which to buy; and against which to sell. Instead, they have to exchange apples for oranges; for example, tariff reductions on iron for foreign market access commitments regarding cloth. This makes the trade policy market less efficient than one in which money can be used, and this is one of the reasons that WTO negotiations can be tortuous and long-drawn process. One outcome of the market exchange is the development of the codes of conduct. The WTO contains a set of specific legal obligations regulating trade policies of member countries which are binding on them.[3]

The WTO is a member-driven organization, with decisions being made by consensus among all member nations.

The WTO is a 'member-driven' organisation, with decisions being made by consensus among all member governments. All decisions are made by the membership as a whole, either by ministers (who meet once in two years) or by their ambassadors or delegates (who meet regularly in Geneva).

In this respect, the WTO is different from other international organisations such as the World Bank and the International Monetary Fund. In the WTO, power is not delegated to a board of directors or to a Chief Executive Officer.

DIFFERENCES BETWEEN GATT AND THE WTO

The WTO is not a simple extension of GATT. On the contrary, it completely replaces its predecessor and has a very different character. The major differences between the two bodies are the following:

- The GATT was a set of rules, a multilateral agreement, with no institutional foundation, only a small associated secretariat which had its origins in the attempt to establish an International Trade Organisation in the 1940s. The WTO is a permanent institution with its own secretariat.
- The GATT was applied on a 'provisional basis' even if, after more than 40 years, governments chose to treat it as a permanent commitment. The WTO commitments are full and permanent.
- The GATT rules applied to trade in merchandise goods. In addition to goods, the WTO covers trade in services and trade-related aspects of intellectual property.

- While GATT was a multi-lateral instrument, by the 1980s, many new agreements had been added of a plurilateral, and therefore, selective nature. The agreements which constitute the WTO are almost all multilateral and thus, involve commitments for the entire membership.

  In contrast to the GATT, the WTO agreement is a "single undertaking"-all its provisions apply to all members. Under the GATT there was flexibility for countries to "optout" of new disciplines, and in practice many developing countries did not sign specific agreements on issues such as customs valuation or subsidies.

- The WTO dispute settlement system is faster, more automatic and thus much less susceptible to blockages, than the old GATT system. The implementation of WTO dispute findings will also be more easily assured.

'GATT 1947' continued to exist until the end of 1995, thereby allowing time for all GATT members to accede to the WTO and permitting an overlap of activity in areas like dispute settlement. Moreover, GATT lives on as 'GATT 1994', the amended and updated version of GATT 1947, which is an integral part of the WTO Agreement and which continues to provide the key disciplines affecting international trade in goods.

THE WTO STRUCTURE

The structure of the WTO is dominated by its highest authority-the Ministerial Conference. This body is composed of representatives of all WTO members. It meets atleast every two years and is empowered to make decisions on all matters under any of the multilateral trade agreements (see Fig.5.1).

Ministerial Conference, comprising all members, is the highest body to administer the provisions of WTO.

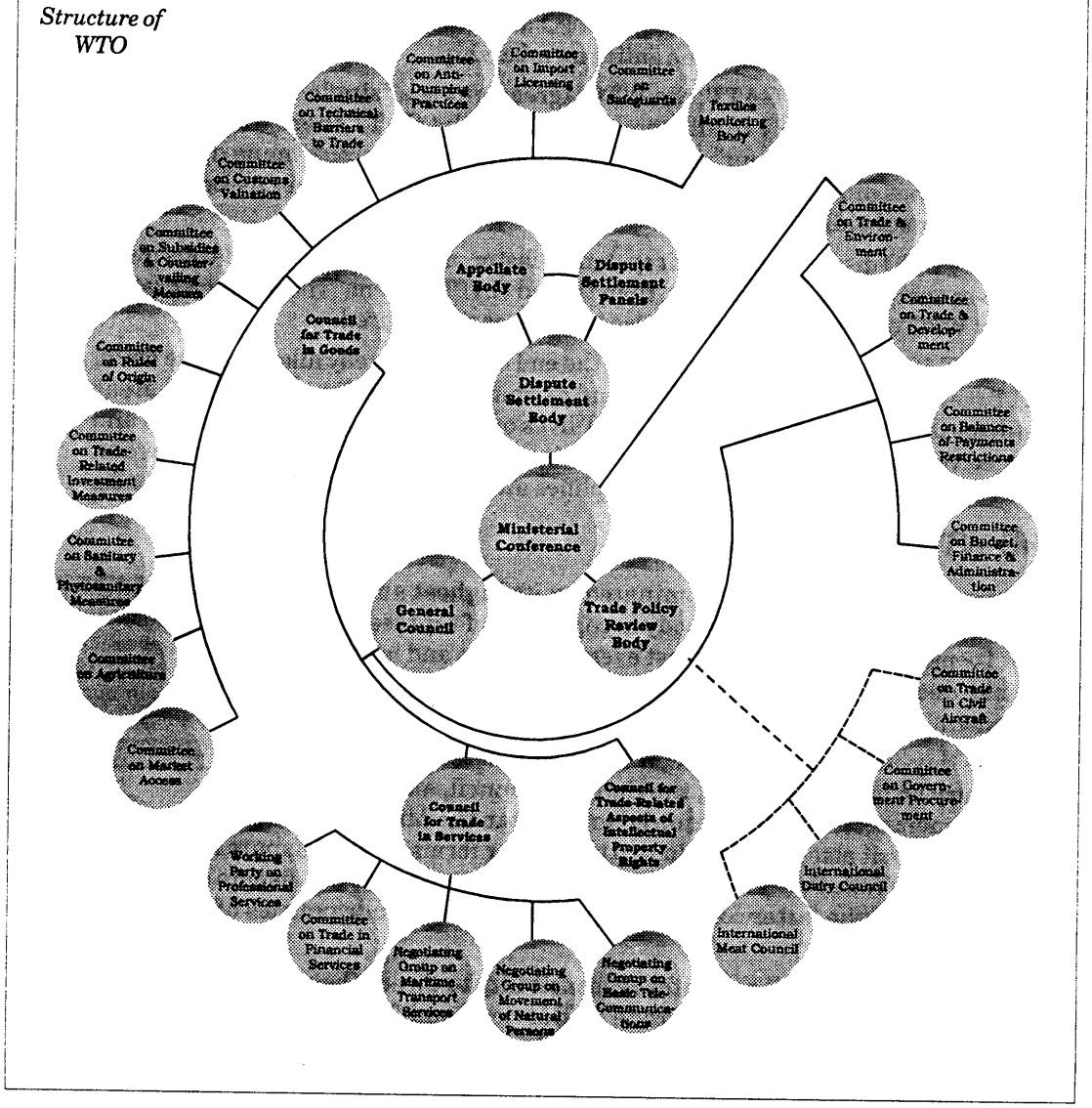
The day-to-day work of the WTO is entrusted to a number of subsidiary bodies; principally, the General Council, also composed of all WTO members, which is required to report to the Ministerial Conference. The General Council also convenes in two particular forms-as the Dispute Settlement Body and the Trade Policy Review Body. The former overseas the dispute settlement procedures and the latter conducts regular reviews of trade policies of individual WTO members.

The General Council delegates responsibility to three other bodies-namely the Councils for Trade in Goods, Trade in Services and Trade-Related Aspects of Intellectual Property Rights. The Council for Goods oversees the implementation and functioning of all the agreements covering trade in goods, though many such agreements have their own specific overseeing bodies. The latter two Councils have responsibility for their respective WTO agreements and may establish their own subsidiary bodies as deemed necessary.

Three other bodies are established by the Ministerial Conference who report to the General Council. The Committee on Trade and Development is concerned with issues relating to the developing countries and especially, to the 'least-developed' among them. The Committee on Balance of Payments is responsible for consultations among WTO members and countries which resort to trade restrictive measures in order to cope with their balance of payments difficulties. Finally, issues relating to WTO's financing and budget are dealt with by a Committee on Budget, Finance and Administration.

Figure 5.1

Structure of WTO



Each of the plurilateral agreements of the WTO-those on civil aircraft, government procurement, dairy products and bovine meat-establish their own management bodies which are required to report to the General Council.

THE FINAL ACT

Ever since the GATT was established after the Second World War, it has been striving hard (along with the World Bank and the International Monetary Fund) to achieve international economic cooperation. Towards this objective, GATT has been conducting several trade rounds (see Box 5.1), the latest being the the Cancum round where no agreement was reached. The most expensive round was the Uruguay round which

Box 5.1

From GATT to WTO

Date	*Name (Round)*	*Outcome*
1947	Geneva Round	45,000 tariff concessions representing half of world trade
1949	Annecy Round	Modest tariff reductions.
1950-51	Torquay Round	25 per cent tariff reductions in relation to 1948 level.
1955-56	Geneva Round	Modest tariff reductions.
1961-62	Dillon Round	Modest tariff reductions.
1963-67	Kennedy Round	Average tariff reduction of 35 per cent of industrial products, only modest reduction for agricultural products, anti-dumping code
1973-79	Tokyo Round	Average tariff reduction of 34 per cent for industrial products. Non-tariff trade barrier code.
1986-94	Uruguay Round	Tariffs, non-trailff measures, rules, services, intellectual property, dispute settlement, creation of WTO, etc.
9-13 Dec. 1966	Singapore Ministerial	Two separate working parties set up on investment, Competition Law. Working Group formed on Government Procurement, Trade Facilitation added to WTO agenda.
18-20 May 1998	Geneva Ministerial	Work, Programme on E-commerce launched
30 Nov. to 3 Dec 1999	Seattle Ministerial	Market Access, Agriculture, Services, Trade Facllitation, E-commerce, New Round
9-13 Nov. 2001	Doha Ministerial	New Round
Sept. 2003	Cancum	No agreement reached.

(***Source:*** Bernard Hockman, et al. (Ed.), *Development Trade and the WTO*, World Bank, 2002, p.46)

involved two thousand six hundred and thirty one days of negotiations and thousands of controversies and debates. Consensus was finally arrived and the agreement, called the Final Act, was signed in April, 1994 at Marrakesh, Morocco.

The major provisions of the Final Act (reportedly implemented by the WTO) relate to agriculture, sanitary measures, helping least developed countries, clothing, TRIPS, GATS and anti-dumping measures. A brief description of each of these follows is given below.

Agriculture

The agreement relating to agriculture is made up of several elements which seek to reform trade in agriculture and provide the basis for market-oriented policies, thereby improving economic cooperation for importing and exporting countries alike. It establishes new rules and commitments in market access, domestic support and export competition and includes provisions that encourage the use of less trade-distorting domestic support policies to maintain the rural economy. It also allows actions to be taken to ease adjustment burdens and provides some flexibility in the implementation

of the commitments. Specific concerns for developing countries are addressed including those of net-food importing developing countries and less developed economies.

Health and Safety Measures

The Agreement on the Application of Sanitary and Phytosanitary Measures concerns the application of food safety and animal and plant health regulations. It recognises government's rights to take sanitary and phytosanitary measures but stipulates that they must be based on science, should be applied only to the extent necessary to protect human, animal or plant life or health and should not arbitrarily or unjustifiably discriminate among members where identical or similar conditions prevail.

Helping Least Developed and Food Importing Countries

It is recognised that during the reform programme, least developed and net food-importing developing countries may experience negative effects with regard to giving food supplies on reasonable terms and conditions. Such countries need assistance. Therefore, a special ministerial decision calls for appropriate mechanisms related to the availability of food and the provision of basic foodstuffs in full grant form and aid for agriculture development. It also refers to the possibility of assistance from the International Monetary Fund (IMF) and the World Bank with respect to the short-term financing of commercial food imports. The Committee on Agriculture holds responsibility to monitor the follow up to the decision.

Textiles and Clothing

The objective of this agreement is to secure the integration of the textiles and the clothing sector-where much of the trade is currently subject to bilateral quota negotiations under the Multi-Fibre Agreement (MFA)-into the main stream of WTO. The integration, however, shall take place in stages (see box 5.2 for the stages). All MFA restrictions in force on 31st December 1994 would be carried over into the Final Act and maintained until such time as the restrictions are removed or the products integrated into WTO.

Box 5.2

Textiles and Clothing-Integration Stages

- On 1st January 1995, each party integrated from the specific list in the agreement products accounting for not less than 16% of its total value of textiles and clothing imports in 1990.
- On 1st January 1998, products accounting for not less than a further 17% of 1990 imports will be integrated.
- On 1st January 2002, products accounting for not less than a further 18% of 1990 imports will be integrated.
- On 1st January 2005, all remaining products will be integrated.

TRIPS

The WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) recognises that widely varying standards in the protection and enforcement of intellec-tual property rights and the lack of multilateral disciplines dealing with

international trade in counterfeit goods have been a growing source of tension in international economic relations. With this end in view, the agreement addresses the applicability of basic GATT principles and those of relevant international intellectual property agreements; the provision of adequate intellectual property rights; the provision of effective enforcement measures for those rights; multilateral dispute settlement and transitional implementation arrangements.

The TRIPS agreement contains three parts: Part 1 sets out the provisions and principles; Part 2 addresses different kinds of intellectual property rights and Part 3 concerns enforcement.

Trade Related Investment Measures (TRIMS)

Multinational firms are aware of the many restrictions on their investments in foreign countries. TRIMS are those restrictions a country places on foreign investment that adversely affect trade in goods and services. WTO members entered into the Agreement on Trade Related Investment Measures as a part of the Uruguay Round agreements.

