

Definition of Economic Types in Simple Language or Talking to My Mother About the Economy!

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Submission: July 24, 2023; **Published:** September 5, 2023

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Abstract

International Economics is concerned with the effects upon economic activity from international differences in productive resources and consumer preferences and the international institutions that affect them. It seeks to explain the patterns and consequences of transactions and interactions between the inhabitants of different countries, including trade, investment and transaction. In this article, I will study on these issues: International Economics, Microeconomics, Macroeconomics, Management Economic, Industrial Economics, Energy Economics, Energy Policy, Energy Supply & Demand, Economic Development, and Sustainable Development.

Keywords: Economy; International Economics; Microeconomics; Macroeconomics; Management Economic; Industrial Economics; Energy Economics; Energy Policy; Energy Supply & Demand; Economic Development; Sustainable Development

Introduction

International Economics

International Economics is concerned with the effects upon economic activity from international differences in productive resources and consumer preferences and the international institutions that affect them. It seeks to explain the patterns and consequences of transactions and interactions between the inhabitants of different countries, including trade, investment and transaction [1].

- International trade studies goods and services flows across international boundaries from supply-and-demand factors, economic integration, international factor movements, and policy variables such as tariff rates and trade quotas.[2]

- International finance studies the flow of capital across international financial markets, and the effects of these movements on exchange rates.[3]

- International monetary economics and international macroeconomics study flows of money across countries and the resulting effects on their economies as a whole.[4]

- International political economy, a sub-category of international relations, studies issues and impacts from for example international conflicts, international negotiations, and international sanctions; national security and economic nationalism; and international agreements and observance.[5-7]

International Trade

Scope and Methodology

The economic theory of international trade differs from the remainder of economic theory mainly because of the comparatively limited international mobility of capital and labor. In that respect, it would appear to differ in degree rather than in principle from the trade between remote regions in one country. Thus, the methodology of international trade economics differs little from that of the remainder of economics. However, the direction of academic research on the subject has been influenced by the fact that governments have often sought to impose restrictions upon international trade, and the motive for the development of trade theory has often been a wish to determine

the consequences of such restrictions. The branch of trade theory which is conventionally categorized as “classical” consists mainly of the application of deductive logic, originating with Ricardo’s Theory of Comparative Advantage and developing into a range of theorems that depend for their practical value upon the realism of their postulates. “Modern” trade analysis, on the other hand, depends mainly upon empirical analysis.

Classical Theory

The theory of comparative advantage provides a logical explanation of international trade as the rational consequence of the comparative advantages that arise from inter-regional differences - regardless of how those differences arise. Since its exposition by David Ricardo the techniques of neo-classical economics have been applied to it to model the patterns of trade that would result from various postulated sources of comparative advantage. However, extremely restrictive (and often unrealistic) assumptions have had to be adopted in order to make the problem amenable to theoretical analysis. The best-known of the resulting models, the Heckscher-Ohlin theorem (H-O) [8] depends upon the assumptions of no international differences of technology, productivity, or consumer preferences; no obstacles to pure competition or free trade and no scale economies. On those assumptions, it derives a model of the trade patterns that would arise solely from international differences in the relative abundance of labor and capital (referred to as factor endowments). The resulting theorem states that, on those assumptions, a country with a relative abundance of capital would export capital-intensive products and import labor-intensive products. The theorem proved to be of very limited predictive value, as was demonstrated by what came to be known as the “Leontief Paradox” (the discovery that, despite its capital-rich factor endowment, America was exporting labor-intensive products and importing capital-intensive products [9]) Nevertheless, the theoretical techniques (and many of the assumptions) used in deriving the H-O model were subsequently used to derive further theorems.

The Stolper-Samuelson theorem, [10-22] which is often described as a corollary of the H-O theorem, was an early example. In its most general form, it states that if the price of a good rises (falls) then the price of the factor used intensively in that industry will also rise (fall) while the price of the other factor will fall (rise). In the international trade context for which it was devised it means that trade lowers the real wage of the scarce factor of production, and protection from trade raises it. Another corollary of the H-O theorem is Samuelson’s factor price equalization theorem which states that as trade between countries tends to equalize their product prices, it tends also to equalize the prices paid to their factors of production. Those theories have sometimes been taken to mean that trade between an industrialized country and a developing country would lower the wages of the unskilled in the industrialized country. (But, as noted below, that conclusion depends upon the unlikely assumption that productivity is the

same in the two countries). Large numbers of learned papers have been produced in attempts to elaborate on the H-O and Stolper-Samuelson theorems, and while many of them are considered to provide valuable insights, they have seldom proved to be directly applicable to the task of explaining trade patterns.

Modern Analysis

Modern trade analysis moves away from the restrictive assumptions of the H-O theorem and explores the effects upon trade of a range of factors, including technology and scale economies. It makes extensive use of econometrics to identify from the available statistics the contribution of particular factors among the many different factors that affect trade. One example of such an econometric model is the gravity equation. The contributions of differences of technology have been evaluated in several such studies. The temporary advantage arising from a country’s development of a new technology is seen as contributory factor in one study. Other researchers have found research and development expenditure, patents issued, and the availability of skilled labor, to be indicators of the technological leadership that enables some countries to produce a flow of such technological innovations and have found that technology leaders tend to export hi-tech products to others and receive imports of more standard products from them. Another econometric study also established a correlation between country size and the share of exports made up of goods in the production of which there are scale economies. The study further suggested that internationally traded goods fall into three categories, each with a different type of comparative advantage:

- Goods that are produced by the extraction and routine processing of available natural resources-such as coal, oil and wheat, for which developing countries often have an advantage compared with other types of production-which might be referred to as “Ricardo goods”;
- Low-technology goods, such as textiles and steel, that tend to migrate to countries with appropriate factor endowments-which might be referred to as “Heckscher-Ohlin goods”; and,
- High-technology goods and high scale-economy goods, such as computers and aero planes, for which the comparative advantage arises from the availability of R&D resources and specific skills and the proximity to large sophisticated markets.

There is a strong presumption that any exchange that is freely undertaken will benefit both parties, but that does not exclude the possibility that it may be harmful to others. However (on assumptions that included constant returns and competitive conditions) Paul Samuelson has proved that it will always be possible for the gainers from international trade to compensate the losers. Moreover, in that proof, Samuelson did not take account of the gains to others resulting from wider consumer choice, from the international specialization of productive activities - and consequent economies of scale, and from the transmission

of the benefits of technological innovation. An OECD study has suggested that there are further dynamic gains resulting from better resource allocation, deepening specialization, increasing returns to R&D, and technology spillover. The authors found the evidence concerning growth rates to be mixed, but that there is strong evidence that a 1 per cent increase in openness to trade increases the level of GDP per capita by between 0.9 per cent and 2.0 per cent. They suggested that much of the gain arises from the growth of the most productive firms at the expense of the less productive. Those findings and others have contributed to a broad consensus among economists that trade confers very substantial net benefits, and that government restrictions upon trade are generally damaging.

Factor Price Equalization

Nevertheless, there have been widespread misgivings about the effects of international trade upon wage earners in developed countries. Samuelson's factor price equalization theorem indicates that, if productivity were the same in both countries, the effect of trade would be to bring about equality in wage rates. As noted above, that theorem is sometimes taken to mean that trade between an industrialized country and a developing country would lower the wages of the unskilled in the industrialized country. However, it is unreasonable to assume that productivity would be the same in a low-wage developing country as in a high-wage developed country. A 1999 study has found international differences in wage rates to be approximately matched by corresponding differences in productivity. (Such discrepancies that remained were probably the result of over-valuation or under-valuation of exchange rates, or of inflexibility in labor markets.) It has been argued that, although there may sometimes be short-term pressures on wage rates in the developed countries, competition between employers in developing countries can be expected eventually to bring wages into line with their employees' marginal products. Any remaining international wage differences would then be the result of productivity differences, so that there would be no difference between unit labour costs in developing and developed countries, and no downward pressure on wages in the developed countries.

Terms of Trade

There has also been concern that international trade could operate against the interests of developing countries. Influential studies published in 1950 by the Argentine economist Raul Prebisch and the British economist Hans Singer suggested that there is a tendency for the prices of agricultural products to fall relative to the prices of manufactured goods; turning the terms of trade against the developing countries and producing an unintended transfer of wealth from them to the developed countries. Their findings have been confirmed by a number of subsequent studies, although it has been suggested that the effect may be due to quality bias in the index numbers used or to the possession of market power by manufacturers. [23] The Prebisch/

Singer findings remain controversial, but they were used at the time-and have been used subsequently-to suggest that the developing countries should erect barriers against manufactured imports in order to nurture their own "infant industries" and so reduce their need to export agricultural products. The arguments for and against such a policy are similar to those concerning the protection of infant industries in general.

Infant Industries

The term "infant industry" is used to denote a new industry which has prospects of gaining comparative advantage in the long-term, but which would be unable to survive in the face of competition from imported goods. This situation can occur when time is needed either to achieve potential economies of scale, or to acquire potential learning curve economies. Successful identification of such a situation, followed by the temporary imposition of a barrier against imports can, in principle, produce substantial benefits to the country that applies it-a policy known as "import substitution industrialization". Whether such policies succeed depends upon the governments' skills in picking winners, with reasonable expectations of both successes and failures. It has been claimed that South Korea's automobile industry owes its existence to initial protection against imports,[24] but a study of infant industry protection in Turkey reveals the absence of any association between productivity gains and degree of protection, such as might be expected of a successful import substitution policy. [25] Another study provides descriptive evidence suggesting that attempts at import substitution industrialization since the 1970s have usually failed,[26] but the empirical evidence on the question has been contradictory and inconclusive.[27] It has been argued that the case against import substitution industrialization is not that it is bound to fail, but that subsidies and tax incentives do the job better.[28] It has also been pointed out that, in any case, trade restrictions could not be expected to correct the domestic market imperfections that often hamper the development of infant industries.[29]

Trade Policies

Economists' findings about the benefits of trade have often been rejected by government policy-makers, who have frequently sought to protect domestic industries against foreign competition by erecting barriers, such as tariffs and import quotas, against imports. Average tariff levels of around 15 per cent in the late 19th century rose to about 30 percent in the 1930s, following the passage in the United States of the Smoot-Hawley Tariff Act. [30] Mainly as the result of international agreements under the auspices of the General Agreement on Tariffs and Trade (GATT) and subsequently the World Trade Organization (WTO), average tariff levels were progressively reduced to about 7 per cent during the second half of the 20th century, and some other trade restrictions were also removed. The restrictions that remain are nevertheless of major economic importance: among other estimates,[31] the World Bank estimated in 2004 that the

removal of all trade restrictions would yield benefits of over \$500 billion a year by 2015.[32] The largest of the remaining trade-distorting policies are those concerning agriculture. In the OECD countries government payments account for 30 per cent of farmers' receipts and tariffs of over 100 per cent are common.[33] OECD economists estimate that cutting all agricultural tariffs and subsidies by 50% would set off a chain reaction in realignments of production and consumption patterns that would add an extra \$26 billion to annual world income.[34] Quotas prompt foreign suppliers to raise their prices toward the domestic level of the importing country. That relieves some of the competitive pressure on domestic suppliers, and both they and the foreign suppliers gain at the expense of a loss to consumers, and to the domestic economy, in addition to which there is a deadweight loss to the world economy. When quotas were banned under the rules of the General Agreement on Tariffs and Trade (GATT), the United States, Britain and the European Union made use of equivalent arrangements known as voluntary restraint agreements (VRAs) or voluntary export restraints (VERs) which were negotiated with the governments of exporting countries (mainly Japan)-until they too were banned. Tariffs have been considered to be less harmful than quotas, although it can be shown that their welfare effects differ only when there are significant upward or downward trends in imports.[35] Governments also impose a wide range of non-tariff barriers [36] that are similar in effect to quotas, some of which are subject to WTO agreements.[37] A recent example has been the application of the precautionary principle to exclude innovatory products.

International Finance

Scope and Methodology

The economics of international finance does not differ in principle from the economics of international trade, but there are significant differences of emphasis. The practice of international finance tends to involve greater uncertainties and risks because the assets that are traded are claims to flow of returns that often extend many years into the future. Markets in financial assets tend to be more volatile than markets in goods and services because decisions are more often revised and more rapidly put into effect. There is the share presumption that a transaction that is freely undertaken will benefit both parties, but there is a much greater danger that it will be harmful to others. For example, mismanagement of mortgage lending in the United States led in 2008 to banking failures and credit shortages in other developed countries, and sudden reversals of international flows of capital have often led to damaging financial crises in developing countries. And, because of the incidence of rapid change, the methodology of comparative statics has fewer applications than in the theory of international trade, and empirical analysis is more widely employed. Also, the consensus among economists concerning its principal issues is narrower and more open to controversy than is the consensus about international trade.

Exchange Rates and Capital Mobility

A major change in the organization of international finance occurred in the latter years of the twentieth century, and economists are still debating its implications. At the end of the Second World War, the national signatories to the Bretton Woods Agreement had agreed to maintain their currencies each at a fixed exchange rate with the United States dollar (\$), and the United States government had undertaken to buy gold on demand at a fixed rate of \$35 per ounce. In support of those commitments, most signatory nations had maintained strict control over their nationals' use of foreign exchange and upon their dealings in international financial assets. But in 1971 the United States government announced that it was suspending the convertibility of the dollar, and there followed a progressive transition to the current regime of floating exchange rates in which most governments no longer attempt to control their exchange rates or to impose controls upon access to foreign currencies or upon access to international financial markets. The behaviour of the international financial system was transformed. Exchange rates became very volatile and there was an extended series of damaging financial crises. One study estimated that by the end of the twentieth century there had been 112 banking crises in 93 countries,[38] another that there had been 26 banking crises, 86 currency crises and 27 mixed banking and currency crises,[39] many times more than in the previous post-war years.

In making an influential case for flexible exchange rates in the 1950s, Milton Friedman had claimed that if there were any resulting instability, it would mainly be the consequence of macroeconomic instability,[40] but an empirical analysis in 1999 found no apparent connection.[41] Neoclassical theory had led them to expect capital to flow from the capital-rich developed economies to the capital-poor developing countries - because the returns to capital there would be higher. Flows of financial capital would tend to increase the level of investment in the developing countries by reducing their costs of capital, and the direct investment of physical capital would tend to promote specialization. Although the majority of developed countries now have "floating" exchange rates, some of them - together with many developing countries - maintain exchange rates that are nominally "fixed", usually with the US dollar or the euro. The adoption of a fixed rate requires intervention in the foreign exchange market by the country's central bank, and is usually accompanied by a degree of control over its citizens' access to international markets. Some governments have abandoned their national currencies in favor of the common currency of a currency area such as the "Eurozone" and some, such as Denmark, have retained their national currencies but have pegged them at a fixed rate to an adjacent common currency. On an international scale, the economic policies promoted by the International Monetary Fund (IMF) have had a major influence, especially upon the developing countries.

The IMF was set up in 1944 to encourage international cooperation on monetary matters, to stabilize exchange rates and create an international payments system. Its principal activity is the payment of loans to help member countries to overcome balance of payments problems, mainly by restoring their depleted currency reserves. Their loans are, however, conditional upon the introduction of economic measures by recipient governments that are considered by the Fund's economists to provide conditions favourable to recovery. Their recommended economic policies are broadly those that have been adopted in the United States and the other major developed countries (known as the "Washington Consensus") and have often included the removal of all restrictions upon incoming investment. The Fund has been severely criticized by Joseph Stiglitz and others for what they consider to be the inappropriate enforcement of those policies and for failing to warn recipient countries of the dangers that can arise from the volatility of capital movements. and the transfer of skills and technology. However, the eventual outcome of these policies was not what had been expected. Theoretical considerations alone cannot determine the balance between those benefits and the costs of volatility, and the question has had to be tackled by empirical analysis. A 2006 working paper from the International Monetary Fund offers a summary of the empirical evidence. The authors found little evidence either of the benefits of the liberalization of capital movements, or of claims that it is responsible for the spate of financial crises. They suggest that net benefits can be achieved by countries that are able to meet threshold conditions of financial competence but that for others, the benefits are likely to be delayed, and vulnerability to interruptions of capital flows is likely to be increased. [42]

Policies and Institutions

International Financial Stability

From the time of the Great Depression onwards, regulators and their economic advisors have been aware that economic and financial crises can spread rapidly from country to country, and that financial crises can have serious economic consequences. For many decades, that awareness led governments to impose strict controls over the activities and conduct of banks and other credit agencies, but in the 1980s many governments pursued a policy of deregulation in the belief that the resulting efficiency gains would outweigh any systemic risks. The extensive financial innovations that followed are described in the article on financial economics. One of their effects has been greatly to increase the international inter-connectedness of the financial markets and to create an international financial system with the characteristics known in control theory as "complex-interactive". The stability of such a system is difficult to analyze because there are many possible failure sequences. The internationally systemic crises that followed included the equity crash of October 1987, [43] the Japanese asset price collapse of the 1990s [44] the Asian financial crisis of 1997 [45] the Russian government default of 1998

[46](which brought down the Long-Term Capital Management hedge fund) and the 2007-8 sub-prime mortgages crisis.[47] The symptoms have generally included collapses in asset prices, increases in risk premiums, and general reductions in liquidity. Measures designed to reduce the vulnerability of the international financial system have been put forward by several international institutions. The Bank for International Settlements made two successive recommendations (Basel I and Basel II[48]) concerning the regulation of banks, and a coordinating group of regulating authorities, and the Financial Stability Forum, that was set up in 1999 to identify and address the weaknesses in the system, has put forward some proposals in an interim report.[49-50]

Migration

Elementary considerations lead to a presumption that international migration results in a net gain in economic welfare. Wage differences between developed and developing countries have been found to be mainly due to productivity differences [19] which may be assumed to arise mostly from differences in the availability of physical, social and human capital. Economic theory indicates that the movement of a skilled worker from a place where the returns to skill are relatively low to a place where they are relatively high should produce a net gain, although it would tend to depress the wages of skilled workers in the recipient country). There have been many econometric studies intended to quantify those gains. A Copenhagen Consensus study suggests that if the share of foreign workers grew to 3% of the labor force in the rich countries there would be global benefits of \$675 billion a year by 2025. [50] However, a survey of the evidence led a House of Lords committee to conclude that any economic benefits of immigration to the United Kingdom are relatively small. [51] Evidence from the United States also suggests that the economic benefits to the receiving country are relatively small, [52] and that the presence of immigrants in its labor market results in only a small reduction in local wages. [52]

From the standpoint of a developing country, the emigration of skilled workers represents a loss of human capital (known as brain drain), leaving the remaining workforce without the benefit of their support. That effect upon the welfare of the parent country is to some extent offset by the remittances that are sent home by the emigrants, and by the increased skill and education with which some of them return. One study introduces a further offsetting factor to suggest that the opportunity to migrate fosters enrolment in education thus promoting a "brain gain" that can counteract the lost human capital associated with emigration. [53] However, these factors can be counterweighed on their turn depending on the intentions that remittances are used for. As evidence from Armenia suggests, instead of acting as a contractual tool, remittances have a potential for recipients to further incentivize emigration by serving as a resource to alleviate the migration process. [54]

Whereas some studies suggest that parent countries can benefit from the emigration of skilled workers, [55] generally it is emigration of unskilled and semi-skilled workers that is of economic benefit to countries of origin, by reducing pressure for employment creation. Where skilled emigration is concentrated in specific highly skilled sectors, such as medicine, the consequences are severe and even catastrophic in cases where 50% or so of trained doctors have emigrated. The crucial issues, as recently acknowledged by the OECD, is the matter of return and reinvestment in their countries of origin by the migrants themselves: thus, government policies in Europe are increasingly focused upon facilitating temporary skilled migration alongside migrant remittances. Unlike the movement of capital and goods, since 1973 government policies have tried to restrict migration flows, often without any economic rationale. Such restrictions have had diversionary effects, channeling the great majority of migration flows into illegal migration and “false” asylum-seeking. Since such migrants work in unskilled industries for lower wages and often zero social insurance costs, the gain from labor migration flows is actually higher than the minimal gains calculated for legal flows; accompanying side-effects are significant, however, and include political damage to the idea of immigration, lower unskilled wages for the host population, and increased policing costs alongside lower tax receipts.

Globalization

The term globalization has acquired a variety of meanings, but in economic terms it refers to the move that is taking place in the direction of complete mobility of capital and labor and their products, so that the world’s economies are on the way to becoming totally integrated. The driving forces of the process are reductions in politically imposed barriers and in the costs of transport and communication (although, even if those barriers and costs were eliminated, the process would be limited by inter-country differences in social capital). It is a process that has ancient origins, which has gathered pace in the last fifty years, but which is very far from complete. In its concluding stages, interest rates, wage rates and corporate and income tax rates would become the same everywhere, driven to equality by competition, as investors, wage earners and corporate and personal taxpayers threatened to migrate in search of better terms. In fact, there are few signs of international convergence of interest rates, wage rates or tax rates. Although the world is more integrated in some respects, it is possible to argue that on the whole it is now less integrated than it was before the First World War, [56] and that many middle-east countries are less globalized than they were 25 years ago. [57]

Of the moves toward integration that have occurred, the strongest has been in financial markets, in which globalization is estimated to have tripled since the mid-1970s. [58] Recent research has shown that risk-sharing has improved risk-sharing, but only in developed countries, and that in the developing countries it has increased macroeconomic volatility. It is estimated to have resulted in net welfare gains worldwide, but

with losers as well as gainers. [59] Increased globalization has also made it easier for recessions to spread from country to country. A reduction in economic activity in one country can lead to a reduction in activity in its trading partners as a result of its consequent reduction in demand for their exports, which is one of the mechanisms by which the business cycle is transmitted from country to country. Empirical research confirms that the greater the trade linkage between countries the more coordinated are their business cycles. [60] Globalization can also have a significant influence upon the conduct of macroeconomic policy. The Mundell-Fleming model and its extensions [61] are often used to analyze the role of capital mobility (and it was also used by Paul Krugman to give a simple account of the Asian financial crisis [62]). Part of the increase in income inequality that has taken place within countries is attributable - in some cases - to globalization. A recent IMF report demonstrates that the increase in inequality in the developing countries in the period 1981 to 2004 was due entirely to technological change, with globalization making a partially offsetting negative contribution, and that in the developed countries globalization and technological change were equally responsible. [63]

Opposition

Globalization is seen as contributing to economic welfare by most economists - but not all. Professor Joseph Stiglitz [64] of the School of International and Public Affairs, Columbia University has advanced the infant industry case for protection in developing countries and criticized the conditions imposed for help by the International Monetary Fund. [65] Professor Dani Rodrik of Harvard [66] has noted that the benefits of globalization are unevenly spread, and that it has led to income inequalities, and to damaging losses of social capital in the parent countries and to social stresses resulting from immigration in the receiving countries.[67] An extensive critical analysis of these contentions has been made by Martin Wolf,[68] and a lecture by Professor Jagdish Bhagwati has surveyed the debate that has taken place among economists.[69]

Microeconomics

Definition, Uses and Concepts What Is Microeconomics?

Microeconomics is the social science that studies the implications of incentives and decisions, specifically how those affect the utilization and distribution of resources. Microeconomics shows how and why different goods have different values, how individuals and businesses conduct and benefit from efficient production and exchange, and how individuals best coordinate and cooperate with one another. Generally speaking, microeconomics provides a more complete and detailed understanding than macroeconomics.

Understanding Microeconomics

Microeconomics is the study of what is likely to happen (tendencies) when individuals make choices in response to changes

in incentives, prices, resources, and/or methods of production. Individual actors are often grouped into microeconomic subgroups, such as buyers, sellers, and business owners. These groups create the supply and demand for resources, using money and interest rates as a pricing mechanism for coordination.

The Uses of Microeconomics

Microeconomics can be applied in a positive or normative sense. Positive microeconomics describes economic behavior and explains what to expect if certain conditions change. If a manufacturer raises the prices of cars, positive microeconomics says consumers will tend to buy fewer than before. If a major copper mine collapses in South America, the price of copper will tend to increase, because supply is restricted. Positive microeconomics could help an investor see why Apple Inc. stock prices might fall if consumers buy fewer iPhones. These explanations, conclusions, and predictions of positive microeconomics can then also be applied normatively to prescribe what people, businesses, and governments should do in order to attain the most valuable or beneficial patterns of production, exchange, and consumption among market participants. This extension of the implications of microeconomics from what is to what ought to be or what people ought to do also requires at least the implicit application of some sort of ethical or moral theory or principles, which usually means some form of utilitarianism.