The agreement does not set broad rules for investors in a member country. It simply prohibits laws or regulations that condition a country's right to import foreign goods on the volume of goods exported. For instance, Argentina may not say to a US MNC: "You may only import foreign raw materials on condition that you export an equal volume of finished goods from our country". Also prohibited are laws that condition the receipt of foreign exchange on the country's foreign exchange revenues. Thus, Argentina may not demand: "Our Central Bank will only permit you to transfer US dollars out of the country if you have brought into the country an equivalent amount this year in dollars, Yen, or other hard currency."[4]

GATS

The General Agreement on Trade in Services (GATS), negotiated during the Uruguay Round, is the first step of multilaterally-agreed and legally enforceable rules and disciplines ever negotiated to cover international trade in services. The agreement contains three elements: a framework of general rules and disciplines, annexes addressing special conditions relating to individual sectors (the sectors covered are: movement of natural persons, financial services, telecommunications and air transport services) and national schedules of market access commitments.

A Council for Trade in Services oversees the operation of the agreement.

Agreement on Subsidies and Countervailing Measures (SCM)

SCM is the outcome of negotiations during the Uruguay Round. Under the GATT agreement subsidies may be dealt within two ways. First, a WTO member country may appeal to the WTO for dispute resolution. The WTO may recommend that the subsidiary may be discontinued, its harmful effects be eliminated, or a countermeasure may be taken by the importing country. Second, an importing country may initiate its own administrative proceedings, similar to antidumping measures, to impose a countervailing duty on the subsidised products in order to eliminate their unfair price advantage.

A countervailing duty is a special tariff, in addition to the normal import tariff, levied on imports of subsidised goods in an amount equal to the amount of the counter-vailable subsidy. A countervailing duty may be brought at the same time as the WTO dispute settlement action.

Anti-dumping Measures

GATT allows members to apply anti-dumping measures. Such measures can be imposed on imports, if such dumped imports cause injury to a domestic industry in the territory of the importing members. More detailed rules governing the application of such measures-which take the form of either duties or undertakings on pricing by the exporter, were negotiated during the Tokyo Round and the same was revised in the Uruguay Round.

The WTO Agreement provides for greater clarity in the method of determining that a product is dumped. It sets out additional criteria for determining the injury caused to a domestic industry by the dumped product and the procedure to be followed in initiating and conducting anti-dumping investigations. Rules on implementation and duration of anti-dumping measures are also part of the agreement. In addition, it clarifies the role of dispute settlement panels in disputes relating to anti-dumping actions taken by the WTO members.

Dispute Settlement Procedure

What makes WTO distinct is its provisions relating to dispute settlement.

One of the unique features of the WTO is its provision relating to dispute settlement mechanism. Infact, the power to settle trade disputes is what it makes the distinction between the WTO and the GATT. Under the GATT, nations could file a complaint against another member and a committee would investigate the matter. If appropriate, the GATT would identify the unfair trade practices and member countries would force the offender to change its ways. But in reality, rulings by the GATT (usually given after a prolonged investigative procedure) were more likely to be ignored than respected.

In contrast, the various agreements of the WTO are essentially contracts between member nations that commit them to maintaining fair and open trade policies. When a member files a complaint against another, the Dispute Settlement Body of the WTO steps in immediately. Decisions are to be made in less than one year-nine months if the case is urgent, 15 months if the case is appealed. The WTO dispute settlement system is faster and automatic and the decisions cannot be ignored or blocked by members. Offending countries must realign their trade policies according to the WTO guidelines or suffer financial penalties and even trade sanctions. Because of its ability to penalise offending member nations, the WTO dispute settlement system is the backbone of the global trading system.

Table 5.1 shows the number of dispute settlement cases between 1995 and 2000. As of September 2000, 207 complaints had been notified to the WTO. Industrial countries brought the most cases, and their share of total complaints (74 per cent) was greater than their share of world exports. Among the different categories of cases, those brought by industrial countries against developing countries have increased the most from 10 to 31 per cent. Over 40 per cent of industrial countries cases were against developing countries. The proportion of

Table 5.1

Number of Dispute Settlement Cases, 1995 through 2000

	Complaint by			
	Industrial countries	*Developing countries*	*Total complaints*	*Share of total cases (per cent)*
Complaint against:				
Industrial countries	89	35	124	60
Developing countries	65	18	83	40
Total	154	53	207	100
Share of total cases (per cent)	74	26		
Memorandum:				
Share of cases under GATT (per cent)	84	16		

Note: Based on number of cases brought by each country. The European Union and its member countries are counted jointly.

(***Source:*** Bernard Hoekman, et al (ed.), *Development Trade and the WTO*, World Bank, 2002, p.76)

cases by developing countries against industrial countries was also higher (66 per cent of all developing country complaints). (See also bax 5.3 for an illustration).

Table 5.2 shows country-wise data in terms of appearances as complainants or respondents. From both perspectives, US tops the list. India appeared as complainant in eight cases and as respondent, the country appeared in 12 cases. Surprisingly least developed countries (sub-Saharan countries) had no complaints to lodge, nor any country lodged a complaint against them. This shows either unwillingness on the part of the least developed countries or resource constraints faced by them. The costs of dispute settlement procedure are disproportionately heavy for developing countries.

Developing countries are not lodging complaints or others are not complaining against them. This is because of unwillingness on the part of developing countries or resource constraints they face.

In general, developing countries do not enjoy a 'neutral' playing field. Although the dispute settlement procedure is not biased against any party in a dispute, developing countries are less well equipped to participate in the process: they have fewer people with necessary training, they are less experienced, and as noted above, they face resource constraints.

Common Misunderstanding About the WTO

Table 5.3 brings out the common apprehensions held against the WTO and how each doubt has been cleared.[4(a)]

Table 5.2

Participation in WTO Dispute Settlement Cases

(April 1994 — March 1999)

No.of Appearances as Complainant		*No.of Appearances as Respondent*	
Member	*No.of Disputes*	*Member*	*No.of Disputes*
United States	54	United States	30
EC	43	EC	26
Canada	13	Japan	12
India	8	India	12
Mexico	7	Korea	10
Japan	7	Canada	9
Brazil	6	Brazil	8
Thailand	4	Argentina	8
New Zealand	4	Australia	6
Honduras	3	Indonesia	4
Guatemala	3	Turkey	4
Switzerland	3	Mexico	3
Argentina	2	Chile	3
Hungary	2	Ireland	3
Australia	2	Guatemala	2
Chile	2	Slovak Republic	2
Philippines	2	Belgium	2
Panama	2	Hungary	2
Korea	2	Greece	2
Uruguay	1	Pakistan	2
Sri Lanka	1	Philippines	2
Singapore	1	Sweden	1
Poland	1	Peru	1
Colombia	1	Thailand	1
Costa Rica	1	United Kingdom	1
Indonesia	1	Denmark	1
Ecuador	1	Czech Republic	1
Peru	1	Venezuela	1
Hong Kong	1	Poland	1
Pakistan	1	Portugal	1
Malaysia	1	Malaysia	1
Venezuela	1	Netherlands	1
Czech Republic	1	France	1
Memo items:			
G4	118	G4	90
Other OECD	22	Other OECD	27
Developing/Transition	43	Developing/Transition	47
Least Developed	0	Least Developed	0

Note: Excludes third parties.

(***Source:*** Bernard Hockman and Martin (Ed.), *Developing Countries and the WTO*, 2001, p.132)

Box 5.3

India Wins WTO Case Against EC

India has won a case against the European Union at the World Trade Organisation (WTO) involving special tariff concessions on textiles being given to Pakistan.

The EU was given this speical treatment on the ground that Pakistan is a beneficiary of a scheme for countries involved in combating drug production and trafficking.

The WTO has ruled that the European Commission has violated its obligations to the international body by granting tariff preferences to 12 countries, including Pakistan, under this special Drug Arrangements program.

The program comes under the EC's Generalised System of Perferences (GSP) scheme, which provides lower traiffs on imports, largely from developing countries to the EU.

The decision will come as a big relief to textile exporters in India who are competing against Pakistan in the European market. The EC's decision to include Pakistan in the drug arrangement scheme since January 2002 had upset Indian exporters who were faced with a significant tariff reduction being provided to textile goods produced in the neighbouring country.

The WTO's decision provides relief to Indian exporters to the EC who are otherwise disadvantaged due to duty concessions to Pakistan under the Drug Arrangements.

The dispute, in the first place, arose primarily because the EC included Pakistan as beneficiary under its Special Traiff Arrangement for combating Drug Production and Trafficking within the GSP schemen for the years 2002-04. Such a scheme was in operation even earlier but the beneficiaries were restricted to Andean and Central American countries. While the scheme, India's view, was not compatible with WTO rules, even then it had not taken up the issue at the world body as it was not significantly affected. The inclusion of Pakistan, as a beneficiary country since January 2002, changed the situation since Indian exports were directly affected. There are a number of export sectors such as clothing where the two countries are close competitors in the EC market.

(Source: *The Hindu*, April 8, 2004)

Table **5.3**

Doubts and Clarifications

Doubts	*Clarifications*
1. The WTO dictates policies	*Not true* The WTO does not tell the governments how to conduct their trade policies. Rather, it is a member-driven organisaiton. Decisions made at the WTO are based on consensus of members.
2. The WTO is for free trade at any cost.	*Not true* It is really a question of what countries are willing to bargain with each other. The role of the world body is to provide a forum for negotiating and implementing the tenets of liberalisation.
3. Commercial interests precede focus on environment	*Not true* Concern for environment is visible in many agreements reached at the WTO. Agreements also provide for efficient allocation of scarce resources. Sustainable development, protection of environment and efficient utilisation of resources are the primary objectives of the WTO

Doubts	*Clarifications*
4. Commercial interests overtake the develop mental needs	*Not true* The WTO believes that free trade promotes and not impedes economic development. Commerce and economic development supplement each other.
5. Interests of health and safety are compromised in favour of commercial interest	*Not true* Certain agreements (such as GATT Art. 20), allow governments to take actions to protect human animal or plant life and health. Some other agreements deal in greater detail with product standards, and with health and safety for food and other products made from animals and plants.
6. Jobs are destoryed and poverty worsened	*Not true* Trade helps promote economic ativities which in turn generate job opportunities which inturn reduce poverty. As a result of eight rounds of negotiations since 1948 (the year of origin of the world trade body), the average import tariff in the world came down from 40 per cent to 6 per cent. The annual value of goods and services traded across the globe is now 14 times more than what it was in 1948. These figures demonstrate the growth of trade and along with it jobs would have multiplied.
7. Small countries are becoming helpless	*Not true* Infact, small countries would become weaker without the WTO. The WTO has boosted their bargaining power. The fact that 75 per cent of the member countries are either poor or small nations shows how the WTO has been pro-small and pro-poor countries.
8. The WTO is the tool of power centres	*Not true* The WTO system offers govenments a means to reduce the influence of powerful lobbies. The 'round' type of negotiations and the decisions are the consequence of different interests being balanced.
9. Weaker countries are forced to join	*Not true* As told earlier, weaker counties would remain weaker by staying outside of the WTO. The principles of non-discrimination and transparency guarantee benefits to all member countries-small or large, poor or rich.
10. The WTO is undemocratic	*Not True* Decisions at the WTO are arrived on consensual basis. Consensus rule means every country has a voice, and every country needs to be pursuaded to join consensus.

IMPLICATIONS FOR INDIA

India was one of the 76 governments that became a member of the WTO on its first day. Divergent views have been expressed in support and against our country becoming a member of the WTO.

Arguments for Joining WTO

1. Ours is one of the few developing countries which has succeded in implementing liberalisation programmes. Over three-quarters of WTO members are developing countries in the process of economic reform from non-market systems. These countries have chosen to join WTO after careful deliberations in their respective countries. Obviously, they have perceived economic gains for themselves by becoming members. India should not be an exception.

   The criticism that the WTO exists only for industrialised countries is not all that valid. During the seven-year course of the Uruguay Round - between 1986 and 1993, over 60 developing countries implemented trade liberalisation programmes. Some did so as part of their accession negotiations to GATT while others acted on an autonomous basis. At the same time, developing countries and transition economies took a much more active and influential role in the Uruguay Round negotiations than in any previous round.

   Many developing countries have benefited by joining WTO. India is no exception.

   With the end of the Uruguay Round, developing countries showed themselves prepared to take on most of the obligations that are required of developed countries. They were, however, given transition periods to adjust to the more unfamiliar and difficult WTO provisions-particularly so far the poorest, 'least developed' countries. In addition, a ministerial decision on measures in favour of least-developed countries gives extra flexibility to those countries in implementing WTO agreements; calls for an acceleration in the implementation of market access concessions, affecting goods of export interest to those countries; and seeks increased technical assistance for them. Thus, the value to development of pursuing open market policies, based on WTO principles, is widely recognised and appreciated. So is the need for some flexibility with respect to the speed at which these policies are pursued.

2. The real importance of the WTO to India lies in the role that a dynamic export industry can play in the country's development. Both in terms of job creation, skill development and technological evolution, an opening up to the outside world is essential. The semi-autarkic earlier system resulted in a major leap forward in the development of indigenous industry and agriculture. But it lacked an internal dynamic. There were no incentives to improve technology and productivity. In short, it was a closed system that left no room for evolution. It is only by forcing industries to sell outside the country and compete for export markets that they will have an incentive to evolve.

   There is another reason why India needs to search for external markets. This is the crucial dependence on imports for survival. The country has for long believed that it is a self-sufficient, independent economy. But, infact, from petroleum and fertilizers to capital goods, raw materials and life saving drugs, the Indian economy is vitally dependent on imports. As long as it is dependent on imports, it needs to export to pay for these imports.

   As long as India needs to export and import, it makes far more sense to be part of the multilateral trading system than stay out of it. That is why even a country like China, despite its fiercely-guarded sovereignty and its status as the world's last major socialist power, has been desperatey trying to get into the WTO.

3. By being a member of the WTO, India can benefit from the International Trade Centre jointly operated by the WTO and the United Nations, the latter acting through UNCTAD (the UN Conference on Trade and Development). The International Trade Centre was earlier set up by GATT in 1964 at the request of the developing countries to help them promote their exports.

WTO membership confers India the advantage of using International Trade Centre.