Method of Microeconomics

Microeconomic study historically has been performed according to general equilibrium theory, developed by Léon Walras in *Elements of Pure Economics* (1874) and partial equilibrium theory, introduced by Alfred Marshall in *Principles of Economics* (1890).¹ The Marshallian and Walrasian methods fall under the larger umbrella of neoclassical microeconomics. Neoclassical economics focuses on how consumers and producers make rational choices to maximize their economic well-being, subject to the constraints of how much income and resources they have available. Neoclassical economists make simplifying assumptions about markets-such as perfect knowledge, infinite numbers of buyers and sellers, homogeneous goods, or static variable relationships- in order to construct mathematical models of economic behavior. These methods attempt to represent human behavior in functional mathematical language, which allows economists to develop mathematically testable models of individual markets. Neoclassicals believe in constructing measurable hypotheses about economic events, then using empirical evidence to see which hypotheses work best. In this way, they follow in the “logical positivism” or “logical empiricism” branch of philosophy. Microeconomics applies a range of research methods, depending on the question being studied and the behaviors involved.

Basic Concepts of Microeconomics

Economics is split between analysis of how the overall

economy works and how single markets function. Physicists look at the big world of planets, stars, galaxies, and gravity. But they also study the minute world of atoms and the tiny particles that comprise those atoms. Economists also look at two realms. There is big-picture macroeconomics, which is concerned with how the overall economy works. It studies such things as employment, gross domestic product, and inflation-the stuff of news stories and government policy debates. Little-picture microeconomics is concerned with how supply and demand interact in individual markets for goods and services. In macroeconomics, the subject is typically a nation-how all markets interact to generate big phenomena that economists call aggregate variables. In the realm of microeconomics, the object of analysis is a single market -for example, whether price rises in the automobile or oil industries are driven by supply or demand changes. The government is a major object of analysis in macroeconomics-for example, studying the role it plays in contributing to overall economic growth or fighting inflation. Macroeconomics often extends to the international sphere because domestic markets are linked to foreign markets through trade, investment, and capital flows. But microeconomics can have an international component as well. Single markets often are not confined to single countries; the global market for petroleum is an obvious example. The macro/micro split is institutionalized in economics, from beginning courses in “principles of economics” through to postgraduate studies. Economists commonly consider themselves microeconomists or macroeconomists. The American Economic Association recently introduced several new academic journals. One is called *Microeconomics*. Another, appropriately, is titled *Macroeconomics*.

Why the divide?

It was not always this way. In fact, from the late 18th century until the Great Depression of the 1930s, economics was economics-the study of how human societies organize the production, distribution, and consumption of goods and services. The field began with the observations of the earliest economists, such as Adam Smith, the Scottish philosopher popularly credited with being the father of economics-although scholars were making economic observations long before Smith authored *The Wealth of Nations* in 1776. Smith’s notion of an invisible hand that guides someone seeking to maximize his or her own well-being to provide the best overall result for society as a whole is one of the most compelling notions in the social sciences. Smith and other early economic thinkers such as David Hume gave birth to the field at the onset of the Industrial Revolution.

Economic theory developed considerably between the appearance of Smith’s *The Wealth of Nations* and the Great Depression, but there was no separation into microeconomics and macroeconomics. Economists implicitly assumed that either markets were in equilibrium-such that prices would adjust to equalize supply and demand-or that in the event of a transient

shock, such as a financial crisis or a famine, markets would quickly return to equilibrium. In other words, economists believed that the study of individual markets would adequately explain the behavior of what we now call aggregate variables, such as unemployment and output.

The severe and prolonged global collapse in economic activity that occurred during the Great Depression changed that. It was not that economists were unaware that aggregate variables could be unstable. They studied business cycles-as economies regularly changed from a condition of rising output and employment to reduced or falling growth and rising unemployment, frequently punctuated by severe changes or economic crises. Economists also studied money and its role in the economy. But the economics of the time could not explain the Great Depression. Economists operating within the classical paradigm of markets always being in equilibrium had no plausible explanation for the extreme "market failure" of the 1930s.

If Adam Smith is the father of economics, John Maynard Keynes is the founding father of macroeconomics. Although some of the notions of modern macroeconomics are rooted in the work of scholars such as Irving Fisher and Knut Wicksell in the late 19th and early 20th centuries, macroeconomics as a distinct discipline began with Keynes's masterpiece, *The General Theory of Employment, Interest and Money*, in 1936. Its main concern is the instability of aggregate variables. Whereas early economics concentrated on equilibrium in individual markets, Keynes introduced the simultaneous consideration of equilibrium in three interrelated sets of markets-for goods, labor, and finance. He also introduced "disequilibrium economics," which is the explicit study of departures from general equilibrium. His approach was taken up by other leading economists and developed rapidly into what is now known as macroeconomics.

Coexistence and Complementarity

Microeconomics is based on models of consumers or firms (which economists call agents) that make decisions about what to buy, sell, or produce-with the assumption that those decisions result in perfect market clearing (demand equals supply) and other ideal conditions. Macroeconomics, on the other hand, began from observed divergences from what would have been anticipated results under the classical tradition. Today the two fields coexist and complement each other. Microeconomics, in its examination of the behavior of individual consumers and firms, is divided into consumer demand theory, production theory (also called the theory of the firm), and related topics such as the nature of market competition, economic welfare, the role of imperfect information in economic outcomes, and at the most abstract, general equilibrium, which deals simultaneously with many markets. Much economic analysis is microeconomic in nature. It concerns such issues as the effects of minimum wages, taxes, price supports, or monopoly on individual markets

and is filled with concepts that are recognizable in the real world. It has applications in trade, industrial organization and market structure, labor economics, public finance, and welfare economics. Microeconomic analysis offers insights into such disparate efforts as making business decisions or formulating public policies. Macroeconomics is more abstruse. It describes relationships among aggregates as big as to be hard to apprehend-such as national income, savings, and the overall price level. The field is conventionally divided into the study of national economic growth in the long run, the analysis of short-run departures from equilibrium, and the formulation of policies to stabilize the national economy-that is, to minimize fluctuations in growth and prices. Those policies can include spending and taxing actions by the government or monetary policy actions by the central bank.

Bridging the Micro/Macro Divide

Like physical scientists, economists develop theory to organize and simplify knowledge about a field and to develop a conceptual framework for adding new knowledge. Science begins with the accretion of informal insights, particularly with observed regular relationships between variables that are so stable they can be codified into "laws." Theory is developed by pinning down those invariant relationships through both experimentation and formal logical deductions-called models. Since the Keynesian revolution, the economics profession has had essentially two theoretical systems, one to explain the small picture, the other to explain the big picture (micro and macro are the Greek words, respectively, for "small" and "big"). Following the approach of physics, for the past quarter century or so, a number of economists have made sustained efforts to merge microeconomics and macroeconomics. They have tried to develop microeconomic foundations for macroeconomic models on the grounds that valid economic analysis must begin with the behavior of the elements of microeconomic analysis: individual households and firms that seek to optimize their conditions.

There have also been attempts to use very fast computers to simulate the behavior of economic aggregates by summing the behavior of large numbers of households and firms. It is too early to say anything about the likely outcome of this effort. But within the field of macroeconomics there is continuing progress in improving models, whose deficiencies were exposed by the instabilities that occurred in world markets during the global financial crisis that began in 2008.

How they differ

Contemporary microeconomic theory evolved steadily without fanfare from the earliest theories of how prices are determined. Macroeconomics, on the other hand, is rooted in empirical observations that existing theory could not explain. How to interpret those anomalies has always been controversial. There are no competing schools of thought in microeconomics-

which is unified and has a common core among all economists. The same cannot be said of macroeconomics-where there are, and have been, competing schools of thought about how to explain the behavior of economic aggregates. Those schools go by such names as New Keynesian or New Classical. But these divisions have been narrowing over the past few decades (Blanchard, Dell'Ariccia, and Mauro, 2010).

Microeconomics and macroeconomics are not the only distinct subfields in economics. Econometrics, which seeks to apply statistical and mathematical methods to economic analysis, is widely considered the third core area of economics. Without the major advances in econometrics made over the past century or so, much of the sophisticated analysis achieved in microeconomics and macroeconomics would not have been possible. The study of microeconomics involves several key concepts, including (but not limited to):

- Incentives and behaviors: How people, as individuals or in firms, react to the situations with which they are confronted.
- Utility theory: Consumers will choose to purchase and consume a combination of goods that will maximize their happiness or "utility," subject to the constraint of how much income they have available to spend.
- Production theory: This is the study of production-or the process of converting inputs into outputs. Producers seek to choose the combination of inputs and methods of combining them that will minimize cost in order to maximize their profits.
- Price theory: Utility and production theory interact to produce the theory of supply and demand, which determine prices in a competitive market. In a perfectly competitive market, it concludes that the price demanded by consumers is the same supplied by producers. That results in economic equilibrium.

Macroeconomics

Definition, History, and Schools of Thought What Is Macroeconomics?

Macroeconomics is a branch of economics that studies how an overall economy-the markets, businesses, consumers, and governments-behave. Macroeconomics examines economy-wide phenomena such as inflation, price levels, rate of economic growth, national income, gross domestic product (GDP), and changes in unemployment. Some of the key questions addressed by macroeconomics include: What causes unemployment? What causes inflation? What creates or stimulates economic growth? Macroeconomics attempts to measure how well an economy is performing, understand what forces drive it, and project how performance can improve.

Understanding Macroeconomics

As the term implies, macroeconomics is a field of study that

analyzes an economy through a wide lens. This includes looking at variables like unemployment, GDP, and inflation. In addition, macroeconomists develop models explaining the relationships between these factors. These models, and the forecasts they produce, are used by government entities to aid in constructing and evaluating economic, monetary, and fiscal policy. Businesses use the models to set strategies in domestic and global markets, and investors use them to predict and plan for movements in various asset classes. Properly applied, economic theories can illuminate how economies function and the long-term consequences of particular policies and decisions. Macroeconomic theory can also help individual businesses and investors make better decisions through a more thorough understanding of the effects of broad economic trends and policies on their own industries.

History of Macroeconomics

While the term "macroeconomics" is not all that old (going back to the 1940s), many of macroeconomics's core concepts have been the study focus for much longer. Topics like unemployment, prices, growth, and trade have concerned economists since the beginning of the discipline in the 1700s. Elements of earlier work from Adam Smith and John Stuart Mill addressed issues that would now be recognized as the domain of macroeconomics.

In its modern form, macroeconomics is often defined as starting with John Maynard Keynes and his book *The General Theory of Employment, Interest, and Money* in 1936. Keynes explained the fallout from the Great Depression when goods remained unsold, and workers were unemployed. Before the popularization of Keynes' theories, economists did not generally differentiate between micro- and macroeconomics. The same microeconomic laws of supply and demand that operate in individual goods markets were understood to interact between individual markets to bring the economy into a general equilibrium, as described by Leon Walras. The link between goods markets and large-scale financial variables such as price levels and interest rates was explained through the unique role that money plays in the economy as a medium of exchange by economists such as Knut Wicksell, Irving Fisher, and Ludwig von Mises.

Macroeconomics, study of the behavior of a national or regional economy as a whole. It is concerned with understanding economy-wide events such as the total amount of goods and services produced, the level of unemployment, and the general behavior of prices. Unlike microeconomics-which studies how individual economic actors, such as consumers and firms, make decisions-macroeconomics concerns itself with the aggregate outcomes of those decisions. For that reason, in addition to using the tools of microeconomics, such as supply-and-demand analysis, macroeconomists also utilize aggregate measures such as gross domestic product (GDP), unemployment rates, and the consumer price index (CPI) to study the large-scale repercussions of micro-level decisions.

Early History and the Classical School

Although complex macroeconomic structures have been characteristic of human societies since ancient times, the discipline of macroeconomics is relatively new. Until the 1930s most economic analysis was focused on microeconomic phenomena and concentrated primarily on the study of individual consumers, firms and industries. The classical school of economic thought, which derived its main principles from Scottish economist Adam Smith's theory of self-regulating markets, was the dominant philosophy. Accordingly, such economists believed that economy-wide events such as rising unemployment and recessions are like natural phenomena and cannot be avoided. If left undisturbed, market forces would eventually correct such problems; moreover, any intervention by the government in the operation of free markets would be ineffective at best and destructive at worst.

Keynesianism

The classical view of macroeconomics, which was popularized in the 19th century as *laissez-faire*, was shattered by the Great Depression, which began in the United States in 1929 and soon spread to the rest of the industrialized Western world. The sheer scale of the catastrophe, which lasted almost a decade and left a quarter of the U.S. workforce without jobs, threatening the economic and political stability of many countries, was sufficient to cause a paradigm shift in mainstream macroeconomic thinking, including a reevaluation of the belief that markets are self-correcting. The theoretical foundations for that change were laid in 1935-36, when the British economist John Maynard Keynes published his monumental work *The General Theory of Employment, Interest, and Money*. Keynes argued that most of the adverse effects of the Great Depression could have been avoided had governments acted to counter the depression by boosting spending through fiscal policy. Keynes thus ushered in a new era of macroeconomic thought that viewed the economy as something that the government should actively manage. Economists such as Paul Samuelson, Franco Modigliani, James Tobin, Robert Solow, and many others adopted and expanded upon Keynes's ideas, and as a result the Keynesian school of economics was born.

In contrast to the hands-off approach of classical economists, the Keynesians argued that governments have a duty to combat recessions. Although the ups and downs of the business cycle cannot be completely avoided, they can be tamed by timely intervention. At times of economic crisis, the economy is crippled because there is almost no demand for anything. As businesses' sales decline, they begin laying off more workers, which causes a further reduction in income and demand, resulting in a prolonged recessionary cycle. Keynesians argued that, because it controls tax revenues, the government has the means to generate demand simply by increasing spending on goods and services during such times of hardship.

Monetarism

In the 1950s the first challenge to the Keynesian school of thought came from the monetarists, who were led by the influential University of Chicago economist Milton Friedman. Friedman proposed an alternative explanation of the Great Depression: he argued that what had started as a recession was turned into a prolonged depression because of the disastrous monetary policies followed by the Federal Reserve System (the central bank of the United States). If the Federal Reserve had started to increase the money supply early on, instead of doing just the opposite, the recession could have been effectively tamed before it got out of control. Over time, Friedman's ideas were refined and came to be known as monetarism. In contrast to the Keynesian strategy of boosting demand through fiscal policy, monetarists favored controlled increases in the money supply as a means of fighting off recessions. Beyond that, the government should avoid intervening in free markets and the rest of the economy, according to monetarists.

Macroeconomics vs. Microeconomics

Macroeconomics differs from microeconomics, which focuses on smaller factors that affect choices made by individuals and companies. Factors studied in both microeconomics and macroeconomics typically influence one another. A key distinction between micro- and macroeconomics is that macroeconomic aggregates can sometimes behave in very different ways or even the opposite of similar microeconomic variables. For example, Keynes referenced the so-called Paradox of Thrift, which argues that individuals save money to build wealth (micro). However, when everyone tries to increase their savings at once, it can contribute to a slowdown in the economy and less wealth in the aggregate (macro). This is because there would be a reduction in spending, affecting business revenues and lowering worker pay. Meanwhile, microeconomics looks at economic tendencies, or what can happen when individuals make certain choices. Individuals are typically classified into subgroups, such as buyers, sellers, and business owners. These actors interact with each other according to the laws of supply and demand for resources, using money and interest rates as pricing mechanisms for coordination.

Limits of Macroeconomics

It is also important to understand the limitations of economic theory. Theories are often created in a vacuum and lack specific real-world details like taxation, regulation, and transaction costs. The real world is also decidedly complicated and includes matters of social preference and conscience that do not lend themselves to mathematical analysis. Even with the limits of economic theory, it is important and worthwhile to follow significant macroeconomic indicators like GDP, inflation, and unemployment. This is because the performance of companies, and by extension their stocks, is significantly influenced by the economic conditions in

which the companies operate. Likewise, it can be invaluable to understand which theories are in favor and influence a particular government administration. The underlying economic principles of a government will say much about how that government will approach taxation, regulation, government spending, and similar policies. By better understanding economics and the ramifications of economic decisions, investors can get at least a glimpse of the probable future and act accordingly with confidence.

Macroeconomic Schools of Thought

The field of macroeconomics is organized into many different schools of thought, with differing views on how the markets and their participants operate.

Classical

Classical economists held that prices, wages, and rates are flexible, and markets tend to clear unless prevented from doing so by government policy, building on Adam Smith's original theories. The term "classical economists" is not actually a school of macroeconomic thought, but a label applied first by Karl Marx and later by Keynes to denote previous economic thinkers with whom they respectively disagreed.

Monetarist

The Monetarist school is a branch of Keynesian economics credited mainly to the works of Milton Friedman. Working within and extending Keynesian models, Monetarists argue that monetary policy is generally a more effective and desirable policy tool to manage aggregate demand than fiscal policy. However, monetarists also acknowledge limits to monetary policy that make fine-tuning the economy ill-advised and instead tend to prefer adherence to policy rules that promote stable inflation rates.

New Keynesian

The New Keynesian School also attempts to add microeconomic foundations to traditional Keynesian economic theories. While New Keynesians accept that households and firms operate based on rational expectations, they still maintain that there are a variety of market failures, including sticky prices and wages. Because of this "stickiness," the government can improve macroeconomic conditions through fiscal and monetary policy.

Austrian

The Austrian School is an older school of economics that is seeing some resurgence in popularity. Austrian economic theories mainly apply to microeconomic phenomena. However, they, like the so-called classical economists, never strictly separated micro and macroeconomics. Austrian theories also have important implications for what is otherwise considered macroeconomic subjects. In particular, the Austrian business cycle theory explains broadly synchronized (macroeconomic) swings in economic activity across markets due to monetary policy and the role that money and banking play in linking (microeconomic) markets to each other and across time.

Macroeconomic Indicators

Macroeconomics is a rather broad field, but two specific research areas represent this discipline. The first area is the factors that determine long-term economic growth or increases in the national income. The other involves the causes and consequences of short-term fluctuations in national income and employment, also known as the business cycle.

Economic Growth

Economic growth refers to an increase in aggregate production in an economy. Macroeconomists try to understand the factors that either promote or retard economic growth to support economic policies that will support development, progress, and rising living standards. Economists can use many indicators to measure economic performance. These indicators fall into 10 categories:

- Gross Domestic Product indicators: Measure how much the economy produces
- Consumer Spending indicators: Measure how much capital consumers feed back into the economy
- Income and Savings indicators: Measures how much consumers make and save
- Industry Performance indicators: Measures GDP by industry
- International Trade and Investment indicators: Indicates the balance of payments between trade partners, how much is traded, and how much is invested internationally
- Prices and Inflation indicators: Indicate fluctuations in prices paid for goods and services and changes in currency purchasing power
- Investment in Fixed Assets indicators: Indicate how much capital is tied up in fixed assets
- Employment indicators: Shows employment by industry, state, county, and other areas
- Government indicators: Shows how much the government spends and receives
- Special indicators: All other economic indicators, such as distribution of personal income, global value chains, healthcare spending, small business well-being, and more

The Business Cycle

Superimposed over long-term macroeconomic growth trends, the levels and rates of change of significant macroeconomic variables such as employment and national output go through fluctuations. These fluctuations are called expansions, peaks, recessions, and troughs—they also occur in that order. When charted on a graph, these fluctuations show that businesses perform in cycles; thus, it is called the business cycle. The National Bureau of Economic Research (NBER) measures the business

cycle, which uses GDP and Gross National Income to date the cycle.² The NBER is also the agency that declares the beginning and end of recessions and expansions.

How to Influence Macroeconomics

Because macroeconomics is such a broad area, positively influencing the economy is challenging and takes much longer than changing the individual behaviors within microeconomics. Therefore, economies need to have an entity dedicated to researching and identifying techniques that can influence large-scale changes. In the U.S., the Federal Reserve is the central bank with a mandate of promoting maximum employment and price stability. These two factors have been identified as essential to positively influencing change at the macroeconomic level. To influence change, the Fed implements monetary policy through tools it has developed over the years, which work to affect its dual mandates. It has the following tools it can use:

- **Federal Funds Rate Range:** A target range set by the Fed that guides interest rates on overnight lending between depository institutions to boost short-term borrowing
- **Open Market Operations:** Purchase and sell securities on the open market to change the supply of reserves
- **Discount Window and Rate:** Lending to depository institutions to help banks manage liquidity
- **Reserve Requirements:** Maintaining a reserve to help banks maintain liquidity-reduced to 0% in 2020
- **Interest on Reserve Balances:** Encourages banks to hold reserves for liquidity and pays them interest for doing so
- **Overnight Repurchase Agreement Facility:** A supplementary tool used to help control the federal funds rate by selling securities and repurchasing them the next day at a more favorable rate
- **Term Deposit Facility:** Reserve deposits with a term, used to drain reserves from the banking system
- **Central Bank Liquidity Swaps:** Established swap lines for central banks from select countries to improve liquidity conditions in the U.S. and participating countries' central banks
- **Foreign and International Monetary Authorities Repo Facility:** A facility for institutions to enter repurchase agreements with the Fed to act as a backstop for liquidity
- **Standing Overnight Repurchase Agreement Facility:** A facility to encourage or discourage borrowing above a set rate, which helps to control the effective federal funds rate.

The Fed continuously updates the tools it uses to influence the economy, so it has a list of 14 other previously used tools it can implement again if needed.

Later Developments

A second challenge to the Keynesian school arose in the 1970s, when the American economist Robert E. Lucas, Jr., laid the foundations of what came to be known as the New Classical school of thought in economics. Lucas's key introduced the rational-expectations hypothesis. As opposed to the ideas in earlier Keynesian and monetarist models that viewed the individual decision makers in the economy as shortsighted and backward-looking, Lucas argued that decision makers, insofar as they are rational, do not base their decisions solely on current and past data; they also form expectations about the future on the basis of a vast array of information available to them. That fact implies that a change in monetary policy, if it has been predicted by rational agents, will have no effect on real variables such as output and the unemployment rate, because the agents will have acted upon the implications of such a policy even before it is implemented. As a result, predictable changes in monetary policy will result in changes in nominal variables such as prices and wages but will not have any real effects.

Following Lucas's pioneering work, economists including Finn E. Kydland and Edward C. Prescott developed rigorous macroeconomic models to explain the fluctuations of the business cycle, which came to be known in the macroeconomic literature as real-business-cycle (RBC) models. RBC models were based on strong mathematical foundations and utilized Lucas's idea of rational expectations. An important outcome of the RBC models was that they were able to explain macroeconomic fluctuations as the product of a myriad of external and internal shocks (unpredictable events that hit the economy). Primarily, they argued that shocks that result from changes in technology can account for the majority of the fluctuations in the business cycle. The tendency of RBC models to overemphasize technology-driven fluctuations as the primary cause of business cycles and to underemphasize the role of monetary and fiscal policy led to the development of a new Keynesian response in the 1980s. New Keynesians, including John B. Taylor and Stanley Fischer, adopted the rigorous modeling approach introduced by Kydland and Prescott in the RBC literature but expanded it by altering some key underlying assumptions. Previous models had relied on the fact that nominal variables such as prices and wages are flexible and respond very quickly to changes in supply and demand. However, in the real world, most wages and many prices are locked in by contractual agreements. That fact introduces "stickiness," or resistance to change, in those economic variables. Because wages and prices tend to be sticky, economic decision makers may react to macroeconomic events by altering other variables. For example, if wages are sticky, businesses will find themselves laying off more workers than they would in an unrealistic environment in which every employee's salary could be cut in half.

Introducing market imperfections such as wage and price stickiness helped Taylor and Fischer to build macroeconomic models that represented the business cycle more accurately. In particular, they were able to show that in a world of market imperfections such as stickiness, monetary policy will have a direct impact on output and on employment in the short run, until enough time has passed for wages and prices to adjust. Therefore, central banks that control the supply of money can very well influence the business cycle in the short run. In the long run, however, the imperfections become less binding, as contracts can be renegotiated, and monetary policy can influence only prices. Following the new Keynesian revolution, macroeconomists seemed to reach a consensus that monetary policy is effective in the short run and can be used as a tool to tame business cycles. Many other macroeconomic models were developed to measure the extent to which monetary policy can influence output. More recently, the impact of the financial crisis of 2007-08 and the Great Recession that followed it, coupled with the fact that many governments adopted a very Keynesian response to those events, brought about a revival of interest in the new Keynesian approach to macroeconomics, which seemed likely to lead to improved theories and better macroeconomic models in the future.

Management Economic

What Is Managerial Economics?

One standard definition for economics is the study of the production, distribution, and consumption of goods and services. A second definition is the study of choice related to the allocation of scarce resources. The first definition indicates that economics includes any business, nonprofit organization, or administrative unit. The second definition establishes that economics is at the core of what managers of these organizations do. This book presents economic concepts and principles from the perspective of “managerial economics,” which is a subfield of economics that places special emphasis on the choice aspect in the second definition. The purpose of managerial economics is to provide economic terminology and reasoning for the improvement of managerial decisions.

Most readers will be familiar with two different conceptual approaches to the study of economics: microeconomics and macroeconomics. Microeconomics studies phenomena related to goods and services from the perspective of individual decision-making entities—that is, households and businesses. Macroeconomics approaches the same phenomena at an aggregate level, for example, the total consumption and production of a region. Microeconomics and macroeconomics each have their merits. The microeconomic approach is essential for understanding the behavior of atomic entities in an economy. However, understanding the systematic interaction of the many households and businesses would be too complex to derive from descriptions of the individual units. The macroeconomic approach provides measures and theories to understand the

overall systematic behavior of an economy. Since the purpose of managerial economics is to apply economics for the improvement of managerial decisions in an organization, most of the subject material in managerial economics has a microeconomic focus. However, since managers must consider the state of their environment in making decisions and the environment includes the overall economy, an understanding of how to interpret and forecast macroeconomic measures is useful in making managerial decisions.

Why Managerial Economics Is Relevant for Managers

In a civilized society, we rely on others in the society to produce and distribute nearly all the goods and services we need. However, the sources of those goods and services are usually not other individuals but organizations created for the explicit purpose of producing and distributing goods and services. Nearly every organization in our society—whether it is a business, nonprofit entity, or governmental unit—can be viewed as providing a set of goods, services, or both. The responsibility for overseeing and making decisions for these organizations is the role of executives and managers.

Most readers will readily acknowledge that the subject matter of economics applies to their organizations and to their roles as managers. However, some readers may question whether their own understanding of economics is essential, just as they may recognize that physical sciences like chemistry and physics are at work in their lives but have determined they can function successfully without a deep understanding of those subjects.

Whether or not the readers are skeptical about the need to study and understand economics per se, most will recognize the value of studying applied business disciplines like marketing, production/operations management, finance, and business strategy. These subjects form the core of the curriculum for most academic business and management programs, and most managers can readily describe their role in their organization in terms of one or more of these applied subjects. A careful examination of the literature for any of these subjects will reveal that economics provides key terminology and a theoretical foundation. Although we can apply techniques from marketing, production/operations management, and finance without understanding the underlying economics, anyone who wants to understand the why and how behind the technique needs to appreciate the economic rationale for the technique.

We live in a world with scarce resources, which is why economics is a practical science. We cannot have everything we want. Further, others want the same scarce resources we want. Organizations that provide goods and services will survive and thrive only if they meet the needs for which they were created and do so effectively. Since the organization's customers also have limited resources, they will not allocate their scarce resources to acquire something of little or no value. And even if the goods or services are of value, when another organization can meet the

same need with a more favorable exchange for the customer, the customer will shift to the other supplier. Put another way, the organization must create value for their customers, which is the difference between what they acquire and what they produce. The thesis of this book is that those managers who understand economics have a competitive advantage in creating value.

Managerial Economics Explained

Managerial economics analyzes the internal and external factors impacting an organization. It aims to resolve problems using micro and macroeconomic tools. Thus, it is a practical approach where economic measures are undertaken to solve business problems. In addition to solving problems, this approach extends to the growth and sustainability of a firm. Managerial economics is defined as the branch of economics which deals with the application of various concepts, theories, and methodologies of economics to solve practical problems in business management. It is also reckoned as the amalgamation of economic theories and business practices to ease the process of decision making. Managerial economics is also said to cover the gap between the problems of logic and problems of policy. Managerial economics is used to find a rational solution to problems faced by firms. These problems include issues around demand, cost, production, marketing, and it is used also for future planning. The best thing about managerial economics is that it has a logical solution to almost every problem that may arise during business management and that too by sticking to the microeconomic policies of the firm. When we talk of managerial economics as a subject, it is a branch of management studies that emphasizes solving business problems using theories of micro and macroeconomics. Spencer and Siegelman have defined the subject as “the integration of economic theory with business practice to facilitate decision making and planning by management.” The study of managerial economics helps the students to enhance their analytical skills, developing a mindset that enables them to find rational solutions.

It is further classified into three subtypes:

- Liberal: Consumer demand dictates markets; customers are free to make their buying decisions and choices.
- Normative: The administration takes pragmatic decisions pertaining to cost management, demand analysis, production, and advertising.
- Radical: The management adopts a game-changing attitude to prioritize customer needs, requirements, and satisfaction-over business profits.

N. Gregory Mankiw stated managerial economics is about answering three crucial questions:

1. How do people make decisions?
2. How do people interact?
3. How does the economy work as a whole?

Finding answers to these questions can drive a business towards success.

Scope of Managerial Economics

The concept is implemented in the following ways:

Microeconomics for Solving Operational Problems

Managers apply microeconomic principles and theories to handle internal issues-production, sales, distribution, capital, pricing, profit, workforce, etc. Given below are the various microeconomic theories:

1. Production Theory: In order to ensure high productivity with limited resources, microeconomics studies the impact of production-related decisions: capital requirement, labor requirement, production capacity, process, methods, techniques, cost, and quality,
2. Investment Theory: Companies diligently plan their capital investment to ensure resource utilization-generating higher returns.
3. Demand Theory: To ensure consumer satisfaction, managers analyze consumer needs and requirements-they understand consumer attitudes and responses toward company products or services.
4. Market Structure Pricing Theory: It involves price determination and management-the business prices its products and services very competitively. To determine the price, the firms consider production cost, market demand, and marketing cost.
5. Profit Management: Profit maximization is the ultimate aim-this approach focuses on cost and revenue.

Macroeconomics for Handling External Environment Issues

Businesses operate in external environments-face unforeseen challenges. Macroeconomics deals with external challenges with the help of tools like PESTEL analysis.

Let us go through the components in detail:

1. Political (P): The government plays a critical role in a firm's progress. Thus, managerial economics studies how governance style, political unrest, and foreign collaboration affect private sector companies.
2. Economic (E): Business profitability greatly depends on government policies, tax reforms, GDP, and the nation's economic stability.
3. Social (S): The social environment molds businesses. This includes factors like societal values, beliefs, attitudes, consumer awareness, employment conditions, literacy rate, and trade unions.
4. Technological (T): Technology enhances the production

and distribution of goods or services.

5. **Environmental (E):** When awareness of environmental concerns increases-firms face pressure to adopt sustainable and eco-friendly practices. This includes the curtailing of pollution, waste management, preservation of water, and preservation of natural resources.

6. **Legal (L):** Businesses must operate within legal boundaries-national laws pertaining to consumer rights, labor laws, health and safety laws, product labeling regulations, and advertising guidelines.

Nature of Managerial Economics

We know about managerial economics like what it is and how different people define it. Managerial Economics is an essential scholastic field. It can be termed as a science in the sense that it fulfills the criteria of being a science.

- We all know science as a systematic body of knowledge, and it is based on methodological observations. Similarly, Managerial Economics is also a science of making decisions and finding alternatives, keeping the scarce of resources in mind.
- In science, we arrive at any conclusion after continuous experimentation. Similarly, in managerial economics policies are formed after constant testing and trailing.
- In science, principles are universally acceptable and in managerial economics, policies are universally applicable at least partially if not fully.

We will now look at the characteristics of managerial economics in brief.

1. Art and Science

Managerial Economics requires a lot of creativity and logical thinking to come up with a solution. A managerial economist should possess the art of utilizing his capabilities, knowledge, and skills to achieve the organizational objective. Managerial Economics is also considered as a stream of science as it involves the application of different economic principles, techniques, and methods to solve business problems.

2. Microeconomics

In managerial economics, problems of a particular organization are looked upon rather than focusing on the whole economy. Therefore, it is termed as a part of microeconomics.

3. Uses Macroeconomics

Any organization operates in a market that is a part of the whole economy, so external environments affect the decisions within the organization. Managerial Economics uses the concepts of macroeconomics to solve problems. Managers analyze

macroeconomic factors like market conditions, economic reforms, and government policies to understand their impact on the organization.

4. Multi-Disciplinary

Managerial Economics uses different tools and principles from different disciplines like accounting, finance, statistics, mathematics, production, operation research, human resource, marketing, etc. This helps in coming up with a perfect solution.

5. Management Oriented and Pragmatic

Managerial economics is a tool in the hands of managers that aids them in finding appropriate solutions to business-related problems and uncertainties. As mentioned above, managerial economics also helps in goal establishment, policy formation, and effective decision making. It is a practical approach to find solutions.

Types of Managerial Economics

Everyone has their perceiving ability, so the same goes for managerial economics. All managers perceive the concept of managerial economics differently. For some, customers' satisfaction can be the priority while some may focus on efficient production. This leads us to different types of managerial economics. So, let us explore the different approaches to managerial economics.

1. Liberal Managerialism

Market is a free and democratic place in terms of decision making. Customers get a lot many options to choose from. So, companies have to modify their policies according to consumers' demands and market trends. If not done so, it may result in business failures. This is what we call liberal managerialism.

2. Normative Managerialism

The normative view of managerial economics means that the decisions taken by the administration would be normal, based on real-life experiences and practices. The decisions reflect a practical approach regarding product design, forecasting, marketing, supply and demand analysis, recruitment, and everything else that is concerned with the growth of a business.

3. Radical Managerialism

Radical managerialism means to come up with revolutionary solutions. Sometimes, when the conventional approach to a problem doesn't work, radical managerialism may have the solution. However, it requires the manager to possess some extraordinary skills and thinking to look beyond. In radical managerialism, consumer needs and satisfaction are prioritized over profit maximization. So, these were the three different types of managerial economics. These are decided based on the different approaches by managers. Managerial economics has often been confused with traditional economics, but it has a whole

new meaning and purpose. Let us understand the distinction by venturing deeper into its characteristics:

- **Microeconomics:** It solves microeconomic problems faced by a particular firm-does not focus on the entire economy.
- **Pragmatic:** Managerial economics is a practical approach-it applies economic principles in decision-making and problem-solving.
- **Multidisciplinary:** This approach aggregates multiple streams-business, management, accounting, statistics, finance, and mathematics.
- **Application of Macro Economics:** Every firm operates in an external environment-influenced by legal, political, global, social, economic, technological, competitive, and demographic factors. Macroeconomics deals with all these threats.
- **Management Oriented:** It educates leaders and managers on how to make crucial decisions in critical situations.

Importance

Following are areas where managerial economics plays a key role:

- The companies use managerial economics for forecasting demand. Based on demand projections, long-term business policies are formulated.
- The external environment poses various challenges and uncertainties. This discipline creates an estimate of those threats; as a result, firms can prepare themselves for damage limitation strategies.
- Inventory management is crucial for business. By employing demand analysis, firms can plan inventory beforehand.
- It facilitates the determination of the future cost of the business. Scarce resources can be utilized efficiently; this way total cost of production and sales can be mitigated.
- This study aids top-level management in making critical capital management decisions-investing in the right venture.

Frequently Asked Questions (FAQs)

What is managerial economics?

It is a management discipline that emphasizes the implementation of micro and macro-economic principles. These theories, methodologies, and concepts are utilized for decision-making and problem-solving.

What is the role of managerial economics?

It plays a key role in business management-it facilitates decision making, planning, demand projections, coordination, cost analysis, cost control, production analysis, profit management, and capital management.

How does managerial economics differ from economics?

It is a systematic application of the various economic policies for decision-making. It solves business problems and focuses on the utilization of scarce resources. Traditional economics, on the other hand, studies the need and availability of resources for enhancing the production, distribution, and consumption of commodities. It focuses on the allocation of limited resources.

What are the characteristics of managerial economics?

Its characteristics are as follows:

- #1 Microeconomic
- #2 Multidisciplinary
- #3 Goal-oriented
- #4 Practical
- #5 Dynamic
- #6 Normative
- #7 Conceptual
- #8 Metrical approach.

Principles of Managerial Economics

The great macroeconomist N. Gregory Mankiw has given ten principles to explain the significance of managerial economics in business operations which can be further classified into three categories.

Based on the real-life decision-making processes, four principles are recalled in Managerial Economics.

1. People Face Tradeoffs

There are enormous options in the market. So, people have to make choices among the various options available.

2. Opportunity Cost

Every decision involves an opportunity cost that is the cost of those options which we let go of while selecting the most appropriate one.

3. Rational People Think at the Margin

When we make choices from the various options available and before investing the capital or resources we look at the profit margin we would make in the investment.

4. People Respond to Incentives

It is human nature to look for something extra while purchasing something. Decision-making is affected by the incentives attached to a particular product or service. Positive incentive motivates people to opt for the particular product while negative incentive discourages.

Principles of How People Interact

Communication with the audience plays a vital role in good performance. Over the years, organizations have realized the need to communicate well with their audience. Based on this, three principles are given in Managerial Economics.

1. Trade can Make Everyone Better Off

This principle states that trade is a medium to exchange services and products. Everyone gets a fair chance to offer products and services which they are good at making and also to purchase those products and services.

2. Markets Are Usually A Good Way to Organize Economic Activity

Market is a place where buyers and sellers interact with each other. Consumers put in their demands and requirements and the producers decide on the production and supply of those products and services.

3. Government can better the market outcomes

Government intervenes in business operations whenever there are unfavorable market conditions like the current pandemic situation or also for the welfare of society. One example of the latter is deciding the minimum wage for laborers.

Principle of How Economy Works as a Whole

Three principles are given to explain the role of the economy in the functioning of an organization.

1. A Country's Standard of Living Depends on the Goods and Services produced

The role of organizations in the economic growth of a country is one of the major, so, the organizations must be capable enough to produce goods and services for the population. This ultimately raises the standard of living and also contributes to GDP growth.

2. Price Rises When Government Prints Too Much Money

If there is surplus money available to people, their spending capacity increases, ultimately leading to a rise in demand. When the producers are unable to meet the consumer's demand, inflation takes place.

3. Society Faces a Short-Run Tradeoff between Inflation and Unemployment

Government bring-in policies to tackle the problem of unemployment and boost the economy in the short run as well. This further leads to inflation.

Scope of Managerial Economics

Managerial Economics has a narrower scope. It solves a firm's problem using microeconomics. In the situation of scarce

resources, managerial economics ensures that managers make effective and efficient decisions that are equally beneficial to customers, suppliers, and the organization. The fact of scarcity of resources gives rise to three fundamental questions-

1. What to produce?
2. How to produce?
3. For whom to produce?

To answer these questions, a firm makes use of managerial economics principles.

Managerial Economics is not only applicable to profit-making business organizations, but also to non-profit organizations such as hospitals, schools, government agencies, etc.

What Is Hyperinflation?

Hyperinflation is what, in layman terms can be called as the economic equivalent of doomsday. Modern societies have become more and more accustomed to having inflation in their daily lives. This has been the case ever since the world went off the gold standard at the "Bretton Woods Conference" and almost all countries worldwide accepted fiat currencies as being the basis of their monetary system. The popular view is that inflation is a harmless byproduct of the modern monetary system. Hyperinflation, as some economists describe is this very same "harmless" inflation on steroids. It is nothing but a result of rising rates of inflation for multiple years. Hyperinflation is a grim reminder as to how inflation can wreak havoc on a monetary system and bring about its complete breakdown overnight! In this article, we will have a look at this interesting phenomenon. You can obtain a more detailed explanation from the following video.

Imagining Hyperinflation

The economic definition of hyperinflation is defined in terms of percentages and figures. This definition is interesting to read but to the average person they appear like big numbers. The average person is unable to fathom what hyperinflation really means until they are asked to imagine the following scenes:

- Imagine a scenario wherein a sweeper is sweeping on the streets except for the fact that he is sweeping away currency notes! Dollar bills and pounds just lying on the street as if they are worthless. The sweeper doesn't steal these notes and run away because these notes are indeed worthless. He quietly sweeps the streets, disposes millions of dollars in the garbage and heads home!
- Imagine a woman trying to keep her house warm in winters. Usually people use wood or old newspapers to keep the fire burning. Imagine a world where a woman uses currency notes to keep that fire burning. They are so worthless that the woman feels if she could heat her house by burning away millions of dollars, she has got a good deal!

Now, once again read the words “complete breakdown of monetary system” and understand this is what the world looks like when this economic cancer of hyperinflation wreaks havoc. There is no such thing as “normal life” during the period of hyperinflation. Everything about life becomes bizarre and unreal.

Consequences of Hyperinflation

Now since we know a fair bit about what hyperinflation really means, let's look at the consequences that hyperinflation is capable of causing in our daily lives:

- **Daily Price Rise:** Hyperinflation is a period when trust is in short supply. Everybody wants to buy their essentials before the money loses its value. It is for this reason that they all rush to spend their money as soon as they receive it causing a drastic rise in prices. In the worst cases of hyperinflation, prices were doubling every couple of hours.
- **Daily Payment of Wages:** Since prices of goods are rising daily, wage earners will not wait till the end of the month or week to obtain their wages. They want their wages to be paid to them every day. A lot of businesses have to shut down because they do not have the cash flow to sustain this, complicating the problem further!
- **Breakdown of Monetary System:** In most cases there is a complete breakdown of the monetary system. For an interim period of time, the nation resorts back to the gold standard. Later, usually the World Bank or IMF interferes and introduces some form of currency to stabilize the system. Usually, currencies like the dollar and pound sterling are used for this purpose.
- **Savings Wiped Out:** Since so much excess money is created, the amount of money lying in the bank loses its value. It does not matter whether there was a billion dollars or one single dollar in a bank account. In the event of hyperinflation their value is the same i.e., zero!

Major Currencies in Crisis

Another common misconception is that hyperinflation affects only economies in decline or those economies which are badly managed. This isn't the complete truth. The first real known case of hyperinflation was observed in the Roman Empire, and it began when the empire was at its helm bringing the whole system down. There have been many more cases in recorded history wherein major empires have been brought down by hyperinflation. If we look at the current scenario, almost all world currencies i.e., the dollar, the pound, the yen and the Swiss franc are dangerously close to a hyperinflationary spiral. It would not be farfetched to think that one or all of these currencies could soon face a major crisis.

Industrial Economics

Industrial Economics is the study of firms, industries, and markets. It looks at firms of all sizes - from local corner shops to

multinational giants such as Walmart or Tesco. And it considers a whole range of industries, such as electricity generation, car production, and restaurants.

When analyzing decision making at the levels of the individual firm and industry, Industrial Economics helps us understand such issues as:

- The levels at which capacity, output, and prices are set;
- The extent that products are differentiated from each other;
- How much firms invest in research and development (R&D)
- How and why firms advertise

Industrial Economics also gives insights into how firms organize their activities, as well as considering their motivation. In many micro courses, profit maximization is taken as given, but many industrial economics courses examine alternative objectives, such as trying to grow market share. There is also an international dimension - firms have the option to source inputs (or outsource production) overseas. As such, while industrial economics more frequently uses skills and knowledge from micro courses, macroeconomic concepts are sometimes employed. One of the key issues in industrial economics is assessing whether a market is competitive. Competitive markets are normally good for consumers (although they might not always be feasible) so most industrial economics courses include analysis of how to measure the extent of competition in markets. It then considers whether regulation is needed, and if so the form it should take. There is again an international dimension to this, as firms that operate in more than one country will face different regulatory regimes.

Industrial Economics uses theoretical models to understand firm and regulatory decision making, and so students should expect to use diagrams and maybe some basic mathematical models, including game theory. In addition, researchers often develop empirical statistical models to identify relationships between variables of interest: for example to understand the relationship between product price, advertising, and profits. While most courses will not require students to conduct their own empirical analysis (that is left to the econometrics courses) understanding and interpreting empirical results is an important skill. Industrial Economists are also highly employable. There is an entire industry of consultancies and government agencies (such as the Office of Fair Trading (OFT) and the Competition Commission (CC)) concerned with competition policy. There is an equally large set of consultancies and regulators (such as Ofcom (the communication sector regulator)) which are concerned with the economics of regulation.

Green Economy

A green economy is an economy that aims at reducing environmental risks and ecological scarcities, and that aims for

sustainable development without degrading the environment. It is closely related to ecological economics, but has a more politically applied focus. [1,2] The 2011 UNEP Green Economy Report argues “that to be green, an economy must not only be efficient, but also fair. Fairness implies recognizing global and country level equity dimensions, particularly in assuring a Just Transition to an economy that is low-carbon, resource efficient, and socially inclusive.”[3] A feature distinguishing it from prior economic regimes is the direct valuation of natural capital and ecological services as having economic value (see *The Economics of Ecosystems and Biodiversity* and *Bank of Natural Capital*) and a full cost accounting regime in which costs externalized onto society via ecosystems are reliably traced back to, and accounted for as liabilities of, the entity that does the harm or neglects an asset. [4] Green sticker and Eco label practices have emerged as consumer facing indicators of friendliness to the environment and sustainable development. Many industries are starting to adopt these standards as a way to promote their greening practices in a globalizing economy. Also known as sustainability standards, these standards are special rules that guarantee the products bought don't hurt the environment and the people that make them. The number of these standards has grown recently, and they can now help build a new, greener economy. They focus on economic sectors like forestry, farming, mining or fishing among others; concentrate on environmental factors like protecting water sources and biodiversity or reducing greenhouse gas emissions; support social protections and workers' rights; and home in on specific parts of production processes.[5]

Green Economists and Economics

Green economics is loosely defined as any theory of economics by which an economy is considered to be component of the ecosystem in which it resides (after Lynn Margulis). A holistic approach to the subject is typical, such that economic ideas are commingled with any number of other subjects, depending on the particular theorist. Proponents of feminism, postmodernism, the environmental movement, peace movement, green politics, green anarchism and anti-globalization movement have used the term to describe very different ideas, all external to mainstream economics. According to Büscher, the increasing liberalization of politics since the 1990s has meant that biodiversity must 'legitimize itself' in economic terms. Many non-governmental organizations, governments, banks, companies and so forth have started to claim the right to Define and defend biodiversity and in a distinctly neoliberal manner that subjects the concept's social, political, and ecological dimensions to their value as determined by capitalist markets.[6]

Some economists view green economics as a branch or subfield of more established schools. For instance, it is regarded as classical economics where the traditional land is generalized to natural capital and has some attributes in common with labor and physical capital (since natural capital assets like rivers directly substitute for man-made ones such as canals). Or, it is

viewed as Marxist economics with nature represented as a form of Lumpenproletariat, an exploited base of non-human workers providing surplus value to the human economy, or as a branch of neoclassical economics in which the price of life for developing vs. developed nations is held steady at a ratio reflecting a balance of power and that of non-human life is very low. An increasing commitment by the UNEP (and national governments such as the UK) to the ideas of natural capital and full cost accounting under the banner 'green economy' could blur distinctions between the schools and redefine them all as variations of "green economics". As of 2010 the Bretton Woods institutions (notably the World Bank [7] and International Monetary Fund (via its "Green Fund" initiative) responsible for global monetary policy have stated a clear intention to move towards biodiversity valuation and a more official and universal biodiversity finance.[8]

Taking these into account targeting not less but radically zero emission and waste is what is promoted by the Zero Emissions Research and Initiatives. [9] The UNEP 2011 Green Economy Report informs that “based on existing studies, the annual financing demand to green the global economy was estimated to be in the range US\$1.05 to US\$2.59 trillion. To place this demand in perspective, it is about one-tenth of total global investment per year, as measured by global Gross Capital Formation.” [3] At COP26, the European Investment Bank announced a set of just transition common principles agreed upon with multilateral development banks, which also align with the Paris Agreement. The principles refer to focusing financing on the transition to net zero carbon economies, while keeping socioeconomic effects in mind, along with policy engagement and plans for inclusion and gender equality, all aiming to deliver long-term economic transformation. [10,11] The African Development Bank, Asian Development Bank, Islamic Development Bank, Council of Europe Development Bank, Asian Infrastructure Investment Bank, European Bank for Reconstruction and Development, New Development Bank, and Inter-American Development Bank are among the multilateral development banks that have vowed to uphold the principles of climate change mitigation and a Just Transition. The World Bank Group also contributed. The International Chamber of Commerce (ICC) representing global business defines green economy as “an economy in which economic growth and environmental responsibility work together in a mutually reinforcing fashion while supporting progress on social development”.[15,16] In 2012, the ICC published the Green Economy Roadmap, containing contributions from international experts consulted bi-yearly. The roadmap represents a comprehensive and multidisciplinary effort to clarify and frame the concept of “green economy”. It highlights the role of business in bringing solutions to global challenges. It sets out the following 10 conditions which relate to business/intra-industry and collaborative action for a transition towards a green economy: Open and competitive markets

- Metrics, accounting, and reporting
- Finance and investment

- Awareness
- Life cycle approach
- Resource efficiency and decoupling
- Employment
- Education and skills
- Governance and partnership
- Integrated policy and decision-making

Finance and Investing

Eco-investing or green investing is a form of socially responsible investing where investments are made in companies that support or provide environmentally friendly products and practices. These companies encourage (and often profit from) new technologies that support the transition from carbon dependence to more sustainable alternatives. [17] Green finance is “any structured financial activity that has been created to ensure a better environmental outcome.” [18] As industries’ environmental impacts become more apparent, green topics have not only taken center stage in pop-culture, but the financial world as well. In the 1990s, many investors “began to look for those companies that were better than their competitors in terms of managing their environmental impact.” While some investors still focus their funds to avoid only “the most egregious polluters,” the emphasis for many investors has switched to changing “the way money is used,” and using “it in a positive, transformative way to get us from where we are now ultimately to a truly sustainable society.” [19] Investment in companies that are damaging to the environment, and investment into the infrastructure that supports those companies detracts from environmentally sustainable investment. [20] The Global Climate Prosperity Scoreboard - launched by Ethical Markets Media and The Climate Prosperity Alliance to monitor private investments in green companies - estimated that over \$1.248 trillion has been invested in solar, wind, geothermal, ocean/hydro and other green sectors since 2007. This number represents investments from North America, China, India, and Brazil, as well as other developing countries [21].