The Centre responds to requests from developing countries for assistance in formulating and implementing export promotion programmes as well as import operations and techniques. It provides information and advice on export markets and marketing techniques, and assists in establishing export promotion and marketing services and training personnel required for these services. The Centre's help is freely available to the least-developed countries.

4. Estimates have been made by the World Bank, OECD and the GATT Secretariat, which show that the income effects of the implementation of the Uruguay Round package will add between 213 to 274 billion US dollars annually to world income. The GATT Secretariat's estimate of the overall trade impact is that the level of merchandise trade in goods will be higher by 745 billion US dollars in the year 2005, than it would otherwise have been. The GATT Secretariat further projects that the largest increases will be in the areas of clothing (60%), agriculture, forestry and fishery products (20%) and processed food and beverages (19%). Since India's existing and potential export competitiveness lies in these product groups, it is logical to believe that India will obtain large gains in these sectors. Assuming that India's market share in world exports improves from 0.5% to 1%, and that we are able to take advantage of the opportunities that are created, the trade gains may conservatively be placed at 2.7 billion US dollars extra exports per year. A more generous estimate will range from 3.5 to 7 billion US dollars worth of extra exports.

5. Another advantage of WTO membership stems from the fact that India (any member-country for that matter) is saved from entering into multiple bilateral trade negotiations with other countries. In the absence of WTO, India, for example, would be required to enter into as many bilateral agreements as the country desires to have trade links. With the WTO membership, our country has the advantage of having trade links with all other member countries without the need for bilateral agreements. The role of WTO is like that of a telephone exchange in this context.

India is saved from entering into multiple bilateral trade negotiations with other countries.

6. WTO provides for a multilateral set of rules which are beneficial to a country like ours. Such rules provide greater protection against bilateral pressures or against trade restrictions that cannot be justified under a multilaterally agreed framework. Further, the system of multilateral rules imparts greater predictability and stability to the international trading system. If the system of rules is not followed, the ensuring chaos and uncertainty will result in a trading system dominated by might rather than right[5].

7. There are several areas in the Uruguay Round package that relate to market access. The more important ones are tariffs, textiles and agriculture. India's position in all these sectors is advantageous to her and the provisions are favourable to the country.

Arguments Against Membership

Arguments against India's membership in WTO are equally strong. The major ones are stated below:

1. The claim that the world trade would increase substantially and that India's exports will expand considerably is not acceptable to many. The estimates relating to world trade (as shown above) may prove to be suspect. Flow of goods and services across the globe depends not much on trade restrictions but on factors like infrastructure, political environment, technology, assured supply of exportable goods and quality consciousness of producing countries. It may, be observed that India is short, to some extent, in all these requisites. Removal of trade barriers will not guarantee expansion in world trade.
2. India and other developing countries have blindly walked into the trap laid by the developed countries. WTO, alongwith IMF and World Bank, represents the interests of developed countries. Rhetoric and platitudes notwithstanding, WTO will not ensure open trade for goods produced by developing countries. It ensures necessary climate for domination and hegemonisation by the consortium of the capitalist countries. Infact, the Uruguay Round negotiations were motivated by the needs of the United States and Western Europe to discover new markets for their industries, especially in sectors like services and finance.
3. It is claimed that there are several areas in the Uruguay Round package that relate to market access and India would, therefore, gain substantially in the long run because of the market access. Figures demonstrating the gains from market access are no doubt praiseworthy. But the gains, if any, in tariff concessions or removal of quotas could easily be lost because of the new rules and disciplines and potential for trade harassment.
4. The worst fears expressed about the WTO agreement relate to the steep hike in prices of drugs and agricultural inputs. Table 5.4 shows how select drug prices will be costlier across the globe.

Box 5.4 gives the balance sheet of the WTO for India. Also read Table 5.3

Conclusion

All things considered, it may be concluded that the WTO membership will prove advantageous to us in terms of the global market thrown open to our goods and servics. To take advantage of the world market, we must improve the quality of our goods and services, cut down costs and wastages, and improve our competitive strength. Only then we will be in a stronger position to sell our products abroad and survive in the competitive global market.

AGENDA FOR THE NEXT MILLENNIUM

The agenda for the next millennium before the World Body is on the following lines:

1. Agricultural products.
2. Services.
3. Tariffs on industrial products.
4. TRIPS, textiles, and anti-dumping duties and subsidies.

Table 5.4

International Comparison of Selecte Drugs Prices

DRUG	INDIA	PAKISTAN	TIMES COST-LIER*	USA	TIMES COST-LIER*	UK	TIMES COST-LIER*
Anti-Bacterials							
Ofloxacin	73.03	151.26	2.07	192.39	2.63	178.77	2.45
Norfloxacin	33.61	161.94	4.82	613.77	18.26	290.88	8.65
Tobramycin	16.49	150.08	9.13	387.50	23.58	86.66	5.27
Anti-inflammatory							
Diclofenac	5.67	72.00	12.70	234.74	41.40	110.29	19.45
Anti-Ulcerants							
Ranitidine	30.03	336.00	11.57	729.93	25.14	553.88	19.08
Cardiovasculars							
Alenolol	7.86	111.78	14.22	223.85	28.48	118.78	15.11
Diltiazem	19.29	96.00	4.98	161.84	8.39	90.90	4.71
Anti-Viral/Fungal							
Ketaconazole	43.00	286.40	6.66	660.36	15.36	287.85	6.69
Anti-Histamine							
Aztemizole	6.00	156.00	26.00	427.74	71.29	115.14	19.19
Anti-Anxiolytics							
Buspirone	4.06	115.73	28.58	147.62	36.45	193.92	47.88
Anti-Cancer							
Mitoxantrone	446.26	N.A.		14876.65	33.34	9116.06	20.43
Vincristine	28.00	416.98	14.48	1047.26	36.36	624.79	21.69
Anti-Depressant							
Pluoxetine	29.00	798.40	27.53	507.60	17.50	647.21	22.32

Notes: 1. Prices are for 1991 and in rupees
2. *=Costlier over the Indian prices
3. Prices are for the same dosage and pack

(**Sources**: USA Prices-Annual Pharmacists Reference
UK Prices-UK Monthly Index for Medical Specialities (MIMS) December 1991
Pakistan Prices-Quarterly Index for Medical Pharmaceuticals (QIMP).)

5. New issues-foreign investment, competition policies, transparency in government procurement, e-commerce.
6. Non-trade issues-linkage between trade and environment, linkage between trade and labour.
7. Technology transfer.
8. Non-tariff barriers.
9. The issue of commodity prices. Lack of stability in commodity prices has been causing economic instability among many developing countries.
10. Review of existing policies relating to subsidies, anti-dumping measures and countervailing duties.
11. Trading blocks (covered latter in this chapter) need to be reviewed as they are creating problems of trade diversion.

REVIEW OF PERFORMANCE

During the last decade of its existence, the WTO has proved to be totally different from its predecessor-GATT. GATT was toothless but WTO has been armed with adequate power by the way disputes between trading countries have been settled. It

Box 5.5

Balance Sheet for India

Advantages

* Benefits from reduction of tariffs on the products of export interest to India.
* Improved prospects for agricultural exports as a result of likely increase in the world prices of agricultural products due to reduction in domestic subsidies and barriers to trade.
* Likely increase in the export of textiles and clothing due to the phasing out of the MFA by 2005.
* Advantages from greater security and predictability of the international trading system due to the revamped dispute settlement procedures, and the agreements on Safeguard, Subsidies and Anti-Dumping Measures.
* Compulsion imposed on us to be competitive in the world market.

Disadvantages

* Tariff reductions on goods of export interest to India are very small. On the other hand, there will be erosion of the preferences enjoyed by India and India will most probably be graduated out of the Generalised System of Preferences (GSP).
* Meagre prospects of increase in agricultural exports due to the very limited extent of agricultural liberalisation.
* There will be hardly any liberalisation of our textile exports during the next 10 years, with most of the liberalisation expected to come at the end of this period.
* We will be put under tremendous pressure to liberalise our services industries.
* There will be only marginal liberalisation to the movement of labour services in which we are competitive.
* We will lose policy options in several areas because of
  - The extensive bindings undertaken by us.
  - Prohibition of certain types of subsidies and making certain other types actionable.
  - Giving up the option of granting process patents only in some sectors.
  - Limitations put on our ability to apply restrictions on balance-of-payments ground.
* Increased outflow of foreign exchange due to commitments undertaken in the field of TRIPS, TRIMs and services.
* Technological dependence on foreign firms will increase as the R & D required to take advantage of the Uruguay Round may not be undertaken on an adequate scale due to paucity of resources.
* Concentration in market structure whereby only a few large firms or transnational corporations may benefit and smaller and tiny firms may disappear.
* Increasing intrusion in our sovereign domestic space in TRIPs, TRIMs, Services and Agriculture.
* The Uruguay Round has paved the way for similar other intrusions in future through linkages between trade and environment, trade and labour standards, and a new regime for the treatment of foreign capital.
* Trend towards neo-protectionism in developed countries against our exports.
* Possibility of cross-retaliation against our report of goods and services.

is to the credit of the WTO that even the mighty US was brought to book on more than one case. *Secondly*, GATT negotiating rounds took place once in a decade or so. But at Singapore, just two years after the conclusion of the Uruguay Round, the WTO virtually concluded an information technology agreement, and launched studies on investment, competition policy, transparency in government procurement and trade facilitation. *Thirdly*, the old leisurely pace of GATT is gone. Instead, there is enormous pressure to compress into the next few years what used to take decades to complete. *Fourthly*, the agenda of the WTO is expanding and the US is trying to push everything possible under the ambit of the WTO. This would facilitate smooth flow of trade across the globe. *Fifth*, the most favoured nation rule is advantageous to all member countries. This means that even when the US uses its muscle to take advantage of the Japanese market for beef and autoparts, the benefits are available not only to the US but for all members including India.

But at Singapore, just two years after the conclusion of the Uruguay Round WTO is a much improved organization than GATT. GATT had no teeth but WTO has.

Sixth, services trade is in place and many countries are opening their markets for trade and investment either unilaterally or through multilateral negotiations.

Finally, the Trade Policy Review Mechanism has created a process of continuous maintaining of trade policy developments thereby creating the process of liberalisation and reform.

WTO benefited, infact pro, developed countries.

There are shortfalls also which need to be taken note of. The WTO has benefited mainly the developed countries, leaving developing countries to fend for themselves. The multilateral trade policies are increasingly becoming a codification of the policies, perceptions, laws and regulations of the industrial countries. These are becoming norms and are made binding on developing countries. Consequently, the 'one-size-fits-all' approach is pushed down the throats of developing countries.

The gains to developing countries from the WTO did not match expectations. The implementation of some commitments was deliberately delayed and sidetracked. Many developing countries have confronted serious institutional and economic constraints in implementing some of the new WTO provisions. With the expansion of the agenda through the inclusion of very complex and slippery issues (such as services, intellectual property, technical barriers, and sanitary and phytosanitary standards), capacity of many developing countries to analyse and turn the analysis into sound negotiating positions is eroded. A proactive and constructive approach to new provisions is out of reach for developing countries because of resources and research capacity constraints.

Less said the better about the dispute settlement mechanism. Developing countries lack the expertise and resources to take advantage of the mechanism.

Experts talk highly about the dispute settlement procedure obtaining in the WTO. Though such a provision is an asset, it gives rise to a need to finance and develop expertise on international trade law in order to take full advantage of it. Given the level of technical expertise required, doubts have been raised about the capacity of developing countries to bring cases efficiently as complainants and to protect their interests as defendants. Even though some technical assistance is available from the WTO Secretariat, it is hardly available for developing countries.[6]

The agreement on GATS is regressive to say the least. It is argued that the rules of the agreement threaten public education, health, and environmental

services, outlaw universal service obligations and subsidised supply; and undermine effective domestic regulation.[7]

Thus, there are appreciations for and criticisms against the WTO. In conclusion it may be stated that the world body is not an international organisation intended to govern the global economy or international trade relations. It is a member-driven organisation and does perform some functions such as providing a forum for trade rule-making; fostering transparency in the trading system and enforcing rules through a dispute settlement system. The WTO needs to be accepted and respected as such.

However, liberalism is ultimately about freedom of choice, and nobody can argue that such freedom is expanded by bringing new items onto the WTO agenda and forcing these down unwilling throats under the threat of trade retaliation. The US argues that a multilateral agreement on investment will be good for developing countries, even those opposed to it, since it will make them more attractive for foreign investors. But the logic of this argument itself is that countries which fail to liberalise foreign investment rules will suffer anyway, so why subject them to further penalties through trade sanctions? WTO serves a major purpose as a rule-making body for trade liberalisation. It should not be expanded into a sort of world government covering every economic subject under the sun, and then using the threat of trade sanctions to bring about a new world order.

TRADING BLOCKS

Discussion on globlisation is incomplete without a reference to trading blocks that are dotting the world map. Table 5.5 gives the trading blocks, names of member countries and years of establishment.

Table **5.5**

Trading Blocks

Name of the trading block	*Member countries*	*Year of establishment*
1. EC (European Community)	Belgium, Denmark, France, Italy, Luxumberg, Netherlands, Portugal, Spain and the UK	1957
2. EFTA (European Free Trade Association)	Australia, Finland, Iceland, Liechten-Stein, Norway, Swedem and Swithzerland	1960
3. NAFTA (North American Free Trade Agreement)	US, Canada and Mexico	1989
4. LAIA (Latin American Integration Association)	Mexico, Paraguay, Peru, Uruguay, Venezuela	1980
5. MERCOSUR (Southern Cone Common Market)	Argentina, Brazil, Paraguay, Uruguay	1991

6. ANCOM (Andean Common Market)	Bolivia, Colombia, Ecuador, Peru, Venezuela	1969
7. CACM (Central American Common Market)	Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua	1960
8. CARICOM (Caribbean Common Market)	Antigua and Bermuda, Bahamas, Barbadas, Belize, Dominica, Geneda, Guyana, Jamaica, Montserrat, St.Kitts Nevis, St.Lucia, St.Vincent, Trinidad	1973
9. OECS (Organisation of Eastern Carribbean States)	Antigua and Bermuda, Dominica, Greneda, Montserrat, St.Kitts-Nevis, St.Lucia, St.Vincent, Grenadines and the Virgin Islands	1981
10. GCC (Gulf Co-operation Council)	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE	1981
11. ACM (Arab Common Market)	Egypt, Iraq, Jordan, Lebanon, Libya, Mauritania, Syria	1964
12. AMU (Arab Maghreb Union)	Algeria, Libya, Mauritania, Morocco, Tunisia	1989
13. SACU (Southern African Customs Union)	Boputhatswana, Botswana, Ciskei, Legotho, Namibia, S.Africa, Swaziland, Transkei, Venda	1969
14. ECOWAS (Economic Community of West African States)	Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo	1975
15. PTA (Preferential Trade Area for Eastern & Southern African States)	Burundi, Comoros, Djibouti, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Rwanda, Somalia, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe	1981
16. CEEAC (Economic	Burundi, Cameroon, Central African Republic, Chad, Congo,	1981

Community of Central African States)	Equatorial Guinea, Gabon, Rwanda, Sao Tome, Zaire	
17. CEAO (West African Economic Community)	Benin, Burkina Faso, Cote d'Ivorie, Mali, Mauritania, Niger, Senegal	1959
18. UDEAC (Economic and Customs and Union of Central Africa)	Comeron, Central African Republic, Chad, Congo, Equatorial Guiena, Gabon	1964
19. MRU (Mano River Union)	Guinea, Liberia, Sierra Leone	1973
20. ASEAN or AFTA (Association of South East Asian Nations)	Brunei, Indonesia, Malaysia, Phillippines, Singapore, Thailand	1967
21. BA (Bangkok Agreement)	Bangladesh, India, Laos, S.Korea, Sri Lanka	1976
22. ANZCERT (Australia-Newzealand Closer Economic Relations and Trade Agreement)	Australia, Newzealand	1983
23. SAPTA (South Asian Preferential Trading Agreements)	SAARC countries	1993

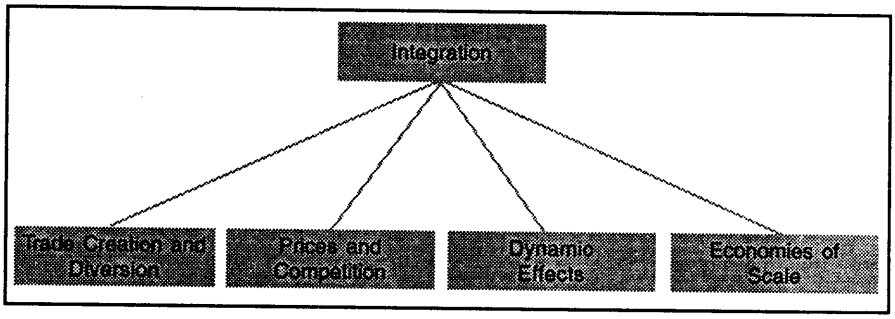
Trading blocks emerged because of the erstwhile GATT's failure in establishing an open world trade. Surprisingly, GATT is reborn as WTO with renewed enthusiasm and wider membership. It is only hoped that the interests of WTO and the trading blocks do not clash.

Impact of Trading Blocks

There are potential gains for member countries from trading blocks (See Fig.5.2).

Figure 5.2

Impact of Regional Groupings



Trade Creation and Trade Diversion

Trade creation occurs when, because of free trade, industries produce more and more goods at lesser cost. This adds to the trade. Trade barriers being removed, new opportunities for trade are created.

When trade barriers between countries are removed, industries in respective countries will concentrate on the most efficient use of resources and produce those goods that they are most efficient in producing. The result is that all participants will gain from trade. In addition, when tariffs and other barriers are removed between the members of a trading area, new opportunities for trade are created. This is because exports can now be sold or imports bought at more reasonable rates inside the trading block. The efficient exporter can sell surplus goods abroad, and the importer, instead of producing the goods inefficiently at home, can reallocate resources to more efficient production.

Trade diversion occurs when trade is diverted from countries outside the trading area to countries inside.

Trade diversion occurs when trade is diverted from countries outside the trading area to countries inside. This results from the removal of tariffs and other barriers in the trading area, making it cheaper or easier to export to or import from these countries. External countries will find it especially difficult to retain their export markets if the common external tariff is higher than the previous importing country's tariff. In such a case, trade diversion may not be beneficial as trade may be diverted from a more efficient producer outside the trading area to a less efficient one inside. Generally, there will be gainers and losers from trade diversion-the net gain or loss will depend on the particular circumstances.[8]

The entry of Spain into the European Union provides an interesting example of trade creation and diversion.[9] In 1986, Spain formally entered the European Union (EU) as a member. Prior to membership, Spain-like all non-members such as the US, Canada, and Japan-traded with the EU and suffered from the common external tariff imposed by the EU. Imports of agricultural products from Spain or US had the same tariff applied to their products, for example, 20 per cent. During this period, the US was a lower-cost producer of wheat compared to Spain. US exports to UN members may have cost $3.00 per bushel, plus a 20 per cent tariff of $60, for a total of $3.60 per bushel. If Spain at the same time produced wheat at $3.20 per bushel, plus a 20 per cent tariff of $0.64 for a total cost to EU customers of $3.84 per bushel, Spain's wheat was more expensive and therefore less competitive.

But when Spain joined the EU as a member, its products were no longer subject to the common external tariffs; Spain had become a member of the "Club" and

therefore enjoyed its benefits. Spain was the low-cost producer of wheat at $3.20 per bushel, compared to the price of $3.60 per bushel from the US. Trade flows changed as a result. The increased export of wheat and other products by Spain to the EU as a result of its membership is termed trade creation. The elimination of tariff literally created more trade between Spain and EU. At the same time, because the US is still outside the EU, its products suffer the higher price as a result of the tariff application. US exports to the EU fell. When the source of trading competitiveness is shifted in this manner from one country to another, it is termed trade diversion.

Prices and Competition

Trade barriers, when removed, will result in lower prices of products. Buyers can buy more at cheap rates.

The removal of trade barriers has both consumption and production effects. The production effect of removal of trade barriers has been explained above. The consumption effects are noticed on prices and consumer choice. When trade barriers come down, consumers can buy goods more cheaply. This applies not just to tariffs, where price is directly affected, but also to non-tariff barriers like customs formalities which raise the cost of selling goods across the borders. Similar arguments apply to consumer choice. Trade creation increases the availability of goods enabling the consumers to pick and choose.

The more relevant issue relates to competition. By removing barriers between national markets, trading blocks create competition. Generally speaking, the longer the trading area and the higher the level of integration, the more competition will be created. Competition benefits consumers immensely in the form of lower prices, wider choice, and better value for money. In addition, competition stimulates innovation, not only in the products themselves but also in the channels of distribution, methods of payment, customer areas, and so on.

Economies of Scale

Trading blocks necessitate huge volumes inuring in economies of scale.

Many industries, such as steel and automobiles, require large-scale production in order to obtain economies of scale in manufacturing. Obviously, industries of this type and others may not be economically viable in smaller, trade-protected countries. However, the formation of a trading block enlarges the market so that large-scale production is justified. The lower per unit cost resulting from scale economies may then be obtained. These lower production costs resulting from greater production for an enlarged market are called internal economies of scale.

In a common market, external economies of scale may also be present. Because a common market allows factors of production to flow freely across borders, the firm may now have access to cheaper capital, more skilled labour, or superior technology. These factors will improve the quality of the firm's product or service, or will lower costs, or both.[10]

Dynamic Effects of Integration

The term dynamic effects describes the continuous pressure for change that is a feature of an integrated competitive environment. Market forces act as a spur to improvements in efficiency, increase in investment, and continual innovation. A

new product or process may create a competitive advantage for a time, but before long, a competitor will introduce something better. The search for success is ongoing. The need to innovate promotes investment in new technology, new methods of production and distribution, and product design. This investment has a multiplier effect on the level of economic activity generally and stimulates further increases in production, income, and demand. Competition also increases the necessity to be efficient. Not only do competitive firms try to minimise their costs of production, they also seek to maximise the effective use of resources.

Trading blocks promote integration which in turn results in efficient allocation of resources, promotion of some businesses and development of new technology.

In general, the dynamic effect of integration is that it brings about a more efficient allocation of resources throughout the trading block, promoting the growth of some businesses and the decline of others, the development of new technology and products, and the elimination of old.[11] This process is creating a large-scale restructuring of industries and firms in the EU, with the relocation of industry and many cross-border mergers and alliances. Obviously, it can be painful process, but it is one, which generally improves the competitiveness of European companies.

Meanwhile, India is a member of two trading blocks, viz., BA and SAPTA, in addition to being the founder member of WTO. India, as was stated earlier, stands to gain through multilateral trading systems as represented by the WTO. Trading blocks, on the other hand, negate multilateral trading and hence are not desirable. India has, therefore, done strategic thinking by shunning the membership of major trading blocks.

QUESTIONS

1. Bring out the provisions of the Uruguay Final Act.
2. Bring out the arguments for and against India's membership of WTO.
3. Bring out the various trading blocks. Which benefits India most-bilateralism? Multilateralism? Discuss.

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CHAPTER 6

Technological Environment

CHAPTER OUTLINE

Main Features of Technology

Impact of Technology

- *Technology and Society*
- *Economic Effects of Technology*
- *Technology and Plant Level Changes*

Management of Technology

Status of Technology in India

- *Technology Policy*
- *Institutional and Other Facilities to Promote Science and Technology*

LEARNING OBJECTIVES

After reading this Chapter, you should be able to:

1. *Describe the features of technology*
2. *Analyse the impact of technology on society, economy and on an individual plant*
3. *Discuss the problems in managing technology*
4. *Describe the status of technology in India*
5. *Understand our policy towards technology*

Among all the segments of macro-environment, technological environment exerts considerable influence on business. This section is devoted to a detailed discussion of the interface between business and technology.

J.K.Galbraith defines technology as a 'systematic application of scientific or other organised knowledge to practical tasks'.

During the last 150 years, technology has developed substantially. Science and technology(see Box 6.1 for the difference between the two terms) enabled man to conquer distances; control birth rate; save lives; generate, preserve and distribute energy; discover new materials and substitutes to existing ones; introduce machines to do the work of human beings; substitute mental work with computers; probe deep into the seas and space in search of new treasures; provide himself with lot of leisure and comfort *ad infinitum*.

Technology helps convert ideas into useful products.

Box 6.1

Science and Technology-the Semantics

It is useful to place the two words-science and technology-in their proper perspective. It may be noted that the word 'science' refers to a systematised body of knowledge and when this knowledge is put into practice, it becomes technology.

There are similarities and dissimilarities between the two terms. With regard to similarity, it may be stated that the two are inter-dependent. Advances in science help develop new technologies while at the same time, the need for new technologies and products provide the drive for new scientific discoveries. The difference between science and technology may be brought out as follows:

	Features	Science	Technology
1.	In pursuit of	Knowledge	Socio-economic gains
2.	People involved	Scientists	Engineers
3.	Agencies involved	Research institutions and universities	Industrial establishments
4.	Funding	Mostly government	Industry
5.	Motivation	To satisfy curiosity	To bring out need satisfying products
6.	Domain	Public	Private/secret
7.	Impact	Discontinuous	Continuous
8.	Time span	Uncertain	Evolutionary

As years roll by, new discoveries have been added. 1983 was particularly considered by scientists as the year of scientific success. In this year, scientists put a billion dollar technology into space; produced the world's first test-tube triplets and obtained evidence of another solar system. In the field of medicine, Japan marketed the much-awaited artificial blood system. A major breakthrough was achieved in the field of genetic engineering to cure dwarfism. The US physicists stripped off all the electrons from the uranium atom thus exposing the bare nucleus.

It was also the year when the doctors were confronted with a baffling disease, *viz.*, AIDS (Acquired Immune Deficiency Syndrome) also named 'Gray Plague' that has taken a heavy toll of human lives.

The year 1998 belonged to nuclear scientists of India-they shook the world with serial underground nuclear blasts at Pokhran: resurrected a dead atomic rector in Rajasthan, and concluded negotiations with Russia on building a 2000-megawatt power station in Tamil Nadu.

Globally, the year witnessed an array of events: construction of an international space station, a lamb delivered by the world's first cloned sheep Dolly, the block-buster anti-impotency pill Viagra, teleportation and the discovery that a strange force is pushing the Universe apart.

We have left dusty footprints on the moon, created the Internet, and learnt how to read the human genome. The world of technology is not going to stop at this. The global economy could be on the cusp of an age of innovation equal to that of the past several decades. All the right factors are in place: Science is advancing rapidly, more countries are willing to devote resources to research and development and education. Table 6.1 contains some major innovations in the last couple of decades.

Table 6.1

Major Innovations

Business and Finance	*Information Technology*	*Health Care*
• Lean manufacturing	• Television	• Antibiotics
• Supply-chain management	• Transistors	• MRI and CT
• Big-box retailing	• Microprocessors	• Antidepressants
• Mutual funds	• Fiber optics and lasers	• Heart surgery and pacemakers
• Financial derivatives	• Internet	• Transplants
• Venture capital	• Cell phones	• Oral contraceptives
• Automated teller machines		• Minimally invasive surgery
• Credit cards		• Biotechnology

(***Source:*** *The Economic Times*, October 10, 2004)

Till now we have described the macro perspective of technology. At the micro level, technology refers to the level of sophistication with which a factory uses inputs such as labour, finance, machines and raw materials to produce output. Viewed from this perspective, technology may be compared to a black box (See Fig.6.1).[1] Several inputs enter the box on the one side and product Y comes out at the other side.