Green Growth

Green growth is a term to describe a hypothetical path of economic growth that is environmentally sustainable. It is based on the understanding that as long as economic growth remains a predominant goal, a decoupling of economic growth from resource use and adverse environmental impacts is required. As such, green growth is closely related to the concepts of green economy and low-carbon or sustainable development. A main driver for green growth is the transition towards sustainable energy systems. Advocates of green growth policies argue that well-implemented green policies can create opportunities for employment in sectors such as renewable energy, green agriculture, or sustainable

forestry. Several countries and international organizations, such as the Organization for Economic Co-operation and Development (OECD), World Bank, and United Nations, [22] have developed strategies on green growth; others, such as the Global Green Growth Institute (GGGI), are specifically dedicated to the issue. The term green growth has been used to describe national or international strategies, for example as part of economic recovery from the COVID-19 recession, often framed as a green recovery. Critics of green growth highlight how green growth approaches do not fully account for the underlying economic systems change needed in order to address the climate crisis, biodiversity crisis and other environmental degradation. Critics point instead to alternative frameworks for economic change such as a circular economy, degrowth, doughnut economics or similar fundamental changes which better account for planetary boundaries. Approximately 57% of businesses responding to a survey are investing in energy efficiency, 64% in reducing and recycling trash, and 32% in new, less polluting industries and technologies. Roughly 40% of businesses made investments in energy efficiency in 2021. [23,24]

Ecological Measurements

Measuring economic output and progress is done through the use of economic index indicators. Green indices emerged from the need to measure human ecological impact, efficiency sectors like transport, energy, buildings and tourism, as well as the investment flows targeted to areas like renewable energy and cleantech innovation. 2016 - 2022 Green Score City Index [25] is an ongoing study measuring the anthropogenic impact human activity has on nature.

1. 2010 - 2018 Global Green Economy Index™ (GGEI), [26] published by consultancy Dual Citizen LLC is in its 6th edition. It measures the green economic performance and perceptions of it in 130 countries along four main dimensions of leadership & climate change, efficiency sectors, markets & investment and the environment.

2. 2009 - 2013 Circles of Sustainability project scored 5 cities in 5 separate countries.

3. 2009 - 2012 Green City Index [27] A global study commissioned by Siemens

Ecological footprint measurements are a way to gauge anthropogenic impact and are another standard used by municipal governments. [28]

Green Energy Issues

Green economies require a transition to green energy generation based on renewable energy to replace fossil fuels as well as energy conservation and efficient energy use. [29] Renewables, like solar energy and wind energy, may eliminate the

use of fossil fuels for electricity by 2035 and replace fossil fuel usage altogether by 2050.[30] The market failure to respond to environmental protection and climate protection needs can be attributed to high external costs and high initial costs for research, development, and marketing of green energy sources and green products.[31] The green economy may need government subsidies as market incentives to motivate firms to invest and produce green products and services. The German Renewable Energy Act, legislations of many other member states of the European Union and the American Recovery and Reinvestment Act of 2009, all provide such market incentives. However, other experts [32] argue that green strategies can be highly profitable for corporations that understand the business case for sustainability and can market green products and services beyond the traditional green consumer.

In the United States, it seemed as though the nuclear industry was coming to an end by the mid-1990s. Until 2013, there had been no new nuclear power facilities built since 1977. One reason was due to the economic reliance on fossil fuel-based energy sources. Additionally, there was a public fear of nuclear energy due to the Three Mile Island accident and the Chernobyl disaster. [33] The Bush administration passed the 2005 Energy Bill that granted the nuclear industry around 10 million dollars to encourage research and development efforts. [34] With the increasing threat of climate change, nuclear energy has been highlighted as an option to work to decarbonize the atmosphere and reverse climate change. [35] Nuclear power forces environmentalists and citizens around the world to weigh the pro and cons of using nuclear power as a renewable energy source. The controversial nature of nuclear power has the potential to split the green economy movement into two branches- anti-nuclear and pro-nuclear. According to a European climate survey, 63% of EU residents, 59% of Britons, 50% of Americans and 60% of Chinese respondents are in favor of switching to renewable energy. As of 2021, 18% of Americans are in favor of natural gas as a source of energy. For Britons and EU citizens nuclear energy is a more popular energy alternative. [36]

After the COVID-19 pandemic, Eastern European and Central Asian businesses fall behind their Southern European counterparts in terms of the average quality of their green management practices, notably in terms of specified energy consumption and emissions objectives. [37,38] External variables, such as consumer pressure and energy taxes, are more relevant than firm-level features, such as size and age, in influencing the quality of green management practices. [37,38] Firms with less financial limitations and stronger green management practices are more likely to invest in a bigger variety of green initiatives. Energy efficiency investments are good for both the bottom line and the environment. [37,38] The shift to greener energy and the adoption of more climate regulations are expected to have a 30% positive impact on businesses, mostly through new business prospects, and a 30% negative impact, according to businesses that took part in a survey in 2022. A little over 40% of the same

businesses do not anticipate the transition to greener alternatives to alter their operations. [39-41]

Criticism

A number of organizations and individuals have criticized aspects of the 'Green Economy', particularly the mainstream conceptions of it based on using price mechanisms to protect nature, arguing that this will extend corporate control into new areas from forestry to water. The research organization ETC Group argues that the corporate emphasis on bio-economy "will spur even greater convergence of corporate power and unleash the most massive resource grab in more than 500 years." [42] Venezuelan professor Edgardo Lander says that the UNEP's report, *Towards a Green Economy*, [43] while well-intentioned "ignores the fact that the capacity of existing political systems to establish regulations and restrictions to the free operation of the markets - even when a large majority of the population call for them - is seriously limited by the political and financial power of the corporations." [44] Ulrich Hoffmann, in a paper for UNCTAD also says that the focus on Green Economy and "green growth" in particular, "based on an evolutionary (and often reductionist) approach will not be sufficient to cope with the complexities of [[climate change]]" and "may rather give much false hope and excuses to do nothing really fundamental that can bring about a U-turn of global greenhouse gas emissions." [45] Clive Spash, an ecological economist, has criticized the use of economic growth to address environmental losses, [46] and argued that the Green Economy, as advocated by the UN, is not a new approach at all and is actually a diversion from the real drivers of environmental crisis. [47] He has also criticized the UN's project on the economics of ecosystems and biodiversity (TEEB), [48] and the basis for valuing ecosystems services in monetary terms. [49]

Engineering Economics

Engineering economics, previously known as engineering economy, is a subset of economics concerned with the use and "...application of economic principles" [1] in the analysis of engineering decisions. [2] As a discipline, it is focused on the branch of economics known as microeconomics in that it studies the behavior of individuals and firms in making decisions regarding the allocation of limited resources. Thus, it focuses on the decision-making process, its context and environment. It is pragmatic by nature, integrating economic theory with engineering practice. But it is also a simplified application of microeconomic theory in that it assumes elements such as price determination, competition and demand/supply to be fixed inputs from other sources. As a discipline though, it is closely related to others such as statistics, mathematics and cost accounting. It draws upon the logical framework of economics but adds to that the analytical power of mathematics and statistics.

Engineers seek solutions to problems, and along with the technical aspects, the economic viability of each potential solution

is normally considered from a specific viewpoint that reflects its economic utility to a constituency. Fundamentally, engineering economics involves formulating, estimating, and evaluating economic outcomes when alternatives to accomplish a defined purpose are available. [3]

In some U.S. undergraduate civil engineering curricula, engineering economics is a required course. [4] It is a topic on the Fundamentals of Engineering examination, and questions might also be asked on the Principles and Practice of Engineering examination; both are part of the Professional Engineering registration process. Considering the time value of money is central to most engineering economic analyses. Cash flows are discounted using an interest rate, except in the most basic economic studies. For each problem, there are usually many possible alternatives. One option that must be considered in each analysis, and is often the choice, is the do nothing alternative. The opportunity cost of making one choice over another must also be considered. There are also non-economic factors to be considered, like color, style, public image, etc.; such factors are termed attributes. [5] Costs as well as revenues are considered, for each alternative, for an analysis period that is either a fixed number of years or the estimated life of the project. The salvage value is often forgotten, but is important, and is either the net cost or revenue for decommissioning the project. Some other topics that may be addressed in engineering economics are inflation, uncertainty, replacements, depreciation, resource depletion, taxes, tax credits, accounting, cost estimations, or capital financing. All these topics are primary skills and knowledge areas in the field of cost engineering. Since engineering is an important part of the manufacturing sector of the economy, engineering industrial economics is an important part of industrial or business economics. Major topics in engineering industrial economics are:

- The economics of the management, operation, and growth and profitability of engineering firms;
- Macro-level engineering economic trends and issues;
- Engineering product markets and demand influences; and
- The development, marketing, and financing of new engineering technologies and products.[6]

Examples of Usage

Some examples of engineering economic problems range from value analysis to economic studies. Each of these is relevant in different situations, and most often used by engineers or project managers. For example, engineering economic analysis helps a company not only determine the difference between fixed and incremental costs of certain operations, but also calculates that cost, depending upon a number of variables. Further uses of engineering economics include:

- Value analysis
- Linear programming
- Critical path economy
- Interest and money - time relationships
- Depreciation and valuation
- Capital budgeting
- Risk, uncertainty, and sensitivity analysis
- Fixed, incremental, and sunk costs
- Replacement studies
- Minimum cost formulas
- Various economic studies in relation to both public and private ventures

Each of the previous components of engineering economics is critical at certain junctures, depending on the situation, scale, and objective of the project at hand. Critical path economy, as an example, is necessary in most situations as it is the coordination and planning of material, labor, and capital movements in a specific project. The most critical of these “paths” are determined to be those that have an effect upon the outcome both in time and cost. Therefore, the critical paths must be determined and closely monitored by engineers and managers alike. Engineering economics helps provide the Gantt charts and activity-event networks to ascertain the correct use of time and resources. [7]

Value Analysis

Proper value analysis finds its roots in the need for industrial engineers and managers to not only simplify and improve processes and systems, but also the logical simplification of the designs of those products and systems. Though not directly related to engineering economy, value analysis is nonetheless important, and allows engineers to properly manage new and existing systems/processes to make them simpler and save money and time. Further, value analysis helps combat common “roadblock excuses” that may trip up managers or engineers. Sayings such as “The customer wants it this way” are retorted by questions such as; has the customer been told of cheaper alternatives or methods? “If the product is changed, machines will be idle for lack of work” can be combated by; can management not find new and profitable uses for these machines? Questions like these are part of engineering economy, as they preface any real studies or analyses.

Linear Programming

Linear programming is the use of mathematical methods to find optimized solutions, whether they be minimized or maximized in nature. This method uses a series of lines to create a polygon then to determine the largest, or smallest, point on that

shape. Manufacturing operations often use linear programming to help mitigate costs and maximize profits or production. [7]

Interest and Money - Time Relationships

Considering the prevalence of capital to be lent for a certain period of time, with the understanding that it will be returned to the investor, money-time relationships analyze the costs associated with these types of actions. Capital itself must be divided into two different categories, equity capital and debt capital. Equity capital is money already at the disposal of the business, and mainly derived from profit, and therefore is not of much concern, as it has no owners that demand its return with interest. Debt capital does indeed have owners, and they require that its usage be returned with "profit", otherwise known as interest. The interest to be paid by the business is going to be an expense, while the capital lenders will take interest as a profit, which may confuse the situation. To add to this, each will change the income tax position of the participants. Interest and money time relationships come into play when the capital required to complete a project must be either borrowed or derived from reserves. To borrow brings about the question of interest and value created by the completion of the project. While taking capital from reserves also denies its usage on other projects that may yield more results. Interest in the simplest terms is defined by the multiplication of the principle, the units of time, and the interest rate. The complexity of interest calculations, however, becomes much higher as factors such as compounding interest or annuities come into play.

Engineers often utilize compound interest tables to determine the future or present value of capital. These tables can also be used to determine the effect annuities have on loans, operations, or other situations. All one needs to utilize a compound interest table is three things; the time period of the analysis, the minimum attractive rate of return (MARR), and the capital value itself. The table will yield a multiplication factor to be used with the capital value, this will then give the user the proper future or present value.

Examples of Present, Future, and Annuity Analysis

Using the compound interest tables mentioned above, an engineer or manager can quickly determine the value of capital over a certain time period. For example, a company wishes to borrow \$5,000.00 to finance a new machine, and will need to repay that loan in 5 years at 7%. Using the table, 5 years and 7% gives the factor of 1.403, which will be multiplied by \$5,000.00. This will result in \$7,015.00. This is of course under the assumption that the company will make a lump payment at the conclusion of the five years, not making any payments prior. A much more applicable example is one with a certain piece of equipment that will yield benefit for a manufacturing operation over a certain period of time. For instance, the machine benefits the company \$2,500.00 every year, and has a useful life of 8 years. The MARR is determined to be roughly 5%. The compound interest tables yield a different factor for different types of analysis in this scenario.

If the company wishes to know the Net Present Benefit (NPB) of these benefits; then the factor is the P/A of 8 yrs at 5%. This is 6.463. If the company wishes to know the future worth of these benefits; then the factors is the F/A of 8 yrs at 5%; which is 9.549. The former gives a NPB of \$16,157.50, while the latter gives a future value of \$23,872.50. These scenarios are extremely simple in nature, and do not reflect the reality of most industrial situations. Thus, an engineer must begin to factor in costs and benefits, then find the worth of the proposed machine, expansion, or facility.

Depreciation and Valuation

The fact that assets and material in the real world eventually wear down, and thence break, is a situation that must be accounted for. Depreciation itself is defined by the decreasing of value of any given asset, though some exceptions do exist. Valuation can be considered the basis for depreciation in a basic sense, as any decrease in value would be based on an original value. The idea and existence of depreciation becomes especially relevant to engineering and project management is the fact that capital equipment and assets used in operations will slowly decrease in worth, which will also coincide with an increase in the likelihood of machine failure. Hence the recording and calculation of depreciation is important for two major reasons.

1. To give an estimate of "recovery capital" that has been put back into the property.
2. To enable depreciation to be charged against profits that, like other costs, can be used for income taxation purposes.

Both of these reasons, however, cannot make up for the "fleeting" nature of depreciation, which makes direct analysis somewhat difficult. To further add to the issues associated with depreciation, it must be broken down into three separate types, each having intricate calculations and implications.

- Normal depreciation, due to physical or functional losses.
- Price depreciation, due to changes in market value.
- Depletion, due to the use of all available resources.

Calculation of depreciation also comes in a number of forms; straight line, declining balance, sum-of-the-year's, and service output. The first method being perhaps the easiest to calculate, while the remaining have varying levels of difficulty and utility. Most situations faced by managers in regard to depreciation can be solved using any of these formulas, however, company policy or preference of individual may affect the choice of model. [7]

The main form of depreciation used inside the U.S. is the Modified Accelerated Capital Recovery System (MACRS), and it is based on a number of tables that give the class of asset, and its life. Certain classes are given certain lifespans, and these affect the value of an asset that can be depreciated each year. This does not

necessarily mean that an asset must be discarded after its MACRS life is fulfilled, just that it can no longer be used for tax deductions.

Capital Budgeting

Capital budgeting, in relation to engineering economics, is the proper usage and utilization of capital to achieve project objectives. It can be fully defined by the statement; "... as the series of decisions by individuals and firms concerning how much and where resources will be obtained and expended to meet future objectives." [7] This definition almost perfectly explains capital and its general relation to engineering, though some special cases may not lend themselves to such a concise explanation. The actual acquisition of that capital has many different routes, from equity to bonds to retained profits, each having unique strengths and weaknesses, especially when in relation to income taxation. Factors such as the risk of capital loss, along with possible or expected returns must also be considered when capital budgeting is underway. For example, if a company has \$20,000 to invest in a number of high, moderate, and low risk projects, the decision will depend upon how much risk the company is willing to take on, and if the returns offered by each category offset this perceived risk. Continuing with this example, if the high risk offered only 20% return, while the moderate offered 19% return, engineers and managers would most likely choose the moderate risk project, as its return is far more favorable for its category. The high-risk project failed to offer proper returns to warrant its risk status. A more difficult decision may be between a moderate risk offering 15% while a low risk offering 11% return. The decision here would be much more subject to factors such as company policy, extra available capital, and possible investors. "In general, the firm should estimate the project opportunities, including investment requirements and prospective rates of return for each, expected to be available for the coming period. Then the available capital should be tentatively allocated to the most favorable projects. The lowest prospective rate of return within the capital available then becomes the minimum acceptable rate of return for analyses of any projects during that period." [8]

Minimum Cost Formulas

Being one of the most important and integral operations in the engineering economic field is the minimization of cost in systems and processes. Time, resources, labor, and capital must all be minimized when placed into any system, so that revenue, product, and profit can be maximized.

Economic Studies, Both Private and Public in Nature

Economic studies, which are much more common outside of engineering economics, are still used from time to time to determine feasibility and utility of certain projects. They do not, however, truly reflect the "common notion" of economic studies, which is fixated upon macroeconomics, something engineers have little interaction with. Therefore, the studies conducted in

engineering economics are for specific companies and limited projects inside those companies. At most one may expect to find some feasibility studies done by private firms for the government or another business, but these again are in stark contrast to the overarching nature of true economic studies. Studies have a number of major steps that can be applied to almost every type of situation, those being as follows;

- Planning and screening - Mainly reviewing objectives and issues that may be encountered.
- Reference to standard economic studies - Consultation of standard forms.
- Estimating - Speculating as to the magnitude of costs and other variables.
- Reliability - The ability to properly estimate.
- Comparison between actual and projected performance - Verify savings, review failures, to ensure that proposals were valid, and to add to future studies.

Objectivity of the analyst - To ensure the individual that advanced proposals or conducted analysis was not biased toward certain outcomes. [70-80]

Energy Economics

Energy economics is a broad scientific subject area which includes topics related to supply and use of energy in societies. Considering the cost of energy services and associated value gives economic meaning to the efficiency at which energy can be produced. Energy services can be defined as functions that generate and provide energy to the "desired end services or states". The efficiency of energy services is dependent on the engineered technology used to produce and supply energy. The goal is to minimize energy input required (e.g., kWh, mJ, see Units of Energy) to produce the energy service, such as lighting (lumens), heating (temperature) and fuel (natural gas). The main sectors considered in energy economics are transportation and building, although it is relevant to a broad scale of human activities, including households and businesses at a microeconomic level and resource management and environmental impacts at a macroeconomic level. Due to diversity of issues and methods applied and shared with a number of academic disciplines, energy economics does not present itself as a self-contained academic discipline, but it is an applied sub discipline of economics. From the list of main topics of economics, some relate strongly to energy economics:

- Computable general equilibrium
- Econometrics
- Environmental economics
- Finance
- Industrial organization

- Input-output model
- Microeconomics
- Macroeconomics
- Operations research
- Resource economics

Energy economics also draws heavily on results of energy engineering, geology, political sciences, ecology etc. Recent focus of energy economics includes the following issues:

- Climate change and climate policy
- Demand response
- Elasticity of supply and demand in energy market
- Energy and economic growth
- Energy derivatives
- Energy elasticity
- Energy forecasting
- Energy markets and electricity markets - liberalization, regulation
- Economics of energy infrastructure
- Energy policy
- Environmental policy
- Risk analysis and security of supply
- Sustainability

Some institutions of higher education (universities) recognize energy economics as a viable career opportunity, offering this as a curriculum. The University of Cambridge, Massachusetts Institute of Technology and the Vrije Universiteit Amsterdam are the top three research universities, and Resources for the Future the top research institute. There are numerous other research departments, companies, and professionals offering energy economics studies and consultations. There are unmistakable signs of change. In 2020, even as economies sank under the weight of Covid-19 lockdowns, additions of renewable sources of energy such as wind and solar PV increased at their fastest rate in two decades, and electric vehicle sales set new records. A new energy economy is coming into view, ushered forward by policy action, technological innovation and the increasing urgency of the need to tackle climate change. There is no guarantee that the emergence of this new energy economy will be smooth, and it is not coming forward quickly enough to avoid severe impacts from a changing climate. But it is already clear that tomorrow's energy economy promises to be quite different from the one we have today. Electricity is taking on an ever-more central role in the lives of consumers, and, for an increasing number of households, it promises to become the energy source on which they rely for

all their everyday needs: mobility, cooking, lighting, heating and cooling. The reliability and affordability of electricity is set to become even more critical to all aspects of people's lives and well-being. Electricity's share of the world's final consumption of energy has risen steadily over recent decades, and now stands at 20%. Its rise accelerates in future years as the pace of transitions picks up. In the NZE, electricity accounts for around 50% of final energy use by 2050 (around 30% in the APS). Given that electricity delivers useful energy services with better efficiency than other fuels, the contribution of electricity is even higher than these numbers would suggest.

The rise of electricity requires a parallel increase in its share of energy-related investment. Since 2016, global investment in the power sector has consistently been higher than in oil and gas supply. The faster that clean energy transitions proceed, the wider this gap becomes, and as a result electricity becomes the central arena for energy-related financial transactions. In the NZE, investment in power generation and infrastructure is six-times higher than in oil and gas supply by 2030. Clean technologies in the power sector and across a range of end-uses have become the first choice for consumers around the world, initially due to policy support but over time because they are simply the most cost-effective. In most regions, solar PV or wind already represents the cheapest available source of new electricity generation. Based on total costs of ownership, the case for electric cars in many markets is already a compelling one. In the new energy economy, the huge market opportunity for clean technology becomes a major new area for investment and international competition; countries and companies jostle for position in global supply chains. We estimate that, if the world gets on track for net zero emissions by 2050, then the annual market opportunity for manufacturers of wind turbines, solar panels, lithium-ion batteries, electrolyzers and fuel cells grows tenfold to USD 1.2 trillion by 2050, around 3.5-times larger than in the STEPS. These five elements alone would be larger than today's oil industry and its associated revenues.

The new energy economy involves varied and often complex interactions between electricity, fuels and storage markets, creating fresh challenges for regulation and market design. A major question is how to manage the potential for increased variability on both the demand and supply sides of the energy equation. The variability of electricity supply will be affected by rising shares of wind and solar PV, putting a huge premium on robust grids and other sources of supply flexibility. The variability of demand will be shaped by increasing deployment of heat pumps and air conditioners (the latter especially in developing economies, where current ownership levels are low), and could be exacerbated by poorly sequenced recharging of EV fleets or by cold snaps, heat waves or other extreme weather events. Without effective policies to prepare for and manage these fluctuations, the daily variation of demand could increase on the basis of announced pledges to 270 gigawatts (GW) in the European Union (from 120 GW today) and over 170 GW in India (from 40 GW) by

mid-century. Digital technologies play crucial roles in integrating different aspects of the new energy system. Sectors that have hitherto operated largely independently (such as electricity and transport) become connected in new ways with the rise of electric mobility, and grids need to cope with a much greater diversity and complexity of flows as many new players, including households, enter the arena as producers. Managing the platforms and data required to keep this system operating effectively becomes a central part of the new energy economy, as does mitigating associated cyber security and data privacy risks [81-90].