At the plant level technology refers to the set of machines, tools and other equipment used to convert inputs into outputs.

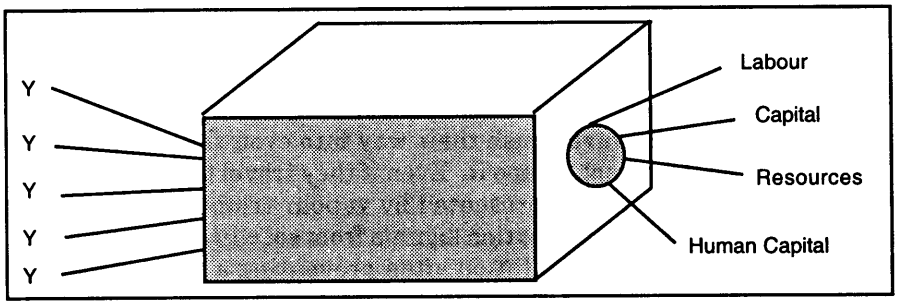


Figure 6.1

Black Box

In this chapter, we understand technology from both its macro and micro perspectives.

Technology is the most dramatic force shaping the destiny of people all over the world. Some of the technological inventions the man feels, are wonders, some others are horrors, and yet others have mixed blessings. Automobiles and television, for example, have evoked mixed reactions. Hydrogen bomb, nerve gas and submarine guns have proved to be horrors. Penicillin, open heart surgery and birth control pills are wonders.

Whether one is enthralled or appalled by a technological invention depends on one's attitude towards it.

FEATURES OF TECHNOLOGY

One feature of technology relates to its change.

Before we describe the impact of technology on business, we propose to bring out the salient features of technology. The first feature of technology is its change and then more change. Technology forces change on people whether they are prepared for it or not. In the modern society, it has brought so much change that it creates what is called *future shock*, which means that change comes so fast and furiously that it approaches the limits of human tolerance and people lose their ability to cope with it successfully.[2]

More ideas are being worked on, the time gap between idea and implementation is falling rapidly and the time between introduction and peak production is shortening considerably (See Box 6.2). Experts have estimated that 80 to 90 of all the scientists who ever lived are still alive today. Business leaders must always watch out for changes and developments taking place around. New developments must be adopted and new ideas explored lest the business units would perish at the earliest.

Box 6.2

Innovation time-from idea to successful product

Photography	112 Years
Telephone	85 Years
Steam engine	56 Years
Telegraphy	42 Years
Radar	18 Years
Transistor	5 Years
Fast logic	2 Years

The second feature of technology is that its effects are widespread.

Another feature of technology is that its effects are widespread, reaching far beyond the immediate point of technological impact. Technology ripples through society until every community is affected by it. The shock waves push their way into even the most isolated places. People cannot escape it. Even if they travel to remote places, as in Far East, technology is still represented by vapour trials from airplanes flying overhead, microwave communication signals from satellites moving at the speed of light and a haze from air pollution often preventing a view of the afar side.[3]

An additional feature of technology is that it is self-reinforcing. As stated by Alvin Toffler, *'Technology feeds on itself. Technology makes more technology possible'*. This self-reinforcing principle implies that technology acts as a multiplier to encourage its own faster development. It acts with other parts of society so that an invention in one place leads to a sequence of inventions in other places. Thus, invention of the wheel led rather quickly to a dozen or more applications. These applications, in turn, have affected 50 other parts of the system and led to several additional inventions that similarly influenced society as technology multiplies.

Third feature of technology is that it feeds on itself.

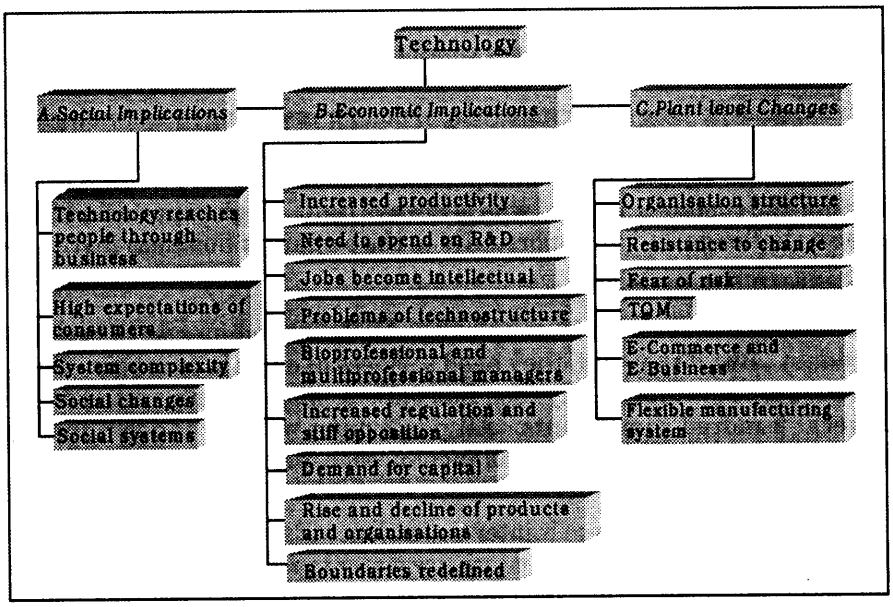
Finally, technology is a complex set of knowledge, ideas, and methods and is likely to be the result of a variety of activities-both internal and external. Technological process, obviously tends to be a gradual process consisting of a sequence of small increments lying along a continuous path.

IMPACT OF TECHNOLOGY

We propose to discuss the impact of technology under three heads: (a) technology and social change, (b) economic effects of technology, and (c) technology and plant level changes (See Fig.6.2).

Figure 6.2

Impact of Technology



A. Technology and Society

Perhaps the most striking influence of technology is found on society. Practically every area of social life and the life of every individual has been, in some sense or the other, changed by the developments in technology.

• *Technology Reaches People Through Business*

Business is an institution through which man expects new discoveries to be converted into goods and services. Managers of business organisations pool the necessary resources and work on the new discoveries to convert them into useful

products. New discoveries would remain mere ideas in mind, sketches on paper or mock models in laboratories but for business institutions.

People are using a great variety of goods and services thanks to technology.

Printing, housing, education and television are all dependent on business activities to make them work productively. Society depends on business to benefit from new discoveries flowing into useful goods and services for all mankind. Developing countries have learnt that scientific discoveries mean very little to them unless they have competent business units to produce for people what science has discovered. Developed countries have learnt that their progress stops unless they operate a business system which contributes to discovery and uses discovery to produce for their people.

That technology reaches people through business is only part of the story. The economic prosperity of a nation (of which business is a part) depends on technology. 50% of economic growth of USA, UK, Germany, France, and Japan has come from technical progress achieved in these countries.

• *High Expectations of Consumers*

People have high expectations. They want not more of same things but newer things as well.

Technology has contributed to the emergence of affluent societies. Affluent citizens want more of many things than more of same things. New varieties of products, superior in quality, free from pollution, more safe and more comfortable, are to be produced and supplied to the affluent sections. This calls for substantial investments in R & D. One important compulsion for investing in technological advances in Japan is its customer's high expectations regarding design sophistication, quality, delivery schedules and prices. Industry owners in Japan swear by the dictum-the customer is a god who is always right. High expectations of consumers pose a challenge and an opportunity to the owners of business institutions.

• *System Complexity*

Technology has resulted in complexity. Modern machines work better and faster, no doubt. But if they fail, they need services of experts to repair. They fail often because of their complexity (See Box 6.3). A machine or a system is composed of several hundred components. All parts must work in tandem to accomplish a desired task. Reliable performance of each part, therefore, assumes greater significance.

Technology creates complexity. As a result living becomes more complex.

Also there is inter-dependence of systems. Failure of power supply, for example, will cause dry water taps, closed petrol bunks, suspended elevators between floors, dark streets, dark houses, no television and radio broadcasts, closed retail establishments and so on. A localised problem in a power house balloons into a regional problem affecting thousands of people. It is possible that technology might eventually lead to simplicity and small independent operational units. Such a possibility still remains a distant dream. Meanwhile, more complexity in work and product systems is expected. Management is, therefore, under pressure to keep the whole system working all the time.

Box 6.3

Where technology failed

Despite the remarkable organisation, discipline and technology of Japan, the havoc that nature wrought in just 20 seconds at dawn on Tuesday continues to exact heavy damage. By Wednesday evening 40 hours after the '1995 Southern Hyogo prefectural earthquake' struck Kobe and its environs, the overnight toll had risen to 2,585 with over a thousand still missing, in one degree centrigrade nights, and nearly 10,000 injured. And 2,40,000 people are to spend another night in shelters.

But in an extraordinary feat, almost all fires that were raging and spreading till last night were either put out or contained.

The Hyogo earthquake came exactly one year after the Los Angeles earthquake. Japanese engineers went to California and claimed that structural damage of that magnitude was never possible in Japan. Fortunately, no Tsunamis (tidal waves) have occurred.

As the newspapers and experts lambasted the city fathers, in the areas of heavy damage, for lack of foresight in employing better technology to protect the infrastructure, on the ground what shone was that one single quality that sets the Japanese people apart. The so-called group spirit and respect for authority. The Chief Cabinet Secretary, Mr.Kozo Igarashi, told reporters today that provision of food and water was the Government's main concern because of the inability to reach all affected people. Not a single case of burglary in evacuated homes or shops has been reported. Not one case of blackmarketing of food or medicines has taken place. Eight lakh homes are without gas supplies. Within eight hours, 80,000, people heeded a call to move out of the homes into shelters to avoid possible consequences of gas leaks. All this has freed law and order officials to focus on more important rescue measures. Above all, the highly-organised garbage collection system in normal times has ensured that there is no likelihood of any epidemic. This too frees medical personnel to concentrate on healing the injured and those affected by it.

Every few hours the round-the-clock television channels broadcast the names and details of those dead. Centres have opened in Tokyo, where even international calls can be received enquiring about missing people. These enquiries are broadcast over the Osaka radio channel.

But, all that said, the public is asking a lot of questions. Several times each year in most towns and cities an 'earthquake van' simulates various magnitudes of earthquakes for the public to experience. Nearly all homes are equipped with emergency kits for three-day self sustained survival. 'The rest of it,' says the Government, 'leave it to us.' But viewing the terrible damage to the Hanshin expressway, the collapsed railway stations and main infrastructure commentators have taken engineers and planners to task for making the excuse that upgrading of highways was not done because 'a quake here was not expected.' NHK TV said 'the myth of the invincibility of Japanese expressways has been shattered' as the highways have been uprooted from their foundations at several places, thus considerably reducing the efficiency of relief measures. Even bridges over which bullet trains pass have had pillars destroyed, severing the main national transport artery.

The entire planning and philosophy of Japan's anti-earthquake measures is under question. Annually, the country spends more than $100 million on damage prevention. In Japan, the focus is on heavy expenditure on building construction in the hope that there will be no damage while the Americans focus on relief. Japan has concentrated on earthquake early warnings and preventive measures, not so much on post-disaster relief and its efficiency. Whatever the reason, perhaps the lateral proximity of the epicentre area and the shallow epicentre of 20 km, the fact is that the transport infrastructure has failed.

Kobe has very large sections of land fill area. Engineers now say that in such places with weak foundations modern 'shock absorption' foundation constructions are not possible. But in this quake, as many as one-third of concrete buildings with such technology have fallen. Though libraries could not provide diagrams, the fundamental design implementation of these tall buildings has revolutionised technology.

(Source: The Hindu, Jan.19, 1995)

• Social Change

Most dramatic effect of technology is felt on social life. Thousands of workers find that the jobs they have been engaged till now become irrelevant. They have to cope with new skills and new jobs.

The role of technology on social change may be observed in more than one way. *First*, there is the change in social life which results from a change in a technological process. Thus, an invention may destroy the economic basis of a city; displace thousands of workers; yet the same invention may result in the creation of a new city somewhere else and create even more jobs than it originally destroyed. Technological changes of this sort create a constant turmoil in society, with socially uprooted, mobile populations drifting about in search of new centres of employment. Sometimes, this drifting may result in a new geographical distribution of population; an example is provided by the constant drift of population centres of electronic or aerospace industries.[4]

Secondly, besides uprooting population, technology directly changes the patterns of their social life, for instance, the family, the sensitive recorder of all types of change, alters with technological development. An invention may open new employment opportunities to women, radically change hours spent at work and in the family, increase available leisure time, open jobs to youth, and deny them to middle aged or old workers. Technological development may basically change the stratificational system of a community. Skilled jobs, carrying great prestige, may be destroyed. Jobs maybe opened to members of discriminated and low-ranking or racial groups. Technological advancement tends to smoothen out social differences, if strategically targeted at the potential workforce. Industrial technology tends to iron out differences between the two sexes and between parents and children in a family.

Thirdly, though social differences tend to be ironed out, status differences are likely to be created by technological advancement in developing countries. Technology flows to less developed countries mainly through multinational companies. With vast resources at their command, multinational corporations

(MNCs) have carved out places and images for themselves distinct from local companies. Along with the MNCs, people associated with them directly or indirectly behave like a class apart by themselves. Such people are better paid than their counterparts in local companies. With higher incomes, the standard of living enjoyed by these people is fairly high. They form exclusive clubs and are culturally more at home with the industrial West. Infact, the cultural integration of these neo-rich people with the industrial West is so complete that they read the same books, see the same films and TV programmes, have similar fashions, similar groups or organisations of family and social life, similar styles of decorating the home, building furniture and urban designs. Despite linguistic barriers, they have a far greater capacity for communication among themselves than is possible between illiterate and managerial persons in the same country speaking the same language. This international community, which has similar patterns of consumption, must have similar patterns of income as well.[5] In India, the employees in foreign collaborations are paid much more than they are paid in other local Indian companies, though they do the same job in the same field.

Technology helps iron out social differences but has created status differences instead.

Finally, the way we cook, communicate, use media and work are affected by technology. Even the language we use is changing: terms that until recently were not even part of our lexicon such as superconductivity, computer engineering, robotics, unmanned factories, miracle drugs, space communications, lasers, fibre optics, satellite networks, e-business, and electronic funds transfer have become common place. New terms continue to emerge as new products are introduced or improved-always with the anticipation that there will be a newer, faster, and better innovation in the market any day. Social changes are also reflected in our vocabularies. Words like *telecommunicating, house-husband, surrogate mother and domestic partner* all represent changes in society. It is, therefore, rightly said that the words are the bugles of social change. When our language changes, behavior will not be far behind.

• Technological Phases and the Social Systems they Create

Technology has brought, along with it, new words, new food, dress and food habits.

Commencing from the later part of the 17th century till the end of 20th century, five sages of technological development can be traced, as shown in Fig.6.3. Each stage leaves a distinct influence on work and on the social system. In history, nations have tended to move sequentially through each phase, beginning with the lowest technology and moving higher with each step, so that the five stages of technology roughly represent the progress of civilisation throughout history. Although one phase of technology tends to dominate a nation's activities at a particular time, other phases often will be practised at the same time.[6]

Of particular interest is the knowledge level of technology. At this level, technology creates a distinct type of social system, *viz.*, knowledge society. In knowledge society, use and transfer of knowledge and information, rather than manual skill, dominates work and employs the largest portion of labour force.

In the knowledge society, the relationship between the knowledge worker and the organisation will be strange and amorphous, redefining itself all the time.The knowledge-worker will have to show why he should be retained, what benefit he

Figure **6.3**

Phases in Development of Technology

Technology Level	*Phases in the Development of Technology*	*Approximate Period of Dominance*	*Activity*	*Primary Skill Used*
1	Nomadic-Agrarian	Until 1650	Harvests	Manual
2	Agrarian	1650-1900	Plants and harvests	Manual
3	Industrial	1900-1960	Builds material goods	Manual and machine
4	Service	1960-1975	Focuses on providing services	Manual and intellectual
5	Knowledge	1975-1990s	Abstractive work	Intellectual and electronic

(**Source**: Adopted from *Business and Society*, by William C.Frederick, et al, p.436).

Note: The approximate periods of dominance apply to the US. But the stages, their activities and the skills used are general and are applicable to any country.

can offer to the organisation, and how he can add value to whatever the organisation does. He will have to create new jobs in consultation with his employer. A job will then become a joint venture. When this happens, the worker can forget pension plans.

B.Technology and Economy

• *Increased Productivity*

Technology has contributed to increased productivity.

The most fundamental effect of technology is greater productivity in terms of both quality and quantity. This is the main reason why technology at all levels is adopted. In a hospital the objective may be qualitative, such as maintaining life with electronic monitoring equipment regardless of costs. In a factory, the objective may be quantitative in terms of more production at less cost.

Modern factories are now able to produce goods in a shorter period of time (to produce one car takes less than 10 seconds) and with fewer defects thanks to the introduction of "Six-Sigma" quality programmes. These programmes are designed to increase quality and to eliminate defects, thus enabling firms to compete in any international market. Six Sigma is a statistical term that means 3.5 errors per million, effectively eliminating performance problems and ensuring that products conform to standards. As a result of such programmes, Nokia has been able to dominate the international cellular telephone business and HP has become the world-leader in printers.

As a result of productivity improvements, real wages of employees tend to rise and prices of some products decline, which spreads the beneficial economic effects of technology throughout the whole social system. The result is that employees and citizens are motivated to want more technological advancement, thereby placing on business major responsibilities to introduce it with due concern for its social and environmental effects.

• Need to Spend on R & D

Research and Development (R&D) assumes considerable relevance in organisations as technology advances. In this context, firms are required to consider, decide and take action on atleast seven issues. *First,* is the allocation of resources to R & D. A company must make the required resources available for effective R & D. A company's R & D intensity (its spending on R & D as a percentage of sales revenue) is a principal means of gaining market share in global competition[7]. Besides, consistence in resource allocation to R & D across lines of business improves corporate performance by enabling the firm to better develop synergies among product lines and business units.

We spend very less on R & D. As percentage on GNP, our normal spending on R & D is less than one percent as shown in Table 6.2.

1980-81	0.62
1985-86	0.89
1987-88	0.98
1989-90	0.94
1990-91	0.89
2002-03	1.00

Table 6.2

National spending as percentage on GNP

In contrast, UK spends more than 2%, Japan 1.96% and US 2.3%. In terms of absolute figures, these sums work out to be staggering because GNPs of these countries themselves run into astronomical figures.

But sectorwise, spending on R&D has been impressive as Table 6.3 indicates.

Table 6.3 contains names of firms engaged in pharmaculticals. At the top is Dr.Reddy's Laboratories which spent 12 per cent of its net sales on R&D in 2003. This spending has been necessitated because the company is focusing on research on new molecules. Glenmark, Torrent, Sun, Wockhardt, and others follow Reddy's Laboratories.

Sector Rank	*Company*	*%R&D Spend*
1	Dr.Reddy's Laboratories	12
2	Glenmark Pharmaceuticals	10
3	Torrent Pharmaceuticals	9
4	Sun Pharmaceuticals Industries	7
5	Wockhardt	6
6	Panacea Biotech	6
7	Cadila Healthcare	6
8	Ranboxy Laborateries	5
9	Biocon	5
10	Pfizer	4

Table 6.3

Spending on R&D by Select Firms

(**Source**: *The Economic Times 500,* Dec. 2004, p.36).

A noticeable trend is that the Indian arms of the multinationals have a much smaller R&D expenditure, compared to their Indian counterparts. This is because their parent companies do their research and the Indian subsidiary simply markets the products. Pfizer is the only exception, investing over 4% of its revenue on research in India. There have been quite a few successes in the Indian research labs. To date, India has already generated over 35 lead molecules, of which nine are undergoing clinical trials. Ranbaxy developed a superior delivery system for ciprofloxacin, which was licinsed to Bayer, the innovator, for global use.

This was not always so. Earlier, when only process patents were recognised, the R&D expenditure was virtually negligible. Indian companies were focussed on the domestic markets and could simply imitate the original innovator. They did not feel the need to spend on research.

Secondly, technology transfer, the process of taking new technology from the laboratory to the market place is equally important. This transfer takes larger time as organisations grow in size. The US based chemical giant Du Pont has long been known for its excellence in basic corporate research. In the early 1990s, for example, it led US chemical companies in patents applied for and granted. The company spent more than $13 billion on chemical and related research during the 1980s but the management admitted that the company failed to develop much in the way of major innovations.

Thirdly, time factor is important in R & D. The time between innovation and commercialisation is getting considerably reduced as shown in Box 6.2.

Companies can no longer assume that competitors will allow them the time needed to recoup their investment. Time to market, therefore, is an important consideration because 60% of successful potential innovations are imitated within four years at 65% of the cost of innovation. In the 1980s, Japanese auto manufacturers gained incredible competitive advantage over US manufacturers by reducing new products' time to market to only three years. US auto companies needed five years.

Technological discontinuity-old replaced by new-is another dimension the businessman needs to keep in mind.

Fourthly, as new technology comes in, the old technology needs to be abandoned. The process of old replaced by new is called *technological discontinuity*. Such discontinuity occurs when a new technology cannot be used simply to enhance the current technology but actually substitutes for that technology to yield better performance. The R & D manager must determine when to abandon present technology and then to develop or adapt new technology.

Fifthly, the firm must also decide on its own R & D or to outsource technology. The make or buy decision can be important to a company's R & D. Although in-house R & D has been traditionally an important source of technical knowledge for companies, firms can also tap the R & D capabilities of competitors, suppliers and other organisations through contractual agreements such as licensing, R & D agreements and joint ventures. When product life cycles were longer, a company was more likely to choose its own R & D, not only because it gave the firm a longer lead time before competitors imitated it, but also because it

Technology can either be outsourced or developed through in-house R&D.

was more profitable in the long run. In today's world of shorter life cycles and global competition, a company may no longer have the luxury of waiting to reap a long-term profit. As a rule, it may be stated that a company should buy technologies that are commonly available but make (and protect) those that are rare, valuable, hard to imitate, and have no close substitutes. In addition, outsourcing technology may be appropriate when[8]—

- The technology is of little significance to competitive advantages;
- The supplier has proprietary technology;
- The supplier's technology is better and/or cheaper and reasonably easy to integrate into the current system;
- The technology development process requires special expertise; and
- The technology development process requires new people and new resources.

The *sixth* issue relates to the decision on product innovation or process innovation. In the early stages, product innovations are most important because the product's physical attributes and capabilities affect financial performance considerably. Later, process innovations such as improved manufacturing facilities, increasing product quality and faster distribution become important in maintaining the product's economic returns.German and Japanese firms have been most successful in process innovations as shown in Table 6.4.

Table **6.4**

Spending on Product and Process Innovations

	Product	*Process*
Germany	50%	50%
Japan	30%	70%
US	70%	30%

(**Source**: M.Robert, "Market Fragmentation Versus Market Segmentation", *Journal of Business Strategy*, Oct, 1992, P.52)

Finally, in the days to come, organisations will be required to spend vast sums of money on R & D in the area of bio-technology. Japanese are ahead of other countries in this emerging area. In simple terms, bio-technology has been understood as the application of scientific and engineering principles to the processing of materials by biological agents to provide goods and services.

Organisations will be required to spend vast sums on R&D.

Though the amount required is enormous, bio-technology offers a wide range of opportunities to the industry as shown in Fig.6.4. It is upto the organisations to seize the opportunities and exploit them to their advantage.

• Jobs Tend to Become More Intellectual

With the advent of technology, jobs tend to become more intellectual or upgraded. A job hitherto handled by an illiterate and unskilled worker now requires the services of an educated and competent worker. A clerical post in an office now demands the services of an expert in computers. Fig.6.5 demonstrates the change in the type of labour now required to work on machines.

Advanced technology needs employees who are knowledgeable and skilled.

Figure 6.4

Industrial Opportunities in Bio-Technology

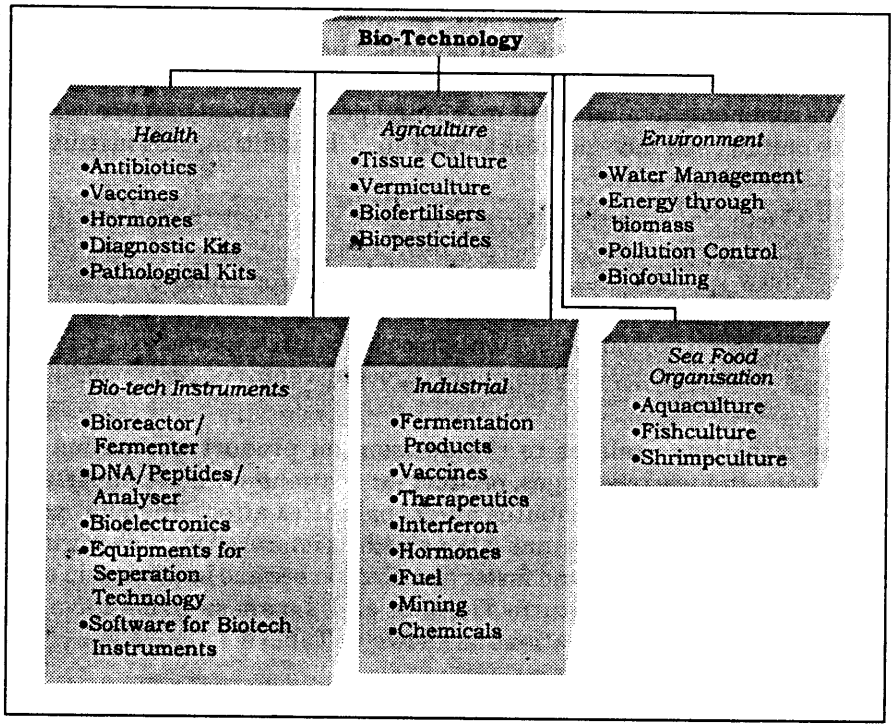
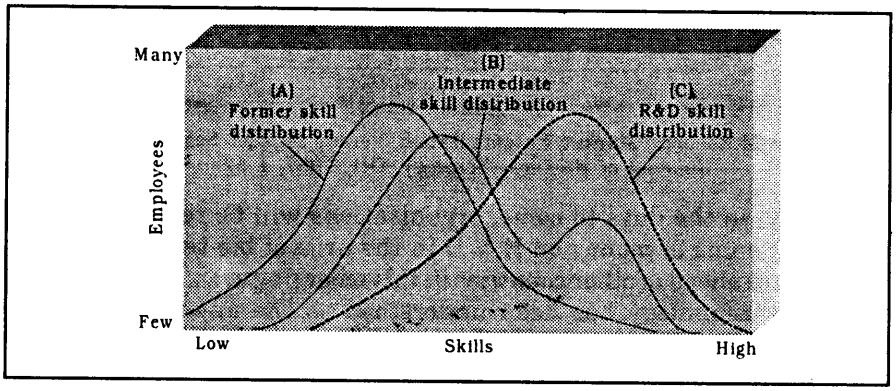


Figure 6.5

Changes in the Skill Distribution in Business Required by Advances in Technology



Decades ago, the typical factory had a range of skills resembling curve A. This curve was shaped like the normal curve of intelligence among people. Being matched to people, it suggested that an adequate supply of labour would be available at all levels of business in the long-run. In modern business, the curve has moved towards the right, higher in skill, as shown in curve B. And in many organisations, the skill distribution has become bi-model, as shown by the second top on the curve. Many scientific and professional people are required in research, development, planning and other specialised work, creating the secondary bulge towards the skills' end of the scale.