Clean electrification is the dominant theme in the early phases of the transformation of the global energy economy together with the quest for improvements in efficiency. Over time, however, continued rapid deployment in these areas needs to be accompanied by clean energy innovation and the widespread use of technologies that are not yet readily available on the market. These technologies are vital to decarbonize areas such as heavy industry and long-distance transport that are not readily susceptible to electrification for one reason or another, and they include advanced batteries, hydrogen electrolyzers, advanced biofuels, and new technologies for the capture and use of CO₂, including direct air capture. Building these additional pillars of the new energy economy requires early and sustained investment in energy R&D and an accelerated program of demonstration projects. These changes redirect global flows of trade and capital. The combined share of hydrogen and critical minerals (such as lithium, cobalt, copper and rare earths elements) in global energy-related trade rises to one-quarter of the total in the APS and takes a dominant share in the NZE as the value of fossil fuels trade declines significantly. This completely upends the present dynamics of international energy-related trade, and it is accompanied by a major shift in energy-related financial flows: the decline in the value of trade in fossil fuels causes the dollar-denominated revenues accruing to producer economies from oil and gas exports to decline significantly over time.

The new energy economy depicted in the NZE is a collaborative one in which countries demonstrate a shared focus on securing the necessary reductions in emissions, while minimizing and taking precautions against new energy security risks. However, the APS highlights the possibility of new divisions and fragmentation as countries proceed at different speeds through energy transitions. By the 2030s, for example, the APS sees the production of “green” steel in economies that have pledged to reach net zero alongside the continuing use of traditional emissions-intensive methods elsewhere, deepening tensions around trade in energy-intensive goods. There could be a gulf too in international investment and finance: increasingly stringent disciplines applicable to financial flows may mean that capital from the “net zero” world does not flow very freely to countries undergoing slower transitions. Successful, orderly and broad-based transitions in which countries enjoy the benefits of global trade will depend on finding ways to lessen and

manage the potential tensions in the international system that are highlighted in the APS.

History

Energy related issues have been actively present in economic literature since the 1973 oil crisis but have their roots much further back in history. As early as 1865, W.S. Jevons expressed his concern about the eventual depletion of coal resources in his book *The Coal Question*. One of the best-known early attempts to work on the economics of exhaustible resources (incl. fossil fuel) was made by H. Hotelling, who derived a price path for non-renewable resources, known as Hotelling’s rule. The development of energy economics theory over the last two centuries can be attributed to three main economic subjects - the rebound effect, the energy efficiency gap and more recently, ‘green nudges’. While energy efficiency is improved with new technology, expected energy savings are less than proportional to the efficiency gains due to behavioral responses. There are three behavioral sub-theories to be considered: the direct rebound effect, which anticipates increased use of the energy service that was improved; the indirect rebound effect, which considers an increased income effect created by savings then allowing for increased energy consumption, and; the economy-wide effect, which results from an increase in energy prices due to the newly developed technology improvements.

The Energy Efficiency Gap (1980s to 1990s)

Suboptimal investment in improvement of energy efficiency resulting from market failures/barriers prevents the optimal use of energy. From an economic standpoint, a rational decision-maker with perfect information will optimally choose between the trade-off of initial investment and energy costs. However, due to uncertainties such as environmental externalities, the optimal potential energy efficiency is not always able to be achieved, thus creating an energy efficiency gap.

Green Nudges (1990s to Current)

While the energy efficiency gap considers economical investments, it does not consider behavioral anomalies in energy consumers. Growing concerns surrounding climate change and other environmental impacts have led to what economists would describe as irrational behaviors being exhibited by energy consumers. A contribution to this has been government interventions, coined “green nudges” by Thaler and Sustein (2008), such as feedback on energy bills. Now that it is realized people do not behave rationally, research into energy economics is more focused on behaviors and impacting decision-making to close the energy efficiency gap.

Energy Policy

Energy is central to nearly all aspects of everyday life and business activity. Therefore, developing a long-term energy plan

is most successfully achieved in a collaborative way that involves all government ministries, as well as outreach to the public and businesses. Producers of energy statistics are a key element in this process. There are two key aspects of this collaboration: first, statisticians will provide the essential information needed to understand the current energy situation. This data needs to be used effectively in the policy planning process and in the ensuing modelling work. Thus, it is vital that the statisticians are effectively integrated in policy planning and later in the policy monitoring processes that are ultimately established. However, there also needs to be collaboration within the statistics community. In general, government statistics are organized in two ways: centralized or decentralized. For centralized information, the National Statistics Institute (NSI) is responsible for collecting and disseminating information to users, including ministries. Decentralized statistics will see ministries collecting and compiling data themselves, although ideally in coordination with the NSI. There are pros and cons to both approaches. A more centralized approach allows for greater resilience and the sharing of knowledge across a wider statistics workforce. A decentralized approach brings policy colleagues closer to the data, but it can also mean that statisticians in ministries may be less aware of wider statistical developments or less able to maximize the benefits of wider statistical surveys.

A large statistical institute will still need a strong push to communicate across all topic areas and will still need to reach out to the respective topic policy makers to ensure the statistics accurately reflect the situation in the country. Where a system is less centralized, statisticians will need to communicate and cooperate across ministries to achieve a cost-effective approach to working, sharing ideas and informing colleagues of policy changes. Fundamentally, structure is less important than achieving good cooperation among statisticians, and effectively working together and enhancing links with policy colleagues (something that should be pushed from both sides). An advisory group involving all the relevant stakeholders has proven to be an effective channel for the countries to coordinate activities around energy statistics. A further beneficial condition for ensuring comprehensive energy statistics is the degree to which they are produced independently. There are several ways of achieving this, either via a Statistics Act or via codes that govern the way statistics are produced and disseminated. To whom the NSI reports in a government structure can also be important, especially in a centralized approach. In general, the closer the NSI is to the heart of government, such as a president or prime minister, the more likely it is that statistics are developed to meet the needs of a whole country across all topics - especially if independently governed.

Long-term energy planning is central to a country's strategic direction. Without it, governments may end up relying on a patchwork of policies and legislation that can be incoherent and ill-

suited for the complex challenges countries are increasingly faced with. Good long-term energy planning encompasses domestic and foreign policy, while touching on many key areas of the economy including industry, natural resources and trade. The process involves multiple stakeholders across the government, but also brings in the private sector as well as citizens, as it aims to set out a strategic path towards a clear goal. Azerbaijan, like many of its peers, is looking to understand how best to meet the opportunities and complexities of the global clean energy transition. The 2014-2015 oil shock prompted the government to consider and draft a slate of new laws and reform packages, and at present efforts are being made to finalize and pass an energy strategy. The price volatility seen in global markets over 2020-2022 is making it even clearer that energy planning using scenario analysis and modelling will help countries successfully respond to new and unexpected challenges in a resilient fashion. This roadmap details the necessary steps in building that process and exploring relevant policy options that producer economies have pursued, which may be relevant to Azerbaijan. It then discusses data collection and survey design, which are key to establishing the base for energy modelling. The roadmap then looks at energy modelling and its role in policy making. This roadmap aims to help Azerbaijan reconsider the policy planning process as it looks to connect key laws and reforms into a greater energy strategy. It also sets out a path for Azerbaijan to make this process sustainable and iterative, connecting its policymakers with its statisticians, and investing in in-house modelling capacity. Every country must choose its own energy path, based on its specific needs and resources, but having a long-term plan can smooth out that path significantly.

Energy Supply & Demand

Think of the industrial revolution of 18th century Britain. What started it, and what kept it going?

The answer has to do with natural energy supplies. This meant a stable supply of coal to power up complex machinery and an economy based on mining and international trading. The historical availability of one type of fuel across various geographical locations has shaped populations as we know them today. Fuel shortages, also known as energy demands, especially in remote areas, would instil energy conservation habits. Fuel richness, where there is a surplus of energy supply, on the other hand, would encourage higher energy consumption. Both energy supply and demand have their own advantages and disadvantages [91-100].

The Definition of Energy Supply and Demand

Energy is generated at power stations and transported through the national grid to substations. From there, it is supplied to customers through a network of cables and transformers (the transmission and distribution lines). The demand for energy fluctuates throughout the day, and the supply must be carefully

managed to meet this demand. To achieve this, power stations can adjust their output or supply in response to changes in demand. Our society functions on different energy mixes. An energy mix is made of different types of primary energy sources such as crude oil, nuclear or sunlight. This energy is obtained through specific technologies which can use different types of fuel:

Fossil fuels: internal combustion engines used in cars, aircraft, boats, etc.

Nuclear power: usually converted into electricity by commercial nuclear stations.

Renewables: usually converted to electricity, heat or kinetic energy by wind turbines, solar thermal tubes, etc.

Industrial Energy Use

The industries we have on Earth range from agriculture and mining to education, transport and telecommunications. Heavy industries are incentivized to use combined heat and power systems to ensure that electricity generation and its resulting heat don't dissipate and thus get wasted.

Methods of Energy Conservation and Management

All methods of energy conservation help reduce energy consumption, greenhouse gas emissions and improve comfort levels. They also help to manage the energy infrastructure better. Both the industrial and domestic sectors employ the following methods:

Controlled Habits:

Carpooling or turning off appliances and lights when not in use. This can be done using energy-efficient appliances, bulbs, timers, or motion sensors to control lights.

Insulation:

Helps keep heat from escaping and excess heat from coming in. It is efficient for maintaining an ideal space temperature in winter and summer.

Exterior design:

Aero- and hydrodynamics are essential in reducing vehicle drag and enhancing speed. Trains worldwide already use a system of magnets to produce a levitating effect and reduce drag. Green roofs and walls can be used for buildings to minimize heat losses through the ceiling and walls.

Orientation and Positioning:

In the northern hemisphere, passive solar gains can be achieved by positioning a building's windows towards the south and ensuring that the north walls are well-insulated and have triple-glazing.

Exchange and Recycling:

Energy, such as heat from industrial processes of burning, cremating or melting, can be harvested and prevented from escaping in closed-loop recycling facilities. Additionally, the heat generated by one industry can be used by another.

Supply and Demand and Energy Prices

The quantity of energy supplied is the flow of energy brought onto the market, and the quantity of energy demanded is the amount of energy purchased for a particular period of time. Quantity can be measured in terms of the number of kilowatt hours produced by an electric generator in a day, the number of barrels of oil or cubic feet of gas brought to the market in a month, or the number of tons of coal produced and sold in a year. Primary energy takes the form of fossil fuels or electricity from primary sources including hydro, nuclear, solar, geothermal, and biomass, while secondary energy is electricity generated from fossil fuels.

Data Sources

Data on the quantity of energy supplied, called energy production, are available from a variety of government, trade association, and international sources. Some of the better sources include the U.S. Energy Information Administration, the American Petroleum Institute, the International Energy Agency, and the United Nations. Secondary energy quantity is reported as net or gross. Net energy is the amount of energy produced and gross is the amount of primary energy required to produce it.

Quantities of energy demanded and supplied are reported in a bewildering variety of ways. The three typical units of measurement are energy content, volume and weight. Energy content includes British thermal units in the United States or kilocalories and kilojoules in the rest of the world, as well as coal or oil equivalents. Kilowatts are the most common units of measurement for electricity and are sometimes applied to other energy sources as well. Weights are most often expressed as short tons, long tons or metric tons. Volumes are expressed as barrels, cubic feet, gallons or liters.

Determinants of Energy Supply

The quantity of energy supplied is a function of the economic and technical variables that influence the cost of bringing the energy source to market and the price that a supplier receives for the energy source in the market. For example, in a competitive market the quantity of coal (Q_s) supplied at the mine mouth is a function of the price received for the coal (P); the price of the capital necessary to produce the coal, such as drag lines, cutting tools, and loaders (P_k); the price of labor, which includes wages, salaries, and indirect labor costs (P_l); the price of using land or any other natural resource or other factor of production (P_n); and technical variables that could include the technologies available

and the geology of the deposits (T). An increasing T in this context represents better technology or more favorable geology. Prices of other related goods also influence quantity supplied. For example, uranium production may produce vanadium as a byproduct. Thus, uranium and vanadium are complementary goods or are goods produced together. When the price of vanadium increases, uranium production becomes more profitable and will increase. Gas found with oil is called associated gas and is considered complementary to oil in production. If the price of oil goes up, drillers may look harder for oil and find more gas to produce as well.

Alternatively, goods may be substitutes in production. If the price of other minerals increase, coal producers may look for other minerals and produce less coal. If gas is non-associated, it is found without oil and is a substitute for oil in supply rather than a complement. If the price of natural gas, a substitute good (Ps) or a good that could be produced instead of oil, increases, drillers may spend less time looking for oil and more time looking for and producing non-associated gas, thus decreasing oil production. Governments often interfere in energy markets and their policies may influence quantity supplied. For example, environmental regulations (Er) that require less pollution or more safety when producing fuels decrease the quantity of fuel supplied. Such regulations in the United States include the removal of sulfur from fuels, the addition of oxygenates to gasoline in some areas of the country, and more safety in coal mines. Additional environmental regulations increase cost and should decrease quantity supplied. Aggregate market supply also depends on the number of suppliers (#S) in the industry. We can write a general supply function as follows: The sign before each variable indicates how the variable influences quantity supplied. A minus sign indicates they are inversely related and a positive sign indicates they are directly related. Thus, in the example of coal, raising the price of coal is likely to increase quantity supplied, whereas raising the price of labor is likely to decrease the quantity supplied. For nonrenewable energy sources such as fossil fuels, expectations about the future price and interest rates influence the current quantity supplied. Expectations of higher future prices should cause less production today and more production tomorrow.

Elasticity of Supply

A measure of how responsive quantity supplied is to a variable (say price) is called the elasticity of supply with respect to that variable. Elasticity of supply is the percentage change in quantity divided by the percentage change in the variable in question or if the supply price elasticity of oil is 1.27, it follows that if the price of oil increases by 1 percent, the quantity of oil supplied increases by 1.27 percent. A cross elasticity of supply indicates how quantity produced is related to another price. For example, if the cross elasticity of oil supply with respect to the price of gas is 0.15, then if the price of gas increases 1 percent, the quantity of oil produced goes up 0.15 percent. Because energy production

is capital-intensive, supply price elasticities are larger or more elastic in the long run than in the short run. The long run is the time it takes for producers to totally adjust to changing circumstances and allows for totally changing the capital stock. In contrast, in the short run capital stock is fixed and total adjustment does not take place. Often the short run is considered a year or less, but the exact length of time depends on the context. Information about supply elasticities would be highly useful for those involved in energy markets, but unfortunately little is available. Carol Dahl and T. Duggan (1996) surveyed studies that use simple models to estimate energy supply or elasticities. They found estimates for the various fossil fuels and uranium in the United States and concluded that studies estimating these elasticities using reserve costs are the most promising. Such studies yielded a U.S. gas supply own-price elasticity of 0.41, a uranium supply own-price elasticity from 0.74 to 3.08, an Appalachia coal supply own-price elasticity of 0.41 to 7.90, and a U.S. oil supply own-price elasticity of 1.27. Even less is known about cross-price elasticities. Dahl and Duggan (1998) surveyed oil and gas exploration models that include cross-price elasticities for oil and gas but did not find strong statistical results from any of the models.

Determinants of Energy Demand

Energy demand is a derived demand. Consumers and businesses demand energy not for itself but for the services that the energy can provide. A consumer may want energy for lighting, space conditioning in the form of heat in the winters and cooling in the summer, and energy to run vehicles and appliances. Businesses often have these same needs and also need energy to run motors and for process heat. For consumers, quantity demanded of energy (Qcd) is a function of the price of energy (P), the price of other related goods, disposable income (Y), and other variables (O) such as personal preferences, lifestyle, weather, and demographic variables and, if it is aggregate demand, the number of consumers (#C). Take for example the quantity of electricity demanded by a household. If the price of electricity increases consumers may use less electricity. If the price of natural gas, a substitute for electricity in consumption (Ps), decreases, that may cause consumers to shift away from electric water heaters, clothes driers and furnaces to ones that use natural gas, thus increasing the quantity of natural gas demanded. If the price of electric appliances (Pc) increases or decreases quantity of electricity demanded. Consumers may buy less appliances and, hence, use less electricity. Increasing disposable income is likely to cause consumers to buy larger homes and more appliances, increasing the quantity of electricity consumed. Interestingly, the effect of an increase in income does not have to be positive. For example, in the past as income increased, homes that heated with coal switched to cleaner fuels such as fuel oil or gas. In the developing world, kerosene is used for lighting, but as households become richer, they switch to electricity. In these contexts, coal and kerosene are inferior goods and their consumption decreases

as income increases. We can write a general consumer energy demand function as follows: Again, the signs before the variables indicate how the variables influence quantity. The sign before income (Y) is \pm , since the sign would be + for a normal good and - for an inferior good. The sign before other variables is also \pm , since the sign depends on what the other variable is. For example, colder weather would raise the demand for natural gas, but an aging population, which drives less than a younger one, would decrease the demand for gasoline.

For businesses the demand for energy is the demand for a factor of production. Its demand depends on the price of the energy demanded (P) as well as the price of its output (Po), technology (T) and prices of other factors of production-land, labor, and capital-that might be substitutes (Ps) or complements (Pc) in consumption. Environmental policy (Ep) might also affect the demand for fuel. If this is aggregate business demand for energy the number of businesses is also relevant. We can write a general business energy demand function as follows: The sign on technology (T) and environmental policy (Ep) are uncertain and depend on the particular technology and policy. For example, environmental regulations requiring lower sulfur emissions favor gas over coal, while new technologies that make oil cheaper to use increase oil demand at the expense of gas and coal.

Elasticity of Demand

The responsiveness of energy consumption to a variable can be represented by elasticity, as was the case for energy production. Again, the elasticity is measured as the percentage change in quantity over the percentage change in the variable. The demand elasticity is negative, since raising price lowers quantity demanded, and if it is less than -1, the demand is called elastic. Lowering price when demand is elastic means that quantity demanded increases by a larger percent than price falls, thus energy expenditures go up. Alternatively, raising prices lowers expenditure. If the demand elasticity is between 0 and -1, then it is called inelastic. Now lowering price means that quantity increases by a smaller percent than price falls. Thus, energy expenditures go down. Alternatively, raising prices lowers expenditure.

Income Elasticities

Income elasticities are positive for normal and non-inferior goods, since raising income increases total consumption of these goods. Goods with income elasticities greater than 1 are said to have income elastic demand. Suppose jet fuel has an income elasticity of 3. The in income goes up by 1 percent, the quantity of jet fuel demanded goes up by 3 percent and a larger share of income is spent on jet fuel. Such goods with income elastic demand are called luxuries and they become a larger share of spending as a person gets richer. If the income elasticity is between 0 and 1, it is called inelastic. As income increases, a smaller share of income is spent on goods with inelastic demand. Often necessities such as fuel for heating are income inelastic. A cross-price elasticity

indicated how the quantity of one good changes when the price of another related good changes. The sign of a cross-price elasticity tells us whether goods are substitutes or complements. Take the case of a cement producer who needs a great deal of heat to produce cement. The producer's cross-price elasticity of demand for natural gas with respect to the price of the substitute good, coal, is the percentage change in natural gas demand divided by the percentage change in coal price. This elasticity for substitute goods will be positive, since an increase in the price of coal will cause an increase in the quantity of natural gas demanded. Alternatively, the cross-price elasticity of demand for complementary goods is negative. If the price of gas furnaces (a complement to gas) goes down, the cement producer may buy more gas furnaces, instead of coal furnaces, and use more natural gas.

Estimated Elasticities

More statistical work has been done estimating demand elasticities. Dahl (1993a) surveyed this work for the United States. She found considerable variation in own price and income elasticities across studies with the most consistency for studies of residential demand and for gasoline. More products seem to be price and income inelastic and short run elasticities are more certain than long run elasticity. Short run price elasticities for a year are probably between 0 and -0.5 for energy products. Dahl (1995) surveyed transportation demand studies and concluded that the price elasticity of demand for gasoline in the United States is -0.6 and the income elasticity is just below 1. Dahl (1992, 1993b, 1994) looked at energy demand elasticities in developing countries and found that oil and price elasticities of demand are inelastic and near -0.3, while income elasticities of demand are elastic and near 1.3. Dahl (1995b) surveyed natural gas's own, cross and income elasticities in industrial countries but was not able to come to a conclusion about the magnitude of these elasticities. Studies are also often inconsistent about whether coal, oil, and electricity are substitutes or complements to natural gas.

Energy Prices

Elasticities tell us how responsive quantities are demanded and supplied. In a competitive market where many buyers and sellers are competing with one another, the interactions of supply and demand determine the price in energy markets. Equilibrium in this market is at P_e where quantity demanded equals quantity supplied. If price is at P_l quantity demanded is Q_d and quantity supplied is at Q_s . There is excess quantity supplied and there would be pressure on prices downward until quantity demanded equaled quantity supplied. Thus, interactions of demand and supply determine price.

Change in Demand

If one of the variables held constant in the demand curve were to change, it would shift the whole demand curve, called a change

in demand. For example, suppose Figure represents the world market for crude oil. The Asian crisis beginning in 1997 reduced Asian income, which in turn reduced Asia's demand for oil. This decrease in demand lowered price moving along the supply curve, called a decrease in quantity supplied.

Change in Supply

The 1990s have seen technical changes in finding oil such as 3D seismic and horizontal drilling that have reduced costs. These technical changes shifted the supply of oil. This shift is called a change in supply and is the result of a change in the variable other than the own price. The increase in supply lowers price causing a movement along the demand curve called a change in quantity demanded.

Market Sets Prices

Thus, as economic and political events occur along with changes in demography, preferences and technology, shifting demand and supply interact to form prices in competitive energy markets. The above discussion assumes competitive markets where consumers and producers compete to buy and to sell products, and they have to take market price as given. This is probably the case most often for buyers of energy products. However, in the case of production, sometime market power exists. For example, in the oil market, first Rockefeller, then the large multinational oil companies, and state regulatory commissions such as the Texas Railroad Commission and then OPEC have exercised pricing power. In such a case, the producer tries to influence price or quantity in order to receive higher prices and earn excess profits.

Fossil Fuel Prices

Figure gives an historical overview of how fossil fuel prices have changed in response to market changes. Price availability varies from series to series and is reported for the period 1861-1998 for the well head price of oil (Poil), 1880-1998 for the fob mine price of bituminous coal, and 1922-1998 for the well head price of natural gas. Figure shows the volatility of oil prices as cartels formed and raised prices and then lost control as higher profits encouraged entry by other. Since the oil market is a global market these prices would be similar to those on the world market, as would prices for coal. The coal market has been reasonably competitive, and from the figure, we can see its price has been more stable than oil. However, coal price has been increased by oil price changes since oil is a substitute for coal in under-the-boiler and heating uses. Sometimes governments interfere with markets by setting price controls. In the United States wellhead price controls were set on natural gas sold into interstate markets beginning in the early 1950s. These controls which were not completely removed until the early 1990s and sometimes caused natural gas shortages. Prices, which had been reasonably stable, became quite volatile as the price controls were increasingly relaxed throughout the 1980s and into the 1990s.

For electricity, economies of scale have existed making it more economical for one firm to produce and distribute electricity for a given market. One firm would be able to monopolize the market and earn excess profits. This has led governments to regulate electricity in the United States and to produce electricity in most of the rest of the world throughout much of the twentieth century. In such a case, electricity price is set not by the market but by the government. In Figure we can see the evolution of constant dollar electricity prices in the United States from the early 1900s to the present, based on the average real consumer price of electricity (Plec). The falling real price reflects the cost reductions in producing and distributing electricity. As the size of markets have increased and the optimal size of electricity generation units have decreased more electricity markets are being privatized and restructured to allow more competition into the markets and less government control over pricing.

Economic Development

Economic Development is the creation of wealth from which community benefits are realized. It is more than a jobs program, it's an investment in growing your economy and enhancing the prosperity and quality of life for all residents. Economic development means different things to different people. On a broad scale, anything a community does to foster and create a healthy economy can fall under the auspice of economic development. Today's economic development professionals are trying harder than ever to define their field in terms that are more concrete and salient to policymakers, the public, and other professionals. There are probably as many definitions for economic development as there are people who practice it. Below is CALED's definition as published in the Economic Development Handbook: From a public perspective, local economic development involves the allocation of limited resources - land, labor, capital and entrepreneurship in a way that has a positive effect on the level of business activity, employment, income distribution patterns, and fiscal solvency. It is a process of deliberate intervention in the normal economic growth by making it easier or more attractive. Today, communities in California are giving attention to what they can do to promote fiscal stability and greater economic development.