Curve C represents the skill distribution which is developing in firms oriented towards research and development. Though these firms manufacture products for

sale, much of their effort is devoted to development and building prototypes. In some of these, the number of engineers, scientists, college graduates and specialists exceeds the total number of other employees.

Introduction of new technology dislocates some workers unless they are well-equipped to work on new machines. This makes it obligatory on the part of business houses to retrain its employees and to rehabilitate those displaced and untrainable. Equal is the responsibility of the government to provide training and educational facilities to its citizens. Government and businessmen should boldly demonstrate and convince the people that economic growth is more an insurance against unemployment than opposition to technological advancement.

But for those who pick up and acquaint themselves with the new technology, the job will be rewarding. The new job will be more challenging and rewarding. Working class, in general, stands to gain through increased productivity, reduced prices and increased real wages-all by-products of technological advancement.

Along with upgrading jobs, technology has its impact on human relations. Technology lays down the requirements for much of the human interaction in organisations. The arrangement of a production set-up determines who will be near whom. The work flow determines who needs to talk to whom. And since interaction and activity affect sentiments, technology indirectly determines what individuals in large groups will feel and think about one another and about their work situation.[9]

• *Problem of Technostructure*

Technostructure creates new problems
- traditional incentives fail to motivate
- retention is a problem
- difficulty in placing people in a pattern

Not only jobs become more intellectual, even the incumbents tend to become highly professional and knowledgeable. An organisation which has adopted the latest technology is flush with scientists, engineers, college graduates and highly skilled workers on its payroll. Though such an organisation can boast of a progressive and modern outlook of its personnel complement, the problems such an enterprise has to face on this account are serious, to say the least. Motivation of such employees, for instance, is a difficult task. Such mundane incentives as attractive remuneration, job security and just treatment, hardly inspire the enlightened employees to work more. They are instead motivated by opportunities which offer challenges or growth and achievement. *Secondly*, retaining such employees for long is a difficult job. Being cosmopolitan in their outlook, these professional employees are known for organisational rootlessness and job-hopping. Flighting and not sticking to one company is their culture. The company has to make several exceptions to discourage rootlessness of its professionalised employees. Regular attendance and punctuality have to be relaxed; dual promotion ladders have to be established so that distinguished technical people can rise in rank; profit-sharing to be provided to give creative persons a financial stake in the ideas they create; attendance at professional get-togethers has to be sponsored; writing professional articles has to be encouraged; and special assignments and part-time teaching may be allowed. *Thirdly*, scientific and professional workers constitute, what Galbraith calls, the *technostructure* of a modern organisation. The technostructure tries to control the organisation through influencing management's decision-making. While there may be nothing

wrong in making decisions prompted by the technostructure, the problem lies in the social effect that is involved. People constituting technostructure are experts, no doubt. But they are more action-oriented and are yet to learn social problems of business decisions. Management is, therefore, in a tight position to balance the ruffled feelings of technocrats and the social consequences of business decisions.

The presence of technicians is not confined to the precincts of an industrial establishment, the influence goes beyond and covers the entire gamut of the society. The social values change to productivity, rationality and efficiency when the society gets dominated by technicians. Social institutions may be reconstructed or even eliminated. Family, for instance, might prove an anachronism as family loyalties might well interfere with rationality and job efficiency. Procreative functions might be according to the laws of eugenics, breaking the age-old barriers of inbreeding. Education could be made a purely pragmatic institution, devoted to scientific and technical disciplines. Most significant is the fact that scientists and technicians are and will continue to be the keymen in our civilisation.

• Need for Bioprofessional and Multiprofessional Managers

Technocrats, who assume reins of administration, need to be qualified in management education in addition to the proficiency they have acquired in the chosen fields of specialisation. Today's business needs bioprofessional and multiprofessional managers. To fill up a factory manager's post, for instance, the desired qualification stipulated is a degree in engineering and MBA from a recognised institution. The need for managers well-versed in different fields of knowledge is greatly felt now than ever before. Technological advancement has made the business more complex and its management more demanding.

Business and government must, therefore, spend more and more on spreading knowledge on know-how (technology) and do-how (management). Such a task is expensive but technology's greater productivity eases the burden of costly education and the training it requires.

• Increased Regulation and Stiff Opposition

Technology, no doubt, helps a lot but invites opposition and regulation.

A by-product of technological advancement is the ever-increasing regulation imposed on business by the government of the land and stiff opposition from the public. The Government has the powers to investigate and ban products that are directly harmful or hurt the sentiments of a section of society. Import of animal tallow has been banned by the Government of India because the alleged mixture of tallow with vanaspati oil hurt the feelings of Hindus. Continuous struggle launched by the FMRAI (Federation of Medical Representatives of India) produced gainful results like banning the sale of harmful drugs and banning of sales promotion and advertisement of infant formula through the mass media.

Technological advancement is inviting opposition from those who fear that new innovations are a threat to ecology, privacy, simplicity and even the human race. These people oppose the construction of high-rise buildings, location of industrial plants that eject harmful effluents, and setting up of hydroelectric plants. As the production process becomes more complex and products assume greater sophistication, public have to be assured of their (products) safety, their minimal

propensity to cause pollution and their least threat to happiness and well-being of the human race.

The public must be enlightened that technology is not always uni-directional in its effects. It can be corrective as well as curative. Technology has created antibiotics which give rise to side effects. The same technology has also shown remedial measures for the side effects. Again, technology causes pollution, but it can also be used to check pollution caused by it and by human beings. Technology does contribute to urban blight, but it can also be used to beautify the city and make it more comfortable and enjoyable for the people to live in.

• *Insatiable Demand for Capital*

Technology demands huge investment of capital.

Today's technology necessitates massive investment of money on acquiring or discovering of new ideas and their adoption; educating, training and maintaining of the managers and the managed and on several other related areas. In fact, today's technology is characterised by its insatiable demand for capital. Business organisations should not only raise huge funds, exploiting all ways and means, but the mobilised funds must be judiciously employed for gainful purposes. This calls for honest and efficient financial management. Qualified and competent people must be appointed to assume responsibility for financial management and should be given due place in the hierarchy of an organisation.

• *Rise and Decline of Products and Organisations*

Product has a life cycle of its own.

Change of technology, therefore, is a norm and not an exception. This poses another problem to business. A new technology may spawn a major industry but it may also destroy an existing one. Transitors, for example, hurt the vacuum-tube industry and xerography hurt the carbon-paper business. Television affected the business of radio broadcasting companies and movies and synthetic fibres reduced the demand for cotton fabrics. It is for this reason that Schumpeter saw technology as a force for '*creative destruction*.' And it is precisely for the same reason that the saying, '*Today's growth product is tomorrow's earthen pot*', becomes relevant. Products, like mortals, have life-cycles. A typical product, today, is subject to a cycle: introduction, growth, maturity, decline and abandonment.

So also an organization.

An organisation that is associated with a particular technology is influenced by it and will have the same life pattern as of the technology. Such an organisation will go in sequence through the introductory, growth, maturity and decline phases. The life of such an organisation may be composed of the following stages: (i) birth, (ii) growth, (iii) policy, (iv) procedure, (v) theory, (vi) religion, (vii) ritual, and (viii) last rites. In this eight-step sequence, an organisation is born and then has its growth. Policies are developed to guide decisions, and these are carried out through procedures. These procedures are refined and made more efficient with theories about efficiency. In time, the organisation may develop characteristics of a religion, it may worship the way it does things. Performance is by ritual; things are done by habit without questioning. The death and last rites of the organisation will ordinarily follow.[10]

• Business Boundaries Redefined

- Technological change is a potent force in the reconfiguring of industry boundaries, it may broaden or narrow generally accepted industry boundaries. For example, advances in information technologies have rendered old conceptions of the financial services industry obsolete: insurance firms, banks and brokerage houses can now all be interconnected to provide new financial services, thus blurring long-held distinctions among the services offered by these industries.
- As a consequence of its impact on whole industries, technological change can have a significant impact on the prevailing business definition of individual companies. Companies may find themselves in a different business due to technological changes that they or others have effected. For example, Xerox (in the US) landed itself in such position in its copier business, thanks to the success of Japanese firms in miniaturising products. Because Japanese firms introduced smaller-sized copiers, Xerox found itself selling to different customers with different needs through different distribution channels and competing for different bases (price was much more important).

Definitions of individual businesses undergoes a change.

- Technological change is one of the important factors giving rise to product substitution and product differentiation. For example, plastics have replaced many uses of steel, and microwave ovens are now frequently substituted for conventional ovens. Similarly in videotape recorders, companies have sought to differentiate their products through the introduction of technologically based features; longer recording time, longer recording time setting, sharper picture reproduction, clearer sound and so on.

Product substitution and product differentiation are the by-products of technology.

The above examples suggest that technological change is a dominant force in shaping competitive dynamics in many industries. It influences industry boundaries and structure, product substitution and differentiation, and the price and quality relationships between products.

- Technological change in the form of process (as opposed to product) and materials innovations may contribute to many of the impacts noted above. For example, process innovations such as automation, robotics and CAD/CAM have bestowed cost and quality advantages on many companies. Japanese automobile manufacturers have gained a significant competitive edge on their rivals elsewhere through the adroit use of this form of technological change.
- Finally, for multi-product companies (preceding discussion applies to single-business units), technological change may have multiple impacts. For example, technological change can create new synergies across businesses or obsolete existing ones. Advances in telecommunications and computer technologies have made new synergies possible across business dealing with computers, television sets and communications.[11]

C. Plant Level Implications

• Technology and Organisation Structure

Technology has considerable influence on organisation structure, length of the line of command, and span of control of the chief executive. Where companies use technology which is fast changing, *matrix structures* are more common. Some companies use a matrix even though the rate of technological change is not fast. Besides technology, other factors which have their influence on organisation structure are history and background of a company and the personalities of the people who founded the firm and managed it subsequently but the impact of technology is considerable.

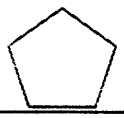
Technology has considerable influence on organization structure.

In this context, three types of technology may be distinguished: small batch technology, mass production technology, and continuous-process technology. Each of these types has its impact on levels of hierarchy, span of control, ratio of managers to non-managers, shape of organisation, type of structure and cost of operation (See Fig.6.6).

Figure 6.6

Technical Complexity and Organisational Structure

Low Technical Complexity High

Structural Characteristics	*Small – Batch Technology*	*Mass Production Technology*	*Continuous Process Technology*
Level in the hierarchy	3	4	6
Span of control of CEO	4	7	10
Span of control of first line supervisor	23	48	15
Ratio of managers to nonmanagers	1 to 23	1 to 16	1 to 8
Approximate shape of organization			
	Relatively flat, with narrow span of control	*Relatively tall, with wide span of control*	*Very tall, with very narrow span of control*
Type of structure	Organic	Mechanistic	Organic
Cost of operation	High	Medium	Low

(***Source:*** Gareth R.Jones, *Organisational Theory*, p.274)

Organisations that employ *small batch technology* make one-of-a-kind, customised products or small quantities of products. Furniture maker is an example for this type of technology. An organisation that uses small-batch technology needs to give people the freedom to make their own decisions quickly so that they can respond to customer's needs fast and produce what they want. For this reason, such an organisation has relatively flat structurise (three levels), and decision

making is decentralised to small teams where managers have a relatively small span of control (23 employees). The most appropriate structure for small-batch technology is an organic structure in which managers and employees work closely to coordinate their activities to meet changing work demands. Small-batch technology is relatively expensive to operate because the work process is unpredictable and the production of made-to-order products makes production planning difficult.

Organisations with *mass production technology* produce large volumes of standardised products such as cars, razor blades, and soft drinks. Here machines control the work process. The use of machines allows tasks to be specified and programmed in advance. As a result, work activities are standardised, and the production process is highly controllable. Organisations with mass production technology have four levels of hierarchy, have span of control of seven each, have mechanistic structures and costs of operation are moderate.

Organisations with *continuous-process technology* produce continuously with little variation in output. In an oil refinery, for example, (an industry where continuous-process technology is employed) crude oil brought continuously to the refinery by tankers flows through pipes to cracking towers where its individual component chemicals are extracted and sent to other parts of the refinery for further refinement. Final products such as gasoline, fuel oil, benzene and tar leave the plant in tankers to be shipped to customers. Workers in a refinery or in a chemical plant rarely see what they are producing.

Organisations that employ continuous-process technology have six levels of hierarchy, have organic structures and costs of operation tend to be low.[12]

Technology has its impact on other areas of an organisation. Any technological advancement will result in (a) the expanded availability of a range of products and services; (b) substitution of capital for labour, leading to higher productivity and lower costs; (c) increases in sales or power for the innovating organisation relative to its competitors; (d) initiation of changes in behaviour among customers, suppliers, employees, or society; and (e) side effects on the quality of physical environment.

• *Fear of Risk*

There is always the fear of risk. Take the case of DuPont's Corfam, an intended substitute for the forecasted shortage of shoe leather. After an investment of $300 million, the company abandoned the project in 1971 because of quality and cost problems. Even a research-oriented company like DuPont, which was responsible for adding totally new dimensions to the textile industry with its introduction of synthetic fibres begining in 1939, was unable to manage technology without great risks and some subsequent failures.

• *Resistance to change*

The manager of a given business unit shall face resistance to change. New technology poses new problems which may not be to the liking of the organisational men. The resistance to change is purely psychological.

A typical businessman himself is opposed to new technology. He does not encourage new technology. Reasons are not purely psychological. Adopting new tecnology is expensive and risky. When he is making enough money with obsolete

technology why must he worry about new tecnology? (See Box 6.4). Take the case of erstwhile Telco for example. Telco's trucks were still antiquated models only found in developing countries. But the turnover of Telco was Rs.1,969 crores during 1989-90. Another example is Bajaj Auto, Ltd. The company claims to be number two in the world in the manufacture of two wheelers. But during the last two decades the company could not develop a self-starting scooter. Or take the case of Indian Telephone Industries (ITI) which was till recently manufacturing strowger crossed switching equipment that became outdated 10 years ago with the development of electronic switching system.

Specifically, resistance to change stems from the following reasons:

1. Psychological and social commitments to existing products, processes and organisation,
2. Sizable capital investments in long-life single-use-facilities,
3. Low profits and reduced rate of growth,
4. Small size or fragmented activities,
5. Complacent top management,
6. Industry norms and associations or cartels which perpetuate industry-bound thinking,
7. Lack of successful entrepenurial models to emulate, and
8. Powerful labour resistance to changes in methods.[13]

• *Total Quality Management(TQM)*

Total Quality Management refers to deep commitment of an organisation to quality. Quality of product and service is an obsession and every step in the company's processes is subjected to intense and regular scrutiny for ways to improve it. Almost every issue is subject to exploration, and the process is a continuing one of long duration. Employers are provided withextensive training in problem solving, group decision making and statistical methods.

TQM replaces traditional beliefs about quality with a new set of principles. Traditional beliefs which are discarded include-

- High quality costs more.
- Quality can be improved by inspection.
- Defects cannot be eliminated completely.
- Quality is the job of the quality control personnel.

The new principles of TQM are-

- Meet the customer's requirement on time, the first time, and 100% of the time.
- Strive to do error-free work.
- Manage by prevention, not by correction.
- Measure the cost of quality.

TQM has been introduced by almost all organisations. It has several implications for employees and organisations. Managers are required continuously

Box 6.4

Thriving on Obsolescence

Not a day passes without journals carrying advertisements proposing new investments running into crores of rupees. All of them explain how the latest equipment and machinery will be bought from abroad. Rarely does one hear of any proposal for investment in indigenous technology development.

Thus, as a rule, Indian industrialists have no interest in preserving the technology they have; no interest in acquiring top quality engineers; neither do they have plans for creating technology on their own. Evidently, in the Indian industrial scene, technology has no past that calls for preservation, no present that requires quality personnel and no future worth investing for.

There is a reason for this. The purpose of technology development is to generate super-normal profits-profits above what production and trading will normally yield. Unfortunately, in India, maximum profits are obtainable from tax evasion, smuggling, speculation and mono-polisation, but not from superior production technology. So the technology that is patronised most is that of tax avoidance, customs evasion, speculative trading and, till recently, cornering of licences. When so much can be made in the innovative treatment of say, excise duties, there is understandably little interest in technology innovation. In any case, for the promoters, procuring technology from abroad is a most profitable exercise. Where, then, is the need to develop one's own technology?

Peter Drucker, the management guru, has emphasised that success depends on making obsolete one's own profitable technologies; and as quickly as possible. His logic is simple: however great your technology is, once a rival develops a better one, he will corner all super-normal profits, leaving you holding an unprofitable, even an unsaleable product. That is why in a competitive economy, entrepreneurs run like hell to remain where they are. Or else, as the experience of IBM and General Motors demonstrates, even the soundest operations are liable to be driven to the wall.

Indian industry has placed its faith in an exactly opposite philosophy: never let a technology depreciate. That is how we have Ambassador cars, Bajaj scooters and a host of other products continuing to stay on in the market place long after such products have been confined to the dust elsewhere. Singapore Airlines changes aircraft every three-four years; we operate the oldest Boeings. In fact, if anyone wants to set up a musuem of technology, the best place to look for is India.

Liberalisation, it was hoped, will force Indian entrepreneurs to look for indigenous technology development. Indications are that it is not going to be so; in the past, industrialists did not change their product till machinery crumbled down;instead, now, they will probably attempt a change as and when a new breed of second hand machinery becomes available. The culture remains the same; the dependence will continue to be on imported machinery.

Now it can be explained why Indian industrialists never ask for tax concessions on account of technology depreciation. Elsewhere, tecnology is embodied in ideas; in Indian industry, it is embodied in machinery. Hence, as technology depreciates, Indian industrialists look for new machinery, not for better ideas.

Also, ideas need innovative researchers; minding machines needs good mechanics. So, the Indian entrepreneur has little concern for technology depreciation, nor for high fliers in R&D.

In Aldous Huxley's Brave New World, there is a telling episode of how Beta type infants are conditioned; they are indoctrinated with the idea that they are happy and they are not alphas who have to struggle to remain ahead all the time. Indian industry is a self conditioned Beta type; happy and proud to be second rate, to borrow ideas from others; to make do with discarded technology.

This mental make-up gets deeply disturbed when anyone steps out of the line and tries to do something better, like for instance, what Sam Pitroda attempted to do. Every other country is greatly worried about external threats to technology; we need have no such fears. We know who the enemy is; it is us.

In his latest book, Drucker warns that the era of comparative advantage-which made competition important-is over; what we are facing is adversarial trade where the aim is the subjugation of others. Incidentally, the weapon for such subjugation is technology.

Isacc Asimov has a beautiful short story about how a brilliant and ambitious youngster is prevented from migrating to other far more glamorous worlds. In the denouement, he realises he can never leave this world because he has an A1 brain; the kind of brain which alone can produce better and better innovations. Emigration, he learns, is permissible only for inferior mortals.

Does any entrepreneur (or decision-maker) in this country understand what Asimov was driving at?

(Source: The Economic Times, Feb. 6, 1993)

to search for improved policies and activities. Employees can no longer rest on their past achievements. They too are required to search for newer and better ways of doing things. Some of them may experience stress from a work climate that no longer accepts complacency with the statusquo. Employees will be more and more involved in process improvement. Management will look at them as a source of improvement of ideas.

Some of our companies have excelled in quality and have won Deeming prize, a sort of Noble Prize for quality. Table 6.5 contains names of firms that have won the prestigious prize for excellence in quality.

Table 6.5

*India's Deming Heroes**

Company	*Year*
Sundaram Clayton (Brakes Division)	1998
Sundaram Brake Linings	2001
TVS Motor	2002
Brakes India (Foundry Division)	2003
Mahindra & Mahindra (Farm Equipment)	2003
Rane Brake Linings	2003
Sona Koyo Steering Systems	2003
Lucas-TVS	2004

(***Source:*** *Business Today*, January 2, 2005, p.157)

*List includes only companies in the auto sector

• E-Commerce and E-Business

Technology has given birth to the Internet and the association world wide web which have made e-commerce possible. E-commerce is contributing to a growing number of transactions within a country and across nations. Viewed globally, the web is emerging as the great equiliser. It rolls back some of the constraints of location, distance, scale and time zones. The web allows, both small and large enterprises to expand their presence globally at a lower cost than ever before. The web makes it much easier for buyers and sellers to find each other, wherever they may be located, and whatever their size of operations.

E-commerce through Internet is made possible through technology.

While e-commerce focuses on marketing and sales process, e-business emphasises integration of systems, processes, organisations, value chains and markets. The integration operates through Internet and helps build new relationships between businesses and customers.

The Internet and e-business provide a number of benefits to business in general including the following:

1. Convenience in conducting business worldwide; facilitating communication across borders which brings globe closer.
2. An electronic meeting and trading place, which adds efficiency in conducting business.
3. Power to consumers as they gain access to limitless options and price differentials.
4. Efficiency in distribution.

• Flexible Manufacturing System(FMS)

Under FMS, machines are designed to produce batches of different products.

Flexible Manufacturing System (FMS) is another by-product of technology. Under FMS, machines are designed to produce batches of different products. Gone are the days of one machine producing multiple units of one component. It can now make dozens or even hundreds of different parts in any order management desires.

The unique characteristic of FMS is that by integrating computer aided design, engineering and manufacturing, they can produce low-volume products for customers at a cost comparable to what had been previously possible through mass production. In effect, FMS is rewriting the laws of economies of scale. Management no longer has to produce on a massive scale to achieve low unit-cost of production. With flexible manufacturing, when management wants to produce a new part, it does not change machines- it needs to change the computer programming.

Under FMS, workers need more training and higher skills. Besides, employees in flexible plants are typically organised into teams and given considerable decision making discretion. Organisational structure needs to be so designed so as to facilitate decentralisation of authority into the hands of operating teams.

MANAGEMENT OF TECHNOLOGY

Technology is a high-risk, costly and uncertain activity. The world has entered an age in which many of the easy inventions and discoveries have already been

produced. To achieve breakthroughs which have social significance and profit potentials for the originator, increasingly larger investments in research must be made. Quantum leaps forward in technological benefits require greater managerial and financial commitments. But while costs of discovery are increasing at an accelerating rate, the incremental pay-off results seem to be growing at a decreasing rate over the short-run.

To obtain cost-discovery effectiveness and justify research and development expenditures, firms need potentially high pay-offs. Pharmaceutical drug companies have been criticized for prices excessively higher than the cost of production and materials. But the uninformed public fails to consider the high research investment that preceded production of an effective and successful drug and all the dead ends and unsuccessful formulations that must be recovered from the successful ones.

There is the added risk that a new product will quickly be duplicated or closely imitated, thereby reducing the market and profit potential for the original innovator. As the technology of any industry becomes easier to duplicate, the motivation for further innovation declines. Undifferentiated competitive advantage, whether in drugs, petrochemicals, electronics, or building materials, ultimately leads to a slowdown in the rate of product improvements generated within the industry. In seeking more profitable potentials for future growth, management either turns more to manufacturing or distribution process improvements.

There is the risk of a product being duplicated or closely imitated.

For a management which wants to import technology, there are problems. Basic infrastructural facilities like training of technicians and supervisors, testing facilities for raw materials, replacement parts, and the like are not easily available. A prestigious tool room located in Bangalore has a CNC mahine lying idle for the past two years. Reason-non-availability of a critical part which is worn out and a replacement is not available locally.

Import of technology is also not easy because developed countries are not willing to lend it. Infact, these countries view India as a potential rival. The technology, the developed countries are willing to lend, is limited in scope and is mainly aimed at exploiting our dynamic competitive advantages in order to feed the markets they are interested in. They will not pass on their key technolgy, such as design know-how for manufacturing equipment, which could help us in challenging them in their own game.

Developed countries do not easily lend technology to others.

If the East Asian Tigers, with hardly any natural resources, can be such wonders and prove a threat to Western MNCs, India with its rich resources-both natural and human-can become a greater threat to developed countries.

Assuming there are companies willing to transfer technology, there is the problem relating to choosing a right collaborator and obtaining clearance from the government. Despite the existence of several research establishments in our country, interaction between them and the industry is not encouraging. The management is forced to look for a collaborator for new technology. Getting a right collaborator is not an easy task. Similarly, any tall talk about streamlining and

Even when a company is willing to transfer technology, finding a collaborator is a problem.

simplifyling the licensing procedure notwithstanding, it takes minimum one year for an enterpreneur to obtain final clearance from the government.

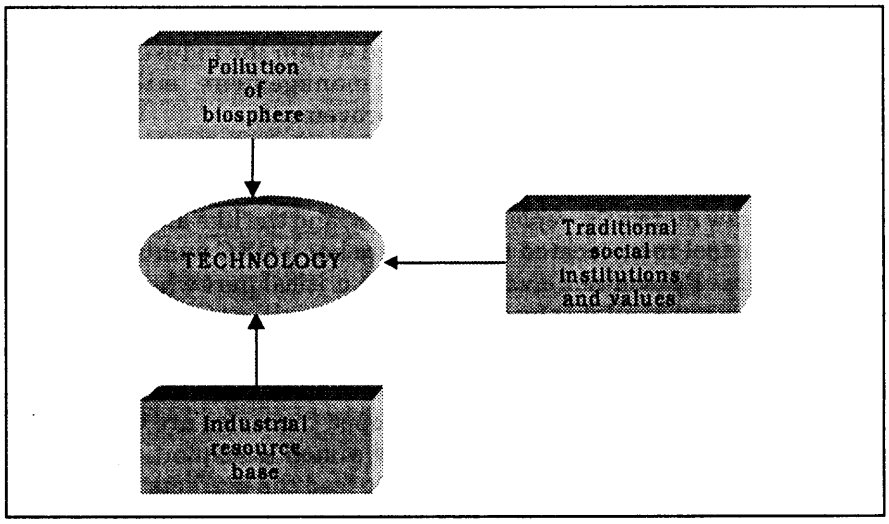
Ability to absorb western technology is low in our firms. 'Bullet', India's once prized 350cc motorcycle manufactured by Enfield India, for example, could not for a long time, change the side of the foot brake-lever from left to right, thus putting the driver to considerable physical risk. The company could not adapt the design (supplied by an European company) for relatively minor changes to left-hand driving system. Bajaj Scooters, claiming to be the second largest scooter manufacturer in the world, took more than six months, after the promulgation of law to introduce direction blinkers on its scooters, and that too as crude protuberances. This was when the amendments in the Motor Vehicles Act were in offing for more than a year and all other leading scooter manufacturers in the world had already integrated blinking indicators in their models.

Three factors: pollution, depletion of resource base and social institutions impede technology.

There are also constraints on the technological growth. Three constraints are significant: pollution, industrial resource base and social institutions (See Fig.6.7).

Figure 6.7

Three Factors Impeding Technological Growth



Pollution

Pollution is an unavoidable consequence of industrial production. Smoke, smell, noise, effluents and dust are generated by industrial establishments.

The biosphere-the land, air, water and natural conditions on which all life on earth depends- can absorb and break down many of these industrial pollutions without harm to people, animals or plants. But the biosphere is not all infinite sponge, and the build-up of harmful chemicals in the ecosystem poses a threat to life and the planet itself. The earth's absorptive capacity is especially limited when a single society concentrates its industrial technology and industrial products too densely in a single region. A critical issue today is society's capability to raise the standard of living everywhere as less-developed countries industrialise without