Economic development is a concerted effort on the part of the responsible governing body in a city or county to influence the direction of private sector investment toward opportunities that can lead to sustained economic growth. Sustained economic growth can provide sufficient incomes for the local labor force, profitable business opportunities for employers and tax revenues for maintaining an infrastructure to support this continued growth. There is no alternative to private sector investment as the engine for economic growth, but there are many initiatives that you can support to encourage investments where the community feels they are needed the most. Economic development, the process whereby simple, low-income national economies are transformed into modern industrial economies. Although the term is sometimes

used as a synonym for economic growth, generally it is employed to describe a change in a country's economy involving qualitative as well as quantitative improvements. The theory of economic development-how primitive and poor economies can evolve into sophisticated and relatively prosperous ones-is of critical importance to underdeveloped countries, and it is usually in this context that the issues of economic development are discussed. Economic development first became a major concern after World War II. As the era of European colonialism ended, many former colonies and other countries with low living standards came to be termed underdeveloped countries, to contrast their economies with those of the developed countries, which were understood to be Canada, the United States, those of western Europe, most eastern European countries, the then Soviet Union, Japan, South Africa, Australia, and New Zealand. As living standards in most poor countries began to rise in subsequent decades, they were renamed the developing countries.

There is no universally accepted definition of what a developing country is; neither is there one of what constitutes the process of economic development. Developing countries are usually categorized by a per capita income criterion, and economic development is usually thought to occur as per capita incomes rise. A country's per capita income (which is almost synonymous with per capita output) is the best available measure of the value of the goods and services available, per person, to the society per year. Although there are a number of problems of measurement of both the level of per capita income and its rate of growth, these two indicators are the best available to provide estimates of the level of economic well-being within a country and of its economic growth. It is well to consider some of the statistical and conceptual difficulties of using the conventional criterion of underdevelopment before analyzing the causes of underdevelopment. The statistical difficulties are well known. To begin with, there are the awkward borderline cases. Even if analysis is confined to the underdeveloped and developing countries in Asia, Africa, and Latin America, there are rich oil countries that have per capita incomes well above the rest but that are otherwise underdeveloped in their general economic characteristics. Second, there are a number of technical difficulties that make the per capita incomes of many underdeveloped countries (expressed in terms of an international currency, such as the U.S. dollar) a very crude measure of their per capita real income. These difficulties include the defectiveness of the basic national income and population statistics, the inappropriateness of the official exchange rates at which the national incomes in terms of the respective domestic currencies are converted into the common denominator of the U.S. dollar, and the problems of estimating the value of the noncash components of real incomes in the underdeveloped countries. Finally, there are conceptual problems in interpreting the meaning of the international differences in the per capita income levels.

Although the difficulties with income measures are well established, measures of per capita income correlate reasonably well with other measures of economic well-being, such as life expectancy, infant mortality rates, and literacy rates. Other indicators, such as nutritional status and the per capita availability of hospital beds, physicians, and teachers, are also closely related to per capita income levels. While a difference of, say, 10 percent in per capita incomes between two countries would not be regarded as necessarily indicative of a difference in living standards between them, actual observed differences are of a much larger magnitude. India's per capita income, for example, was estimated at \$270 in 1985. In contrast, Brazil's was estimated to be \$1,640, and Italy's was \$6,520. While economists have cited a number of reasons why the implication that Italy's living standard was 24 times greater than India's might be biased upward, no one would doubt that the Italian living standard was significantly higher than that of Brazil, which in turn was higher than India's by a wide margin. The interpretation of a low per capita income level as an index of poverty in a material sense may be accepted with two qualifications. First, the level of material living depends not on per capita income as such but on per capita consumption. The two may differ considerably when a large proportion of the national income is diverted from consumption to other purposes; for example, through a policy of forced saving. Second, the poverty of a country is more faithfully reflected by the representative standard of living of the great mass of its people. This may be well below the simple arithmetic average of per capita income or consumption when national income is very unequally distributed and there is a wide gap in the standard of living between the rich and the poor.

The usual definition of a developing country is that adopted by the World Bank: "low-income developing countries" in 1985 were defined as those with per capita incomes below \$400; "middle-income developing countries" were defined as those with per capita incomes between \$400 and \$4,000. To be sure, countries with the same per capita income may not otherwise resemble one another: some countries may derive much of their incomes from capital-intensive enterprises, such as the extraction of oil, whereas other countries with similar per capita incomes may have more numerous and more productive uses of their labor force to compensate for the absence of wealth in resources. Kuwait, for example, was estimated to have a per capita income of \$14,480 in 1985, but 50 percent of that income originated from oil. In most regards, Kuwait's economic and social indicators fell well below what other countries with similar per capita incomes had achieved. Centrally planned economies are also generally regarded as a separate class, although China and North Korea are universally considered developing countries. A major difficulty is that prices serve less as indicators of relative scarcity in centrally planned economies and hence are less reliable as indicators of the per capita availability of goods and services than in market-

oriented economies. Estimates of percentage increases in real per capita income are subject to a somewhat smaller margin of error than are estimates of income levels. While year-to-year changes in per capita income are heavily influenced by such factors as weather (which affects agricultural output, a large component of income in most developing countries), a country's terms of trade, and other factors, growth rates of per capita income over periods of a decade or more are strongly indicative of the rate at which average economic well-being has increased in a country.

Economic Development as an Objective Of Policy

Motives for development

The field of development economics is concerned with the causes of underdevelopment and with policies that may accelerate the rate of growth of per capita income. While these two concerns are related to each other, it is possible to devise policies that are likely to accelerate growth (through, for example, an analysis of the experiences of other developing countries) without fully understanding the causes of underdevelopment. Studies of both the causes of underdevelopment and of policies and actions that may accelerate development are undertaken for a variety of reasons. There are those who are concerned with the developing countries on humanitarian grounds; that is, with the problem of helping the people of these countries to attain certain minimum material standards of living in terms of such factors as food, clothing, shelter, and nutrition. For them, low per capita income is the measure of the problem of poverty in a material sense. The aim of economic development is to improve the material standards of living by raising the absolute level of per capita incomes. Raising per capita incomes is also a stated objective of policy of the governments of all developing countries. For policymakers and economists attempting to achieve their governments' objectives, therefore, an understanding of economic development, especially in its policy dimensions, is important. Finally, there are those who are concerned with economic development either because they believe it is what people in developing countries want or because they believe that political stability can be assured only with satisfactory rates of economic growth. These motives are not mutually exclusive. Since World War II many industrial countries have extended foreign aid to developing countries for a combination of humanitarian and political reasons.

Those who are concerned with political stability tend to see the low per capita incomes of the developing countries in relative terms; that is, in relation to the high per capita incomes of the developed countries. For them, even if a developing country is able to improve its material standards of living through a rise in the level of its per capita income, it may still be faced with the more intractable subjective problem of the discontent created by the widening gap in the relative levels between itself and the richer countries. (This effect arises simply from the operation of the arithmetic of growth on the large initial gap between the income

levels of the developed and the underdeveloped countries. As an example, an underdeveloped country with a per capita income of \$100 and a developed country with a per capita income of \$1,000 may be considered. The initial gap in their incomes is \$900. Let the incomes in both countries grow at 5 percent. After one year, the income of the underdeveloped country is \$105, and the income of the developed country is \$1,050. The gap has widened to \$945. The income of the underdeveloped country would have to grow by 50 percent to maintain the same absolute gap of \$900.) Although there was once in development economics a debate as to whether raising living standards or reducing the relative gap in living standards was the true desideratum of policy, experience during the 1960-80 period convinced most observers that developing countries could, with appropriate policies, achieve sufficiently high rates of growth both to raise their living standards fairly rapidly and to begin closing the gap.

The Impact of Discontent

Although concern over havee question of a subjective sense of discontent among the underdeveloped and developing countries has waxed and waned, it has never wholly disappeared. The underdeveloped countries' sense of dissatisfaction and grievance arises not only from measurable differences in national incomes but also from the less easily measurable factors, such as their reaction against the colonial past and their complex drives to raise their national prestige and achieve equality in the broadest sense with the developed countries. Thus, it is not uncommon to find their governments using a considerable proportion of their resources in prestige projects, ranging from steel mills, hydroelectric dams, universities, and defense expenditure to international athletics. These symbols of modernization may contribute to nationally shared satisfaction and pride but may or may not contribute to an increase in the measurable national income. Second, it is possible to argue that in many cases the internal gap in incomes within individual underdeveloped countries may be a more potent source of the subjective level of discontent than the international gap in income. Faster economic growth may help to reduce the internal economic disparities in a less painful way, but it must be remembered that faster economic growth also tends to introduce greater disruption and the need for making bigger readjustments in previous ways of life and may thus increase the subjective sense of frustration and discontent. Finally, it is difficult to establish that the subjective problem of discontent will bear a simple and direct relationship to the size of the international gap in incomes. Some of the apparently most discontented countries are to be found in Latin America, where the per capita incomes are generally higher than in Asia and Africa. A skeptic can turn the whole approach to a reduction ad absurdum by pointing out that even the developed countries with their high and rising levels of per capita income have not been able to solve the subjective problem of discontent and frustration among various sections of their population.

Two conclusions may be drawn from the above points. First, the subjective problem of discontent in the underdeveloped countries is a genuine and important problem in international relations. But economic policy acting on measurable economic magnitudes can play only a small part in the solution of what essentially is a problem in international politics. Second, for the narrower purpose of economic policy there is no choice but to fall back on the interpretation of the low per capita incomes of the underdeveloped countries as an index of their poverty in a material sense. This can be defended by explicitly adopting the humanitarian value judgment that the underdeveloped countries ought to give priority to improving the material standards of living of the mass of their people. But, even if this value judgment is not accepted, the conventional measure of economic development in terms of a rise in per capita income still retains its usefulness. The governments of the underdeveloped countries may wish to pursue other, nonmaterial goals, but they could make clearer decisions if they knew the economic cost of their decisions. The most significant measure of this economic cost can be expressed in terms of the foregone opportunity to raise the level of per capita income.

The Hypothesis of Underdevelopment

If the underdeveloped countries are merely low-income countries, why call them underdeveloped? The use of the term underdeveloped in fact rests on a general hypothesis on which the whole subject matter of development economics is based. According to this hypothesis, the existing differences in the per capita income levels between the developed and the underdeveloped countries cannot be accounted for purely in terms of differences in natural conditions beyond the control of man and society. That is to say, the underdeveloped countries are underdeveloped because, in some way or another, they have not yet succeeded in making full use of their potential for economic growth. This potential may arise from the underdevelopment of their natural resources, or their human resources, or from the "technological gap." More generally, it may arise from the underdevelopment of economic organization and institutions, including the network of the market system and the administrative machinery of the government. The general presumption is that the development of this organizational framework would enable an underdeveloped country to make a fuller use not only of its domestic resources but also of its external economic opportunities, in the form of international trade, foreign investment, and technological and organizational innovations.

Development thought after World War II

After World War II a number of developing countries attained independence from their former colonial rulers. One of the common claims made by leaders of independence movements was that colonialism had been responsible for perpetuating low living standards in the colonies. Thus, economic development after independence became an objective of policy not only because of the humanitarian desire to raise living standards but also because

political promises had been made, and failure to make progress toward development would, it was feared, be interpreted as a failure of the independence movement. Developing countries in Latin America and elsewhere that had not been, or recently been, colonies took up the analogous belief that economic domination by the industrial countries had thwarted their development, and they, too, joined the quest for rapid growth. At that early period, theorizing about development, and about policies to attain development, accepted the assumption that the policies of the industrial countries were to blame for the poverty of the developing countries. Memories of the Great Depression, when developing countries' terms of trade had deteriorated markedly, producing sharp reductions in per capita incomes, haunted many policymakers. Finally, even in the developed countries, the Keynesian legacy attached great importance to investment.

In this milieu, it was thought that a "shortage of capital" was the cause of underdevelopment. It followed that policy should aim at an accelerated rate of investment. Since most countries with low per capita incomes were also heavily agricultural (and imported most of the manufactured goods consumed domestically), it was thought that accelerated investment in industrialization and the development of manufacturing industries to supplant imports through "import substitution" was the path to development. Moreover, there was a fundamental distrust of markets, and a major role was therefore assigned to government in allocating investments. Distrust of markets extended especially to the international economy. Experience with development changed perceptions of the process and of the policies affecting it in important ways. Nonetheless, there are significant elements of truth in some of the earlier ideas, and it is important to understand the thinking underlying them.

Growth economics and development economics

Development economics may be contrasted with another branch of study, called growth economics, which is concerned with the study of the long-run, or steady-state, equilibrium growth paths of the economically developed countries, which have long overcome the problem of initiating development. Growth theory assumes the existence of a fully developed modern capitalist economy with a sufficient supply of entrepreneurs responding to a well-articulated system of economic incentives to drive the growth mechanism. Typically, it concentrates on macroeconomic relations, particularly the ratio of savings to total output and the aggregate capital-output ratio (that is, the number of units of additional capital required to produce an additional unit of output). Mathematically, this can be expressed (the Harrod-Domar growth equation) as follows: the growth in total output (g) will be equal to the savings ratio (s) divided by the capital-output ratio (k); i.e., $g = s/k$. Thus, suppose that 12 percent of total output is saved annually and that three units of capital are required to produce an additional unit of output: then the rate of growth in output is $12/3\% = 4\%$ per annum. This result is obtained from

the basic assumption that whatever is saved will be automatically invested and converted into an increase in output on the basis of a given capital-output ratio. Since a given proportion of this increase in output will be saved and invested on the same basis, a continuous process of growth is maintained.

Growth theory, particularly the Harrod-Domar growth equation, has been frequently applied or misapplied to the economic planning of a developing country. The planner starts from a desired target rate of growth of perhaps 4 percent. Assuming a fixed overall capital-output ratio of, say, 3, it is then asserted that the developing country will be able to achieve this target rate of growth if it can increase its savings to 3×4 percent = 12 percent of its total output. The weakness of this type of exercise arises from the assumption of a fixed overall capital-output ratio, which assumes away all the vital problems affecting the developing country's capacity to absorb capital and invest its saving in a productive manner. These problems include the central problem of the efficient allocation of available savings among alternative investment opportunities and the associated organizational and institutional problems of encouraging the growth of a sufficient supply of entrepreneurs; the provision of appropriate economic incentives through a market system that correctly reflects the relative scarcities of products and factors of production; and the building up of an organizational framework that can effectively implement investment decisions in both the private and the public sectors. Such problems, which generally affect the developing country's absorptive capacity for capital and a number of other inputs, constitute the core of development economics. Development economics is needed precisely because the assumptions of growth economics, based as they are on the existence of a fully developed and well-functioning modern capitalist economy, do not apply.

The developing and underdeveloped countries are a very mixed collection of countries. They differ widely in area, population density, and natural resources. They are also at different stages in the development of market and financial institutions and of an effective administrative framework. These differences are sufficient to warn against wide-sweeping generalizations about the causes of underdevelopment and all-embracing theoretical models of economic development. But when development economics first came into prominence in the 1950s, there were powerful intellectual and political forces propelling the subject toward such general theoretical models of development and underdevelopment. First, many writers who popularized the subject were frankly motivated by a desire to persuade the developed countries to give more economic aid to the underdeveloped countries, on grounds ranging from humanitarian considerations to considerations of cold-war strategy. Second, there was the reaction of the newly independent underdeveloped countries against their past "colonial economic pattern," which they identified with free trade and primary production for the export market. These countries were eager to accept general

theories of economic development that provided a rationalization for their deep-seated desire for rapid industrialization. Third, there was a parallel reaction, at the academic level, against older economic theory, with its emphasis on the efficient allocation of scarce resources and a striving after new and "dynamic" approaches to economic development. All of these forces combined to produce a crop of theoretical approaches that soon developed into a fairly fixed orthodoxy with its characteristic emphasis on "crash" programs of investment in both material and human capital, on domestic industrialization, and on government economic planning as the standard ingredients of development policy. These new theories have continued to have a considerable influence on the conventional wisdom in development economics, although in retrospect most of them have turned out to be partial theories. A broad survey of these theories, under three main heads, is given below. It is particularly relevant to the debate over whether the underdeveloped countries should seek economic development through domestic industrialization or through international trade. The limitations of these new theories-and how they led to a gradual revival of a more pragmatic approach to development problems, which falls back increasingly on the older economic theory of efficient allocation of resources-are subsequently traced.

The Missing-Component Approach

First, there are the theories that regard the shortage of some strategic input (such as the supply of savings, foreign exchange, or technical skills) as the main cause of underdevelopment. Once this missing component was supplied-say, by external economic aid-it was believed that economic development would follow in a predictable manner based on fixed quantitative relationships between input and output. The overall capital-output ratio, mentioned above, is the most well-known of these fixed technical coefficients. But similar fixed coefficients have been assumed between the foreign-exchange requirements and total output and between the input of skilled manpower and output.

Shortage of savings

Given the broad relationship between capital accumulation and economic growth established in growth theory, it was plausible for growth theorists and development economists to argue that the developing countries were held back mainly by a shortage in the supply of capital. These countries were then saving only 5-7 percent of their total product, and it was manifest (and it remains true) that satisfactory growth cannot be supported by so low a level of investment. It was therefore thought that raising the savings ratio to 10-12 percent was the central problem for developing countries. Early development policy therefore focused on raising resources for investment. Steps toward this end were highly successful in most developing countries, and savings ratios rose to the 15-25 percent range. However, growth rates failed even to approximate the savings rates, and theorists were forced to search for other explanations of differences in

growth rates. It has become increasingly clear that there can be much wastage of capital resources in the developing countries for various reasons, such as wrong choice of investment projects, inefficient implementation and management of these projects, and inappropriate pricing and costing of output. These faults are particularly noticeable in public-sector investment projects and are one of the reasons why the Pearson Commission Report of the International Bank for Reconstruction and Development (1969) found that “the correlation between the amounts of aid received in the past decades and the growth performance is very weak.” But even in the private sector there may be a considerable distortion in the direction of investment induced by policies designed to encourage development. Thus, in most underdeveloped countries, a considerable part of private expansion investment, both foreign and domestic, has been diverted into the expansion of the manufacturing sector, catering to the domestic market through various inducements, including tariff protection, tax holidays, cheap loans, and generous foreign-exchange allocations granting the opportunity to import capital goods cheaply at overvalued exchange rates. As a consequence, there developed a very considerable amount of excess capacity in the manufacturing sector of the underdeveloped countries pursuing such policies.

Foreign-Exchange Shortage

In the 1950s most developing countries were primary commodity exporters, relying on crops and minerals for the bulk of their foreign-exchange earnings through exports, and importing a large number of manufactured goods. The experience of colonialism, and the distrust of the international economy that it engendered, led policymakers in most developing countries to adopt a policy of import substitution. This policy was intended to promote industrialization by protecting domestic producers from the competition of imports. Protection, in the form of high tariffs or the restriction of imports through quotas, was applied indiscriminately, often to inherently high-cost industries that had no hope of ever becoming internationally competitive. Also, after the early stages of import substitution, protected new industries tended to be very intensive in the use of capital and especially of imported capital goods. The import-substitution approach defined “industrialization” rather narrowly as the expansion of the modern manufacturing sector based on capital-intensive technology. Capital was therefore identified with durable capital equipment in the form of complex machinery and other inputs that the underdeveloped countries were not able to produce domestically. Thus, foreign-exchange requirements were calculated on the basis of the fixed technical input-output coefficients of the manufacturing sector.

With high levels of protection for domestic industry, and with exchange rates that were often maintained at unrealistic levels (usually in an effort to make imported capital goods “cheap”), the experience of most developing countries was that export earnings grew relatively slowly. The simultaneously sharp increase in demand for imported capital goods (and for raw materials

and replacement parts as well) resulted in unexpectedly large increases in imports. Most developing countries found themselves with critical foreign-exchange shortages and were forced to reduce imports in order to cut their current-account deficits to manageable proportions. The cutbacks in imports usually resulted in reduced growth rates, if not recessions. This result led to the view that economic stagnation was caused primarily by a shortage of foreign exchange with which to buy essential industrial inputs. But over the longer term the growth rates of countries that continued to protect their domestic industries heavily not only stagnated but declined sharply. Contrasting the experience of countries that persisted in policies of import substitution with those that followed alternative policies (see below) subsequently demonstrated that foreign-exchange shortage was a barrier to growth only within the context of the protectionist policies adopted and was not inherently a barrier to the development process itself.

Education and Human Capital in Development

As it became apparent that the physical accumulation of capital was not by itself the key to development, many analysts turned to a lack of education and skills among the population as being a crucial factor in underdevelopment. If education and skill are defined as everything that is required to raise the productivity of the people in the developing countries by improving their skills, enterprise, initiative, adaptability, and attitudes, this proposition is true but is an empty tautology. However, the need for skills and training was first formulated in terms of specific skills and educational qualifications that could be supplied by crash programs in formal education. The usual method of manpower planning thus started from a target rate of expansion in output and tried to estimate the numbers of various types of skilled personnel that would be required to sustain this target rate of economic growth on the basis of an assumed fixed relationship between inputs of skill and national output. This approach was plausible enough in many developing countries immediately after their political independence, when there were obvious gaps in various branches of the administrative and technical services. But most countries passed through this phase rather quickly. In the meantime, as the result of programs in education expansion, their schools and colleges began producing large numbers of fresh graduates at much faster rates than their general rate of economic growth could supply suitable new jobs for. This created a growing problem of educational unemployment. An important factor behind the rapid educational expansion was the expectation that after graduation students would be able to obtain well-paying white-collar jobs at salary levels many times the prevailing per capita income of their countries. Thus, the underdeveloped countries’ inability to create jobs to absorb their growing armies of graduates created an explosive element in what came to be called the revolution of expectations.

It is possible to see a close parallelism between the narrow concept of industrialization as the expansion of the

manufacturing sector and the narrow concept of education as the academic and technical qualifications that can be supplied by the expansion of the formal educational system. If a broader concept of education, relevant for economic development, is needed, it is necessary to seek it in the pervasive educational influence of the economic environment as a whole on the learning process of the people of the underdeveloped countries. This is a complex process that depends on, among other less easily analyzable things, the system of economic incentives and signals that can mold the economic behavior of the people of the underdeveloped countries and affect their ability to make rational economic decisions and their willingness to introduce or adapt to economic changes. Unfortunately, the economic environment in many underdeveloped countries is dominated by a network of government controls that tend not to be conducive to such ends.

Sustainable Development

The Sustainable Development Goals or Global Goals are a set of 17 interconnected global goals designed to provide a blueprint for achieving a better and more sustainable future for all. Sustainable development goals, also known as global goals, were established by the United Nations in 2015 as a global call to action to end poverty, protect the planet and ensure that by 2030, all people will enjoy peace and prosperity, it was approved. The world is facing serious challenges of natural and environmental resources: such as climate change, reduction of fresh water, overfishing of the oceans, deforestation, water and air pollution and efforts to Billion Planet Nutrition. From an environmental point of view, sustainability is about the management and protection of natural resources, ecosystems, climate and the earth's atmosphere so that current and future generations can have a good life. Environmentally sustainable economic growth is another name for the concept of sustainable development. Its purpose is to achieve harmony between environmental sustainability, economic sustainability and socio-political sustainability. Sustainable development always encourages us to conserve and improve our resources by gradually changing the ways we develop and use technologies. All countries must meet their basic needs such as employment, food, energy, water and sanitation. Everyone has the right to a healthy, safe and clean environment. This can be easily achieved by reducing pollution, poverty and unemployment.

Sustainable development is an organizing principle for meeting human development goals while also sustaining the ability of natural systems to provide the natural resources and ecosystem services on which the economy and society depend. The desired result is a state of society where living conditions and resources are used to continue to meet human needs without undermining the integrity and stability of the natural system. Sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. While the modern concept of sustainable development is derived mostly from the 1987 Brundtland Report, it is also rooted in earlier ideas about

sustainable forest management and 20th-century environmental concerns. As the concept of sustainable development developed, it has shifted its focus more towards economic development, social development and environmental protection for future generations. The UN-level Sustainable Development Goals (2015-2030) address global challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice.

Definition

Sustainable development can be defined as the practice of maintaining productivity by replacing used resources with resources of equal or greater value without degrading or endangering natural biotic systems. Sustainable development binds together concern for the carrying capacity of natural systems with the social, political and economic challenges faced by humanity. Sustainability science is the study of the concepts of sustainable development and environmental science. There is an emphasis on the present generations' responsibility to regenerate, maintain and improve planetary resources for use by future generations.

History of sustainable development

The concept of sustainable development was the theme of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. This summit was the first international effort to draw practical and strategic plans that would make it possible to move towards a model of sustainable development. How was the idea of sustainable development formed? The industrial revolution is involved in the emergence of the idea of sustainable development. Since the second half of the 19th century, Western societies have come to the conclusion that their economic and industrial activities have a significant impact on the environment and social balance. Several ecological and social crises occurred in the world and the need for a more sustainable model increased.

First United Nations Conference on Environment and Sustainable Development [1972]

In 1972, the United Nations Conference on the Environment was held in Stockholm - the first major meeting of world leaders convened by the United Nations to discuss human impact on the environment and how it relates to economic development. One of the main goals of this gathering was to find a common vision and common principles to inspire and guide the world's population to preserve the "human environment".

Three pillars and sustainable development [1994]

The three pillars are an important part of the foundations of sustainable development. The term was first used by John Elkington, founder of a sustainability consulting firm. Companies should consider 3 important pillars in their business - and not just think about their profits and losses. This means that organizations must measure the social responsibility of operations throughout

their value chain as well as the environmental impact of their actions on the planet.

Development of the concept

Origins

Sustainable development has its roots in ideas about sustainable forest management, which were developed in Europe during the 17th and 18th centuries. In response to a growing awareness of the depletion of timber resources in England, John Evelyn argued, in his 1662 essay *Sylva* that “sowing and planting of trees had to be regarded as a national duty of every landowner, in order to stop the destructive over-exploitation of natural resources.” In 1713, Hans Carl von Carlowitz, a senior mining administrator in the service of Elector Frederick Augustus I of Saxony published *Sylvicultura economica*, a 400-page work on forestry. Building upon the ideas of Evelyn and French minister Jean-Baptiste Colbert, von Carlowitz developed the concept of managing forests for sustained yield. His work influenced others, including Alexander von Humboldt and Georg Ludwig Hartig, eventually leading to the development of the science of forestry. This, in turn, influenced people like Gifford Pinchot, the first head of the US Forest Service, whose approach to forest management was driven by the idea of wise use of resources, and Aldo Leopold whose land ethic was influential in the development of the environmental movement in the 1960s.

Following the publication of Rachel Carson’s *Silent Spring* in 1962, the developing environmental movement drew attention to the relationship between economic growth and environmental degradation. Kenneth E. Boulding, in his influential 1966 essay *The Economics of the Coming Spaceship Earth*, identified the need for the economic system to fit itself to the ecological system with its limited pools of resources. Another milestone was the 1968 article by Garrett Hardin that popularized the term “tragedy of the commons”. One of the first uses of the term sustainable in the contemporary sense was by the Club of Rome in 1972 in its classic report on the *Limits to Growth*, written by a group of scientists led by Dennis and Donella Meadows of the Massachusetts Institute of Technology. Describing the desirable “state of global equilibrium”, the authors wrote: “We are searching for a model output that represents a world system that is sustainable without sudden and uncontrolled collapse and capable of satisfying the basic material requirements of all of its people.”

In 1980, the International Union for Conservation of Nature published a world conservation strategy that included one of the first references to sustainable development as a global priority and introduced the term “sustainable development”. Two years later, the United Nations World Charter for Nature raised five principles of conservation by which human conduct affecting nature is to be guided and judged. In 1987, the United Nations World Commission on Environment and Development released

the report *Our Common Future*, commonly called the Brundtland Report. The report included what is now one of the most widely recognized definitions of sustainable development. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains Within it two key concepts: The concept of ‘needs’, in particular, the essential needs of the world’s poor, to which overriding priority should be given; and The idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs.

Since the Brundtland Report, the concept of sustainable development has developed beyond the initial intergenerational framework to focus more on the goal of “socially inclusive and environmentally sustainable economic growth”. In 1992, the UN Conference on Environment and Development published the *Earth Charter*, which outlines the building of a just, sustainable, and peaceful global society in the 21st century. The action plan *Agenda 21* for sustainable development identified information, integration, and participation as key building blocks to help countries achieve development that recognizes these interdependent pillars. It emphasizes that in sustainable development, everyone is a user and provider of information. It stresses the need to change from old sector-centered ways of doing business to new approaches that involve cross-sectoral co-ordination and the integration of environmental and social concerns into all development processes. Furthermore, *Agenda 21* emphasizes that broad public participation in decision making is a fundamental prerequisite for achieving sustainable development. Under the principles of the United Nations Charter the Millennium Declaration identified principles and treaties on sustainable development, including economic development, social development and environmental protection. Broadly defined, sustainable development is a systems approach to growth and development and to manage natural, produced, and social capital for the welfare of their own and future generations. The term sustainable development as used by the United Nations incorporates both issues associated with land development and broader issues of human development such as education, public health, and standard of living. A 2013 study concluded that sustainability reporting should be reframed through the lens of four interconnected domains: ecology, economics, politics and culture.

Reception

The concept of sustainable development has been, and still is, subject to criticism, including the question of what is to be sustained in sustainable development. It has been argued that there is no such thing as a sustainable use of a non-renewable resource, since any positive rate of exploitation will eventually lead to the exhaustion of earth’s finite stock; this perspective renders the Industrial Revolution as a whole unsustainable.

The sustainable development debate is based on the assumption that societies need to manage three types of capital (economic, social, and natural), which may be non-substitutable and whose consumption might be irreversible. Leading ecological economist and steady-state theorist Herman Daly, for example, points to the fact that natural capital can not necessarily be substituted by economic capital. While it is possible that we can find ways to replace some natural resources, it is much more unlikely that they will ever be able to replace eco-system services, such as the protection provided by the ozone layer, or the climate stabilizing function of the Amazonian Forest. In fact natural capital, social capital and economic capital are often complementarities. A further obstacle to substitutability lies also in the multi-functionality of many natural resources. Forests, for example, not only provide the raw material for paper but they also maintain biodiversity, regulate water flow, and absorb CO₂.

Requirements

Six interdependent capacities are deemed to be necessary for the successful pursuit of sustainable development. These are the capacities to measure progress towards sustainable development; promote equity within and between generations; adapt to shocks and surprises; transform the system onto more sustainable development pathways; link knowledge with action for sustainability; and to devise governance arrangements that allow people to work together in exercising the other capacities.

Dimensions

Sustainable development can be thought of in terms of three spheres, dimensions, domains or pillars: the environment, the economy and society. The three-sphere framework has also been worded as “economic, environmental and social” or “ecology, economy and equity”. This has been expanded by some authors to include a fourth pillar of culture, institutions or governance, or alternatively reconfigured as four domains of the social - ecology, economics, politics and culture, thus bringing economics back inside the social, and treating ecology as the intersection of the social and the natural.

Sustainable Development Goals

The Sustainable Development Goals (SDGs) or Global Goals are a collection of 17 interlinked global goals designed to be a “blueprint to achieve a better and more sustainable future for all”. The SDGs were set up in 2015 by the United Nations General

Assembly (UN-GA) and are intended to be achieved by the year 2030. They are included in a UN-GA Resolution called the 2030 Agenda or what is colloquially known as Agenda 2030. The SDGs were developed in the Post-2015 Development Agenda as the future global development framework to succeed the Millennium Development Goals which ended in 2015 [101-112].

Pathways

Deforestation and increased roadbuilding in the Amazon rainforest are a concern because of increased human encroachment upon wilderness areas, increased resource extraction and further threats to biodiversity. The ecological stability of human settlements is part of the relationship between humans and their natural, social and built environments. Also termed human ecology, this broadens the focus of sustainable development to include the domain of human health. Fundamental human needs such as the availability and quality of air, water, food and shelter are also the ecological foundations for sustainable development; addressing public health risk through investments in ecosystem services can be a powerful and transformative force for sustainable development which, in this sense, extends to all species. Environmental sustainability concerns the natural environment and how it endures and remains diverse and productive. Since natural resources are derived from the environment, the state of air, water, and the climate is of particular concern. The IPCC Fifth Assessment Report outlines current knowledge about scientific, technical and socio-economic information concerning climate change, and lists options for adaptation and mitigation. Environmental sustainability requires society to design activities to meet human needs while preserving the life support systems of the planet. This, for example, entails using water sustainably, using renewable energy and sustainable material supplies (e.g., harvesting wood from forests at a rate that maintains the biomass and biodiversity). An unsustainable situation occurs when natural capital (the total of nature’s resources) is used up faster than it can be replenished. Sustainability requires that human activity only uses nature’s resources at a rate at which they can be replenished naturally. The concept of sustainable development is intertwined with the concept of carrying capacity. Theoretically, the long-term result of environmental degradation is the inability to sustain human life. Such degradation on a global scale should imply an increase in human death rate until population falls to what the degraded environment can support Table 1.

Table 1: The long-term result of environmental degradation is the inability to sustain human life.

Consumption of Natural Resources	State of the Environment	Sustainability
More than nature’s ability to replenish	Environmental degradation	Not sustainable
Equal to nature’s ability to replenish	Environmental equilibrium	Steady state economy
Less than nature’s ability to replenish	Environmental renewal	Environmentally sustainable

Pollution of the public resources is not a different action, it is just a reverse tragedy of the commons, in that instead of taking something out, and something is put into the commons. When the costs of polluting the commons are not calculated into the cost of the items consumed, then it becomes only natural to pollute, as the cost of pollution is external to the cost of the goods produced and the cost of cleaning the waste before it is discharged exceeds the cost of releasing the waste directly into the commons. One of the ways to mitigate this problem is by protecting the ecology of the commons by making it, through taxes or fines, more costly to release the waste directly into the commons than would be the cost of cleaning the waste before discharge.

Land Use Changes, Agriculture and Food

Alterations in the relative proportions of land dedicated to urbanization, agriculture, forest, woodland, grassland and pasture have a marked effect on the global water, carbon and nitrogen biogeochemical cycles and this can impact negatively on both natural and human systems. On the local human scale, major sustainability benefits accrue from sustainable parks and gardens and green cities. Feeding almost eight billion human bodies takes a heavy toll on the Earth's resources. This begins with the appropriation of about 38% of the Earth's land surface and about 20% of its net primary productivity. Added to this are the resource-hungry activities of industrial agribusiness- everything from the crop needs for irrigation water, synthetic fertilizers and pesticides to the resource costs of food packaging, transport (now a major part of global trade) and retail. Environmental problems associated with industrial agriculture and agribusiness are now being addressed through such movements as sustainable agriculture, organic farming and more sustainable business practices. The most cost-effective mitigation options include afforestation, sustainable forest management, and reducing deforestation. The environmental effects of different dietary patterns depend on many factors, including the proportion of animal and plant foods consumed and the method of food production. At the global level the environmental impact of agribusiness is being addressed through sustainable agriculture and organic farming. At the local level there are various movements working towards sustainable food systems which may include local food production, slow food, sustainable gardening, and organic gardening.

Materials and Waste

As global population and affluence have increased, so has the use of various materials increased in volume, diversity, and distance transported. Included here are raw materials, minerals, synthetic chemicals (including hazardous substances), manufactured products, food, living organisms, and waste. By 2050, humanity could consume an estimated 140 billion tons of minerals, ores, fossil fuels and biomass per year (three times its current amount) unless the economic growth rate is decoupled from the rate of natural resource consumption. Developed countries' citizens

consume an average of 16 tons of those four key resources per capita per year, ranging up to 40 or more tons per person in some developed countries with resource consumption levels far beyond what is likely sustainable. By comparison, the average person in India today consumes four tons per year. Sustainable use of materials has targeted the idea of dematerialization, converting the linear path of materials (extraction, use, disposal in landfill) to a circular material flow that reuses materials as much as possible, much like the cycling and reuse of waste in nature. Dematerialization is being encouraged through the ideas of industrial ecology, eco design and eco-labelling. The use of sustainable biomaterials that come from renewable sources and that can be recycled is preferred to the use on non-renewables from a life cycle standpoint. This way of thinking is expressed in the concept of circular economy, which employs reuse, sharing, repair, refurbishment, remanufacturing and recycling to create a closed-loop system, minimizing the use of resource inputs and the creation of waste, pollution and carbon emissions. The European Commission has adopted an ambitious Circular Economy Action Plan in 2020, which aims at making sustainable products the norm in the EU.

Improving on Economic and Social Aspects

It has been suggested that because of rural poverty and overexploitation, environmental resources should be treated as important economic assets, called natural capital. Economic development has traditionally required a growth in the gross domestic product. This model of unlimited personal and GDP growth may be over. Sustainable development may involve improvements in the quality of life for many but may necessitate a decrease in resource consumption. According to ecological economist Malte Faber, ecological economics is defined by its focus on nature, justice, and time. Issues of intergenerational equity, irreversibility of environmental change, uncertainty of long-term outcomes, and sustainable development guide ecological economic analysis and valuation. As early as the 1970s, the concept of sustainability was used to describe an economy "in equilibrium with basic ecological support systems". Scientists in many fields have highlighted The Limits to Growth, and economists have presented alternatives, for example a 'steady-state economy', to address concerns over the impacts of expanding human development on the planet. In 1987, the economist Edward Barbier published the study The Concept of Sustainable Economic Development, where he recognized that goals of environmental conservation and economic development are not conflicting and can be reinforcing each other.

A World Bank study from 1999 concluded that based on the theory of genuine savings, policymakers have many possible interventions to increase sustainability, in macroeconomics or purely environmental. Several studies have noted that efficient policies for renewable energy and pollution are compatible with increasing human welfare, eventually reaching a golden-rule steady state. However, Gilbert Rist says that the World

Bank has twisted the notion of sustainable development to prove that economic development need not be deterred in the interest of preserving the ecosystem. He writes: "From this angle, 'sustainable development' looks like a cover-up operation... The thing that is meant to be sustained is really 'development', not the tolerance capacity of the ecosystem or of human societies." The World Bank, a leading producer of environmental knowledge, continues to advocate the win-win prospects for economic growth and ecological stability even as its economists express their doubts. Herman Daly, an economist for the Bank from 1988 to 1994, writes: When authors of WDR '92 [the highly influential 1992 World Development Report that featured the environment] were drafting the report, they called me asking for examples of "win-win" strategies in my work. What could I say? None exists in that pure form; there are trade-offs, not "win-wins." But they want to see a world of "win-wins" based on articles of faith, not fact. I wanted to contribute because WDRs are important in the Bank, [because] task managers read [them] to find philosophical justification for their latest round of projects. But they did not want to hear about how things really are, or what I find in my work.

A Meta review in 2002 looked at environmental and economic valuations and found a lack of "sustainability policies". A study in 2004 asked if humans consume too much. A study concluded in 2007 that knowledge, manufactured and human capital (health and education) has not compensated for the degradation of natural capital in many parts of the world. It has been suggested that intergenerational equity can be incorporated into sustainable development and decision making, as has become common in economic valuations of climate economics. A Meta review in 2009 identified conditions for a strong case to act on climate change, and called for more work to fully account of the relevant economics and how it affects human welfare. According to John Baden, a free-market environmentalist, "the improvement of environment quality depends on the market economy and the existence of legitimate and protected property rights". They enable the effective practice of personal responsibility and the development of mechanisms to protect the environment. The State can in this context "create conditions which encourage the people to save the environment"

Environmental Economics

The total environment includes not just the biosphere of Earth, air, and water, but also human interactions with these things, with nature, and what humans have created as their surroundings. As countries around the world continue to advance economically, they put a strain on the ability of the natural environment to absorb the high level of pollutants that are created as a part of this economic growth. Therefore, solutions need to be found so that the economies of the world can continue to grow, but not at the expense of the public good. In the world of economics, the amount of environmental quality must be considered as limited

in supply and therefore is treated as a scarce resource. This is a resource to be protected. One common way to analyze possible outcomes of policy decisions on the scarce resource is to do a cost-benefit analysis. This type of analysis contrasts different options of resource allocation and, based on an evaluation of the expected courses of action and the consequences of these actions, the optimal way to do so in the light of different policy goals can be elicited. Further complicating this analysis are the interrelationships of the various parts of the environment that might be impacted by the chosen course of action. Sometimes, it is almost impossible to predict the various outcomes of a course of action, due to the unexpected consequences and the number of unknowns that are not accounted for in the benefit-cost analysis.

Management of Human Consumption and Impacts

The environmental impact of a community or humankind as a whole depends both on population and impact per person, which in turn depends in complex ways on what resources are being used, whether or not those resources are renewable, and the scale of the human activity relative to the carrying capacity of the ecosystems involved. Careful resource management can be applied at many scales, from economic sectors like agriculture, manufacturing and industry, to work organizations, the consumption patterns of households and individuals, and the resource demands of individual goods and services. The underlying driver of direct human impacts on the environment is human consumption. This impact is reduced by not only consuming less but also making the full cycle of production, use, and disposal more sustainable. Consumption of goods and services can be analyzed and managed at all scales through the chain of consumption, starting with the effects of individual lifestyle choices and spending patterns, through to the resource demands of specific goods and services, the impacts of economic sectors, through national economies to the global economy. Analysis of consumption patterns relates resource use to the environmental, social and economic impacts at the scale or context under investigation. The ideas of embodied resource use (the total resources needed to produce a product or service), resource intensity, and resource productivity are important tools for understanding the impacts of consumption. Key resource categories relating to human needs are food, energy, raw materials and water. In 2010, the International Resource Panel published the first global scientific assessment on the impacts of consumption and production. The study found that the most critical impacts are related to ecosystem health, human health and resource depletion. From a production perspective, it found that fossil-fuel combustion processes, agriculture and fisheries have the most important impacts. Meanwhile, from a final consumption perspective, it found that household. Consumption related to mobility, shelter, food, and energy-using products causes the majority of life-cycle impacts of consumption. According to the IPCC Fifth Assessment Report, human consumption, with current

policy, by the year 2100 will be seven times bigger than in the year 2010.

Biodiversity and Ecosystem Services

In 2019, a summary for policymakers of the largest, most comprehensive study to date of biodiversity and ecosystem services was published by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. It recommended that human civilization will need a transformative change, including sustainable agriculture, reductions in consumption and waste, fishing quotas and collaborative water management.

Technology

Before flue-gas desulfurization was installed, the air-polluting emissions from this power plant in New Mexico contained excessive amounts of sulfur dioxide. A sewage treatment plant that uses solar energy, located at Santuari de Lluc monastery, Majorca. One of the core concepts in sustainable development is that technology can be used to assist people to meet their developmental needs. Technology to meet these sustainable development needs is often referred to as appropriate technology, which is an ideological movement (and its manifestations) originally articulated as intermediate technology by the economist E. F. Schumacher in his influential work *Small Is Beautiful* and now covers a wide range of technologies. Both Schumacher and many modern-day proponents of appropriate technology also emphasize the technology as people centered. Today appropriate technology is often developed using open-source principles, which have led to open-source appropriate technology (OSAT) and thus many of the plans of the technology can be freely found on the Internet. OSAT has been proposed as a new model of enabling innovation for sustainable development.

Business

The most broadly accepted criterion for corporate sustainability constitutes a firm's efficient use of natural capital. This eco-efficiency is usually calculated as the economic value added by a firm in relation to its aggregated ecological impact. This idea has been popularized by the World Business Council for Sustainable Development (WBCSD) under the following definition: "Eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle to a level at least in line with the earth's carrying capacity" (DeSimone and Popoff, 1997: 47). Similar to the eco-efficiency concept but so far less explored is the second criterion for corporate sustainability. Socio-efficiency describes the relation between a firm's value added and its social impact. Whereas, it can be assumed that most corporate impacts on the environment are negative (apart from rare exceptions such as the planting of trees) this is not true for social impacts. These can be either positive (e.g., corporate

giving, creation of employment) or negative (e.g., work accidents, human rights abuses). Both eco-efficiency and socio-efficiency are concerned primarily with increasing economic sustainability. In this process they instrumentalize both natural and social capital aiming to benefit from win-win situations. Some point towards eco-effectiveness, socio-effectiveness, sufficiency, and eco-equity as four criteria that need to be met if sustainable development is to be reached.

Architecture and Construction

In sustainable architecture the recent movements of New Urbanism and New Classical architecture promote a sustainable approach towards construction that appreciates and develops smart growth, architectural tradition and classical design. This is in contrast to modernist and International Style architecture, as well as opposing to solitary housing estates and suburban sprawl, with long commuting distances and large ecological footprints. The global design and construction industry is responsible for approximately 39 percent of greenhouse gas emissions. Green building practices that avoid emissions or capture the carbon already present in the environment, allow for reduced footprint of the construction industry, for example, use of hempcrete, cellulose fiber insulation, and landscaping.

Sustainable Development

Sustainable development is the overarching paradigm of the United Nations. The concept of sustainable development was described by the 1987 Brundtland Commission Report as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." There are four dimensions to sustainable development - society, environment, culture and economy - which are intertwined, not separate. Sustainability is a paradigm for thinking about the future in which environmental, societal and economic considerations are balanced in the pursuit of an improved quality of life. For example, a prosperous society relies on a healthy environment to provide food and resources, safe drinking water and clean air for its citizens. One might ask, what is the difference between sustainable development and sustainability? Sustainability is often thought of as a long-term goal (i.e., a more sustainable world), while sustainable development refers to the many processes and pathways to achieve it (e.g., sustainable agriculture and forestry, sustainable production and consumption, good government, research and technology transfer, education and training, etc.).

What are the Sustainable Development Goals?

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. The 17 SDGs are integrated—they recognize that action in one area will

affect outcomes in others, and that development must balance social, economic and environmental sustainability. Countries have committed to prioritizing progress for those who're furthest behind. The SDGs are designed to end poverty, hunger, AIDS, and discrimination against women and girls. The creativity, know-how, technology and financial resources from all of society is necessary to achieve the SDGs in every context.

Goal 1

No Poverty

Eradicating poverty in all its forms remains one of the greatest challenges facing humanity. While the number of people living in extreme poverty dropped by more than half between 1990 and 2015, too many are still struggling for the most basic human needs. As of 2015, about 736 million people still lived on less than US\$1.90 a day; many lack food, clean drinking water and sanitation. Rapid growth in countries such as China and India has lifted millions out of poverty, but progress has been uneven. Women are more likely to be poor than men because they have less paid work, education, and own less property. Progress has also been limited to other regions, such as South Asia and sub-Saharan Africa, which account for 80 percent of those living in extreme poverty. New threats brought on by climate change, conflict and food insecurity mean even more work is needed to bring people out of poverty. The SDGs are a bold commitment to finish what we started, and end poverty in all forms and dimensions by 2030. This involves targeting the most vulnerable, increasing basic resources and services, and supporting communities affected by conflict and climate-related disasters.

Goal 2

Zero Hunger

Unfortunately, extreme hunger and malnutrition remain a huge barrier to development in many countries. There are 821 million people estimated to be chronically undernourished as of 2017, often as a direct consequence of environmental degradation, drought and biodiversity loss. Over 90 million children under five are dangerously underweight. Undernourishment and severe food insecurity appear to be increasing in almost all regions of Africa, as well as in South America. The SDGs aim to end all forms of hunger and malnutrition by 2030, making sure all people-especially children-have sufficient and nutritious food all year. This involves promoting sustainable agricultural, supporting small-scale farmers and equal access to land, technology and markets. It also requires international cooperation to ensure investment in infrastructure and technology to improve agricultural productivity.

Goal 3

Good Health and Well-Being

We have made great progress against several leading causes

of death and disease. Life expectancy has increased dramatically; infant and maternal mortality rates have declined; we've turned the tide on HIV and malaria deaths have halved. Good health is essential to sustainable development and the 2030 Agenda reflects the complexity and interconnectedness of the two. It takes into account widening economic and social inequalities, rapid urbanization, threats to the climate and the environment, the continuing burden of HIV and other infectious diseases, and emerging challenges such as noncommunicable diseases. Universal health coverage will be integral to achieving SDG, ending poverty and reducing inequalities. Emerging global health priorities not explicitly included in the SDGs, including antimicrobial resistance, also demand action. But the world is off-track to achieving the health-related SDGs. Progress has been uneven, both between and within countries. There's a 31-year gap between the countries with the shortest and longest life expectancies. And while some countries have made impressive gains, national averages hide the fact that many are being left behind. Multisectoral, rights-based and gender-sensitive approaches are essential to address inequalities and to build good health for all.

Goal 4

Quality Education

Since 2000, there has been enormous progress in achieving the target of universal primary education. The total enrollment rate in developing regions reached 91 percent in 2015, and the worldwide number of children out of school has dropped by almost half. There has also been a dramatic increase in literacy rates, and many more girls are in school than ever before. These are all remarkable successes. Since 2000, there has been enormous progress in achieving the target of universal primary education. The total enrollment rate in developing regions reached 91 percent in 2015, and the worldwide number of children out of school has dropped by almost half. There has also been a dramatic increase in literacy rates, and many more girls are in school than ever before. These are all remarkable successes. Progress has also been tough in some developing regions due to high levels of poverty, armed conflicts and other emergencies. In Western Asia and North Africa, ongoing armed conflict has seen an increase in the number of children out of school. This is a worrying trend. While Sub-Saharan Africa made the greatest progress in primary school enrollment among all developing regions - from 52 percent in 1990, up to 78 percent in 2012 - large disparities still remain. Children from the poorest households are up to four times more likely to be out of school than those of the richest households. Disparities between rural and urban areas also remain high. Achieving inclusive and quality education for all reaffirms the belief that education is one of the most powerful and proven vehicles for sustainable development. This goal ensures that all girls and boys complete free primary and secondary schooling by 2030. It also aims to provide equal access to affordable vocational training, to eliminate gender and wealth disparities, and achieve

universal access to a quality higher education.

Goal 5

Gender Equality

Ending all discrimination against women and girls is not only a basic human right, it's crucial for sustainable future; it's proven that empowering women and girls helps economic growth and development. UNDP has made gender equality central to its work and we've seen remarkable progress in the past 20 years. There are more girls in school now compared to 15 years ago, and most regions have reached gender parity in primary education. But although there are more women than ever in the labor market, there are still large inequalities in some regions, with women systematically denied the same work rights as men. Sexual violence and exploitation, the unequal division of unpaid care and domestic work, and discrimination in public office all remain huge barriers. Climate change and disasters continue to have a disproportionate effect on women and children, as do conflict and migration. It is vital to give women equal rights land and property, sexual and reproductive health, and to technology and the internet. Today there are more women in public office than ever before, but encouraging more women leaders will help achieve greater gender equality.

Goal 6

Clean Water and Sanitation

Water scarcity affects more than 40 percent of people, an alarming figure that is projected to rise as temperatures do. Although 2.1 billion people have improved water sanitation since 1990, dwindling drinking water supplies are affecting every continent. More and more countries are experiencing water stress, and increasing drought and desertification is already worsening these trends. By 2050, it is projected that at least one in four people will suffer recurring water shortages. Safe and affordable drinking water for all by 2030 requires we invest in adequate infrastructure, provide sanitation facilities, and encourage hygiene. Protecting and restoring water-related ecosystems is essential. Ensuring universal safe and affordable drinking water involves reaching over 800 million people who lack basic services and improving accessibility and safety of services for over two billion. In 2015, 4.5 billion people lacked safely managed sanitation services (with adequately disposed or treated excreta) and 2.3 billion lacked even basic sanitation.

Goal 7

Affordable and Clean Energy

Between 2000 and 2018, the number of people with electricity increased from 78 to 90 percent, and the numbers without electricity dipped to 789 million. Yet as the population continues to grow, so will the demand for cheap energy, and an economy reliant on fossil fuels is creating drastic changes to our

climate. Investing in solar, wind and thermal power, improving energy productivity, and ensuring energy for all is vital if we are to achieve SDG 7 by 2030. Expanding infrastructure and upgrading technology to provide clean and more efficient energy in all countries will encourage growth and help the environment.

Goal 8

Decent Work and Economic Growth

Over the past 25 years the number of workers living in extreme poverty has declined dramatically, despite the lasting impact of the 2008 economic crisis and global recession. In developing countries, the middle class now makes up more than 34 percent of total employment - a number that has almost tripled between 1991 and 2015. However, as the global economy continues to recover we are seeing slower growth, widening inequalities, and not enough jobs to keep up with a growing labor force. According to the International Labor Organization, more than 204 million people were unemployed in 2015. The SDGs promote sustained economic growth, higher levels of productivity and technological innovation. Encouraging entrepreneurship and job creation are key to this, as are effective measures to eradicate forced labor, slavery and human trafficking. With these targets in mind, the goal is to achieve full and productive employment, and decent work, for all women and men by 2030.

Goal 9

Industry, Innovation and Infrastructure

Investment in infrastructure and innovation are crucial drivers of economic growth and development. With over half the world population now living in cities, mass transport and renewable energy are becoming ever more important, as are the growth of new industries and information and communication technologies. Technological progress is also key to finding lasting solutions to both economic and environmental challenges, such as providing new jobs and promoting energy efficiency. Promoting sustainable industries, and investing in scientific research and innovation, are all important ways to facilitate sustainable development. More than 4 billion people still do not have access to the Internet, and 90 percent are from the developing world. Bridging this digital divide is crucial to ensure equal access to information and knowledge, as well as foster innovation and entrepreneurship.

Goal 10

Reduced Inequalities

Income inequality is on the rise. The richest 10 percent have up to 40 percent of global income whereas the poorest 10 percent earn only between 2 to 7 percent. If we take into account population growth inequality in developing countries, inequality has increased by 11 percent. Income inequality has increased in nearly everywhere in recent decades, but at different speeds. It's the lowest in Europe and highest in the Middle East. These

widening disparities require sound policies to empower lower income earners, and promote economic inclusion of all regardless of sex, race or ethnicity. Income inequality requires global solutions. This involves improving the regulation and monitoring of financial markets and institutions, encouraging development assistance and foreign direct investment to regions where the need is greatest. Facilitating the safe migration and mobility of people is also key to bridging the widening divide.

Goal 11

Sustainable Cities and Communities

More than half of us live in cities. By 2050, two-thirds of all humanity -6.5 billion people- will be urban. Sustainable development cannot be achieved without significantly transforming the way we build and manage our urban spaces. The rapid growth of cities -a result of rising populations and increasing migration has led to a boom in mega-cities, especially in the developing world, and slums are becoming a more significant feature of urban life. Making cities sustainable means creating career and business opportunities, safe and affordable housing, and building resilient societies and economies. It involves investment in public transport, creating green public spaces, and improving urban planning and management in participatory and inclusive ways.

Goal 12

Responsible Consumption and Production

Achieving economic growth and sustainable development requires that we urgently reduce our ecological footprint by changing the way we produce and consume goods and resources. Agriculture is the biggest user of water worldwide, and irrigation now claims close to 70 percent of all freshwaters for human use. The efficient management of our shared natural resources, and the way we dispose of toxic waste and pollutants, are important targets to achieve this goal. Encouraging industries, businesses and consumers to recycle and reduce waste is equally important, as is supporting developing countries to move towards more sustainable patterns of consumption by 2030. A large share of the world population is still consuming far too little to meet even their basic needs. Halving the per capita of global food waste at the retailer and consumer levels is also important for creating more efficient production and supply chains. This can help with food security and shift us towards a more resource efficient economy.

Goal 13

Climate Action

There is no country that is not experiencing the drastic effects of climate change. Greenhouse gas emissions are more than 50 percent higher than in 1990. Global warming is causing long-lasting changes to our climate system, which threatens irreversible

consequences if we do not act. The annual average economic losses from climate-related disasters are in the hundreds of billions of dollars. This is not to mention the human impact of geo-physical disasters, which are 91 percent climate-related, and which between 1998 and 2017 killed 1.3 million people and left 4.4 billion injured. The goal aims to mobilize US\$100 billion annually by 2020 to address the needs of developing countries to both adapt to climate change and invest in low-carbon development. Supporting vulnerable regions will directly contribute not only to Goal 13 but also to the other SDGs. These actions must also go hand in hand with efforts to integrate disaster risk measures, sustainable natural resource management, and human security into national development strategies. It is still possible, with strong political will, increased investment, and using existing technology, to limit the increase in global mean temperature to two degrees Celsius above pre-industrial levels, aiming at 1.5°C, but this requires urgent and ambitious collective action.

Goal 14

Life below Water

The world's oceans - their temperature, chemistry, currents and life - drive global systems that make the Earth habitable for humankind. How we manage this vital resource is essential for humanity as a whole, and to counterbalance the effects of climate change. Over three billion people depend on marine and coastal biodiversity for their livelihoods. However, today we are seeing 30 percent of the world's fish stocks overexploited, reaching below the level at which they can produce sustainable yields. Oceans also absorb about 30 percent of the carbon dioxide produced by humans, and we are seeing a 26 percent rise in ocean acidification since the beginning of the industrial revolution. Marine pollution, an overwhelming majority of which comes from land-based sources, is reaching alarming levels, with an average of 13,000 pieces of plastic litter to be found on every square kilometer of ocean. The SDGs aim to sustainably manage and protect marine and coastal ecosystems from pollution, as well as address the impacts of ocean acidification. Enhancing conservation and the sustainable use of ocean-based resources through international law will also help mitigate some of the challenges facing our oceans.

Goal 15

Life on Land

Human life depends on the earth as much as the ocean for our sustenance and livelihoods. Plant life provides 80 percent of the human diet, and we rely on agriculture as an important economic resource. Forests cover 30 percent of the Earth's surface, provide vital habitats for millions of species, and important sources for clean air and water, as well as being crucial for combating climate change. Every year, 13 million hectares of forests are lost, while the

persistent degradation of dry lands has led to the desertification of 3.6 billion hectares, disproportionately affecting poor communities. While 15 percent of land is protected, biodiversity is still at risk. Nearly 7,000 species of animals and plants have been illegally traded. Wildlife trafficking not only erodes biodiversity, but creates insecurity, fuels conflict, and feeds corruption. Urgent action must be taken to reduce the loss of natural habitats and biodiversity which are part of our common heritage and support global food and water security, climate change mitigation and adaptation, and peace and security.

Goal 16

Peace, Justice and Strong Institutions

We cannot hope for sustainable development without peace, stability, human rights and effective governance, based on the rule of law. Yet our world is increasingly divided. Some regions enjoy peace, security and prosperity, while others fall into seemingly endless cycles of conflict and violence. This is not inevitable and must be addressed. Armed violence and insecurity have a destructive impact on a country's development, affecting economic growth, and often resulting in grievances that last for generations. Sexual violence, crime, exploitation and torture are also prevalent where there is conflict, or no rule of law, and countries must take measures to protect those who are most at risk. The SDGs aim to significantly reduce all forms of violence, and work with governments and communities to end conflict and insecurity. Promoting the rule of law and human rights are key to this process, as is reducing the flow of illicit arms and strengthening the participation of developing countries in the institutions of global governance.

Goal 17

Partnerships for the Goals

The SDGs can only be realized with strong global partnerships and cooperation. Official Development Assistance remained steady but below target, at US\$147 billion in 2017. While humanitarian crises brought on by conflict or natural disasters continue to demand more financial resources and aid. Many countries also require Official Development Assistance to encourage growth and trade. The world is more interconnected than ever. Improving access to technology and knowledge is an important way to share ideas and foster innovation. Coordinating policies to help developing countries manage their debt, as well as promoting investment for the least developed, is vital for sustainable growth and development. The goals aim to enhance North-South and South-South cooperation by supporting national plans to achieve all the targets. Promoting international trade and helping developing countries increase their exports is all part of achieving a universal rules-based and equitable trading system that is fair and open and benefits all.

What is the importance of sustainable development?

Global goals, such as the Sustainable Development Goals or SDGs, mobilize the global community to achieve them because a specific time frame is defined for these goals. These goals cause the cooperation of stakeholders from different countries and promote innovation and the sharing of expertise and new methods. An example of the effects of these collaborations and mobilizing global resources are achievements in the field of health: reducing child mortality and universal access to health. The Sustainable Development Goals provide a long-term approach to addressing global challenges. The challenges facing many countries of the world and to solve them requires joint cooperation. Due to rapid changes in governments and their policies, most government programs have a relatively short lifespan (4-5 years). Having long-term goals and plans that have been agreed upon by 193 countries will increase the continuity of efforts towards these goals and will strengthen the commitment to accomplish them. Sustainable development goals not only refer to people's well-being, economic development of countries and a better environment, but also provide the tools needed to achieve them and how to make these changes. These goals address the root causes of poverty and inequality. Problems such as weak rule of law, corruption, traditionalism and norms that cause discrimination. Since all these goals are interrelated, without knowing the root causes of one, the other cannot be achieved.

What is development?

You might have listed some of the following words: change, consumption, economic development, economic growth, education, entitlements, equality, equity, freedom, gender equity, goals, good governance, Gross Domestic Product (GDP), health, human development, human rights, income, justice, livelihoods, Millennium Development Goals (MDGs), participation, peace, positive change, poverty reduction, process of change, production, progress, reducing vulnerability, responsibilities, self-determination, social development, social inclusion, sustainability, targets, wealth.

Development - A Political Term

A multitude of meanings is attached to the idea of development; the term is complex, contested, ambiguous, and elusive. However, in the simplest terms, development can be defined as bringing about social change that allows people to achieve their human potential. An important point to emphasize is that development is a political term: it has a range of meanings that depend on the context in which the term is used, and it may also be used to reflect and to justify a variety of different agendas held by different people or organizations. The idea of development articulated by the World Bank, for instance, is very different from that promoted by Greenpeace activists. This point has important implications for the task of understanding sustainable development, because

much of the confusion about the meaning of the term 'sustainable development' arises because people hold very different ideas about the meaning of 'development' (Adams 2009). Another important point is that development is a process rather than an outcome: it is dynamic in that it involves a change from one state or condition to another. Ideally, such a change is a positive one - an improvement of some sort (for instance, an improvement in maternal health). Furthermore, development is often regarded as something that is done by one group (such as a development agency) to another (such as rural farmers in a developing country). Again, this demonstrates that development is a political process, because it raises questions about who has the power to do what to whom.

Development Transforms the Environment

But development is not simply about the interactions between human groups; it also involves the natural environment. So, from another point of view, development is about the conversion of natural resources into cultural resources. This conversion has taken place throughout the history of human societies, although the process has generally increased in pace and complexity with time. If we use a system diagram to illustrate - in very general terms - what an economy does, we see that the basic function of an economy is to convert natural resources (in the forms of raw materials and energy) into products and services that are useful to humans. Inevitably, because conversion processes are never totally efficient, some waste is produced which is usually discarded into the environment as various forms of pollution. Therefore, the environment is both a source and a sink in relation to economic processes: it is a source of raw materials and energy and a sink for pollution.

Resources, Energy, and Waste

An example of this type of conversion would be the extraction of crude oil from the North Sea, its fractionation and distillation in oil refineries, and its conversion to petroleum or diesel. In turn, those products (petrol and diesel) are converted - through combustion processes - into useful work (such as transportation) whilst the waste products are released into the atmosphere as greenhouse gases (such as carbon dioxide). If we add together all of the conversion processes that occur, for instance, in a given country, we would have a sense of the total input and output of that national economy. This could be expressed in terms of the total natural resources and energy consumed, the total products and services created and the total pollution generated. (In fact, the total value of the finished products and services created in a given country is expressed using a widely-used measure, the Gross Domestic Product, or GDP.) If we wanted to increase the creation of products and services, in a given economy, we would require more natural resources and energy, and we would also generate more pollution as a by-product.

Economic Growth

From this point of view, development means an increase in the size or pace of the economy such that more products and services are produced. Conventionally, a common assumption has been that, if an economy generates more products and services, then humans will enjoy a higher standard of living. The aim of many conventional approaches to development has been to increase the size of the economy (economic growth) in order to increase the output of products and services. Of course, without any change in the fundamental economic processes involved, the production of more products and services will inevitably require more raw materials and energy, and will generate more waste.

Development Theory

The Emergence of Development Theory

The use of the term development to refer to national economic growth emerged in the United States beginning in the 1940s and in association with a key American foreign policy concern: how to shape the future of the newly independent states in ways that would ensure that they would not be drawn into the communist Soviet bloc. Motivated by this concern, the United States enlisted its social scientists to study and devise ways of promoting capitalist economic development and political stability in what was termed the developing world. Development theory refers to the research and writing that resulted from this effort. There are different conceptions of development and, consequently, disparate approaches to the subject. However, all approaches are concerned with the relationship between development and governance. Development is usually seen as crucially determined by structures of governance; governance is interpreted through and shaped by the goal of development. Most development theory equates development with national economic growth and sees the state as its primary agent; consequently, one of its central concerns is to understand and explain the role of the state in development and the nature of government-market relations. Because these explanations relate development outcomes to the extent and form of the state's role in development, there is a close relationship between development theory and practice. Development theory has changed over time with changes in ideology and the international environment, and, as it changes, so do its conceptions of development and governance and how they are related. Changing conceptions of governance and its relation to development can be traced through the major perspectives on development that have emerged since World War II, as represented by theories of modernization and growth, dependency and world systems theories, the resurgence of neoclassical theory, and an array of newer critical perspectives.

Theories of Modernization and Growth

Development involves innumerable variables, including

economic, social, political, gender, cultural, religious, and environmental factors. But though development theory integrates concepts and perspectives from a range of disciplines, it was highly influenced by economic thought from the start. Early theoretical models of development equated development with economic growth and industrialization, and theorists saw countries that had not yet achieved these as being at an earlier or lower stage of development relative to Europe and North America. The most influential proponent of this view was the American economic historian Walt W. Rostow. His 1960 book, *The Stages of Economic Growth: A Non-Communist Manifesto*, elaborated a linear-stages-of-growth model that defined development as a sequence of stages through which all societies must pass. This conception of the nature and process of development became the basic blueprint for modernization theory. This perspective formed the basis of what came to be known as dependency theory. Dependency theory rejects the limited national focus of modernization theory and emphasizes the importance of understanding the complexity of imperialism and its role in shaping postcolonial states. Its main tenet is that the periphery of the international economy is being economically exploited (drained) by the centre. Building on ECLA's perspective, dependency theorists argued that colonialism recast economies in the Third World in a highly specialized export-producing mold, creating fundamental and interrelated structural distortions that have continued to thwart development. Once this reshaping was accomplished, market forces worked to perpetuate the relationship of dominance and exploitation between center and periphery.

During the 1970s there also emerged a perspective that elaborated an account of capitalist exploitation of the periphery from the perspective of the system's core. This theoretical enterprise became known as world systems theory. It typically treats the entire world, at least since the 16th century, as a single capitalist world economy based on an international division of labor among a core that developed originally in northwestern Europe (England, France, Netherlands), a periphery, and a semi periphery consisting of core regions in decline (e.g., Portugal and Spain) or peripheries attempting to improve their relative position in the world economy (e.g., Italy, southern Germany, and southern France). The division of labor among these regions determined their relationship to each other as well as their type of labor conditions and political system. In the core, strong central governments, extensive bureaucracies, and large mercenary armies enabled the local bourgeoisies to obtain control of international commerce and accumulate capital surpluses from this trade. The periphery, which lacked strong central governments or was controlled by other states, exported raw materials to the core and relied on coercive labor practices. Much of the capital surplus generated by the periphery was expropriated by the core through unequal trade relations. The semi periphery had limited access to international banking and the production of high-

cost, high-quality manufactured goods but did not benefit from international trade to the same extent as the core.

Dependency and world systems theories share a common emphasis on global analysis and similar assumptions about the nature of the international system and its impact on national development in different parts of the world, but they tend to emphasize different political dynamics. Dependency theorists tend to focus on the power of transnational classes and class structures in sustaining the global economy, whereas world systems analysts tended to focus on the role of powerful states and the interstate system. Initially, the logic of these perspectives supported a strategy that came to be known as import-substitution industrialization (ISI). The ISI strategy was to produce internally manufactured goods for the national market instead of importing them from industrialized countries. Its long-run objective was to first achieve greater domestic industrial diversification and then to export previously protected manufactured goods as economies of scale and low labor costs make domestic costs more competitive in the world market. In the 1950s, 1960s, and 1970s, ISI strategies were pursued by countries such as Chile, Peru, Brazil, Mexico, Argentina, Ecuador, India, Pakistan, the Philippines, Indonesia, Nigeria, Ethiopia, Ghana, Zambia, South Korea, Taiwan, and Japan. The strategy ultimately foundered because of the smallness of the domestic market and, according to many structuralist theorists, the role of transnational corporations in this system. These theorists concluded that ISI, carried out in conditions of capitalist relations of production dominated by the economic empires led by the United States, was a recipe for further colonization, domination, and dependency.

Thus, beginning in the 1970s, theorists and practitioners heralded an export-oriented strategy as the way out of dependency. This strategy gives priority to the growth of manufacturing production aimed at world markets and the development of a particular comparative advantage as a basis for success in world trade. The strategy is based on lower wages and levels of domestic consumption (at least initially) to foster competitiveness in world markets, as well as to provide better conditions for foreign investment and foreign financing of domestic investment. By the 1980s, however, many countries that pursued this strategy ended up with huge foreign indebtedness, causing a dramatic decrease in economic growth. Though the theorization of types of peripheral development and their connection with the international system continued to undergo refinement in the 1980s and 1990s, structural theorists were not able to agree about what would end dependence and how a nondependent growth could be achieved.

The Neoclassical Counterrevolution

In the 1980s a neoclassical (sometimes called neoliberal) counterrevolution in development theory and policy reasserted dominance over structuralist and other schools of thought in

much of the world. The emergence of this counterrevolution coincided with the abandonment by the developed countries of social democratic and Keynesian economic policies and, in particular, the policy of controlling capital movements, as well as the post-World War II trading regime. Critics have pointed out that this counterrevolution also coincided with and seemed to offer justification and support for a wave of market-oriented interventions by the World Bank and International Monetary Fund (IMF) and efforts to forge a unified global market regulated only by institutions reflecting the interests of transnational capital. The neoclassical or neoliberal perspective represents a modification and further elaboration of modernization theory. However, in contrast to modernization theory, neoclassical theorists see development as the outcome not of strategic state action but of the action of market forces. The central claim is that failure to develop is primarily the result of too much government intervention and regulation of the economy. Neoclassical theory emphasizes the beneficial role of free markets, open economies, and the privatization of inefficient public enterprises. Its recommended strategy for development is to free markets from state control and regulation, so that capital, goods, and services can have total freedom of movement and there can be greater openness to international trade.

This is the basic blueprint for what has been termed good governance. The notion of good governance has been elaborated, in part, through a component of the neoclassical counterrevolution called new institutionalism. The basic premise of this perspective is that development outcomes depend on institutions such as property rights, price and market structures, money and financial institutions, firms and industrial organizations, and relationships between government and markets. The essence of good governance is to ensure the existence of these institutions and their proper role and functioning, as seen from the perspective of neoliberal theory. According to neoliberal thought, good governance requires freeing the market from state control and regulation; reducing government expenditures for social services like education and health care; maintaining roads, bridges, the water supply, and so forth; and selling state-owned enterprises, goods, and services (including banks, key industries, railroads, toll highways, electricity, schools, and hospitals) to private investors. As evidence of the soundness of these policy prescriptions for the developing world, proponents point to the experience of four "Asian tigers": South Korea, Taiwan, Singapore, and Hong Kong. These were the most-successful cases of the export-led industrialization strategy adopted by many countries in the 1970s. All were able to achieve economic growth based on export industries with a comparative advantage in cheap but skilled labor. All maintained high rates of domestic savings and investment (with correspondingly lower levels of consumption). However, many people point out that, in contradiction to the market-oriented reforms prescribed by neoliberal theory and its underlying rejection of state intervention,

this national development strategy in all the tigers except Hong Kong was planned and executed through the institutions of a centralized authoritarian state.

Critical Perspectives

A number of critical perspectives emerged in the 1970s that highlighted the cultural and ethical dimensions of development. Most prominent among these were the postmodern, postcolonial, and subaltern critiques of Eurocentric conceptions of modernity and development. Postmodern writing challenged grand narratives of the modern era—narratives of the inevitability of progress, the triumph of individuality, and the primacy of scientific truth—as oversimplified, oppressive, or tyrannical. Postcolonial theory focused on the legacy of colonial rule and especially the difficulties faced by former colonial peoples in developing national identity. Working within this general perspective, subaltern studies sought to rethink history from the perspective of the subaltern and, in this way, bring to light and assert the value of alternative experiences and ways. These critiques succeeded in drawing attention to the ethnocentric basis of the idea of what constitutes development and the potential limitations inherent within this development, the tension between universal theories and a diverse developing world, the treatment of gender in conventional development theory, and the political content of economic development strategies as pursued by national governments, encouraged by international institutions and nongovernmental organizations (NGOs), and concealed behind the notion of aid. Eventually, these critiques helped focus attention on the need to broaden the concept of development to include a social development and human security dimension. One notable result has been the United Nations Development Program's conceptualization of human development, which includes the capacity of people to lead long and healthy lives, acquire knowledge, and have access to the resources needed for a decent standard of living.

The notion of human development influenced development theory in at least two ways. First, it clarified the inadequacy of theories that focus on whole nations or societies and that use macroeconomic factors to explain differences in development conditions and to measure development: these theories cannot predict whether the wealth and material well-being generated nationally are widely enough distributed to provide the conditions for human development. Second, the notion of development as human development reemphasizes the importance of the state. It assigns the state a major role in protecting and advancing sustainable human well-being and argues the need for just the socially oriented state policies that neoliberalism proscribes—policies that improve the access of all people to human resource investments, productive assets, credit facilities, information flows, and physical infrastructure and protect the legitimate interests of producers, consumers, workers, and vulnerable groups in society. Thus, alongside the neoliberal call to dismantle public ownership,

state planning, and government regulation of economic activities, there was a perspective that reinvigorated the call for a larger state role in development. These contending perspectives informed political debates about growth and governance and, in particular, what constituted good governance in the global context of development.

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DOI: [10.19080/RAPSCI.2023.08.555731](https://doi.org/10.19080/RAPSCI.2023.08.555731)

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