carrying capacity
Environmental term referring to the number of people that the earth's resources can support indefinitely if those resources are managed effectively.

drawing down
An environmental term referring to the process of using up resources (such as minerals or forests) or abusing ones (such as fresh water or air) in the present that should be available for future generations.

sustainable development
Economic development that considers how current production and consumption patterns affect the ability of future generations to meet their needs with respect to economic prosperity, social justice, and environmental sustainability.

Including the Environment in Economic Decisions

In his book *The David Suzuki Reader*, Canadian scientist David Suzuki calls for ecologists and economists to unite. He begins one of his essays by comparing the root words of the two disciplines:

> *The words* ecology *and* economics *derive from the same Greek word,* oikos, *meaning "household" or "home." So ecology* (logos *meaning "study") is the study of home, and economics* (nomics *meaning "management") is home management. These two fields should be companion disciplines, and yet with few exceptions there is little communication between them.*

Suzuki goes on to point out that all the natural resources of our world are really the "fundamental capital that all countries depend on" and that the actions of many of the participants in our economic system do not always consider our best interests in using these resources. Our natural resources provide benefits that exist beyond the dollar values that they contribute to economic output; yet these benefits—or the destruction thereof—are not factored into the output decisions made in the economy. Suzuki concludes the essay by stating that "economists cannot afford any longer to ignore their companion discipline of ecology."

SUSTAINABLE DEVELOPMENT

Concerns about the relationship between economics and the environment relate to our initial introduction to the study of economics and the underlying economic problem—scarcity. The resources that sustain our world are finite. Some will regenerate given time and effective management, some are used up in the production of goods, and others can be recycled. If our world is to continue and the human race to thrive, these resources must be managed carefully.

In 1982, sociologist William Catton wrote about the concept of carrying capacity in his book *Overshoot: The Ecological Basis of Revolutionary Change*. He defined **carrying capacity** as the number of people that the earth's resources can support indefinitely if managed effectively. In other words, resources must be used in a way that sees the environment is not harmed to the extent that it cannot continue to support its human population.

Over time, concern has grown that economic activity is consuming resources at a pace beyond the earth's carrying capacity. Catton referred to this idea as the **drawing down** of resources—the process of using up resources in the present that should be available for future generations. Many people interpret this statement as applying only to the overconsumption of non-renewable resources, such as minerals and fossil fuels, but it goes well beyond this. Poor management of renewable resources (such as forests, fish, fresh water, and even air) must also be included.

In discussions about the balance between economic development and its impact on the environment, the term *sustainable development* is frequently used. The United Nations' World Commission on Environment and Development introduced the concept of **sustainable development** in its 1987 report titled

Our Common Future. It stated that "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." In other words, a sustainable society is one that considers the impact of current production and consumption patterns on the economic viability of future generations. Since 1987, the term *sustainable development* has grown beyond its application to the environment to include three pillars: economic prosperity, social justice, and environmental sustainability. To achieve sustainability, affluent societies must adjust how they consume and change how they interact with the environment. Paying the full economic and social cost of the resources that they use would be a place to start.

EXTERNALITIES

The conflict between economic and environmental concerns can be explained by the existence of a market inefficiency that is known as an *externality*. An **externality** is a side effect of the productive process that is experienced by a third party who does not participate, as either a buyer or a seller, in an actual market transaction related to the good.

For example, a pulp and paper company produces paper that is sold to a printing company. During the manufacturing process, the pulp and paper company dumps liquid waste (known as *effluent*) into a river, which causes fish to die. People who catch fish from the river now suffer from the side effect of fewer fish to catch. They are not engaged in the economic transaction, yet suffer a cost. This is a **negative externality**—a cost (such as pollution or some other annoyance) that is imposed on a third party as the result of an economic transaction. Other examples of negative externalities include the consequences of oil spills, traffic congestion, toxic-waste dumping, greenhouse gas (GHG) emissions, solid-waste disposal, and noise generated by a factory near a residential area.

An opposing externality also exists. A **positive externality** is a benefit to a third party as the result of an economic transaction. Examples include an increase in the property values of surrounding homes owing to the construction of a new subway and the recreational use of an area that is developed for resource extraction due to the building of roads that allows access for other purposes.

Externalities are really sources of economic inefficiency because market forces do not account for all the costs and benefits associated with making an economic decision. In fact, the primary costs and benefits considered are monetary measurements associated with the parties directly involved, while the external costs borne by other parties are ignored. For this reason, externalities are also called **spillover costs** and **neighbourhood effects**. If the market does not require decision makers to consider these costs, there is no incentive for producers to limit their harmful effects.

A solution to the problem of externalities requires producers to consider spillover costs as part of their inputs. Remember that an input is any factor used in the production process. A producer who uses river or coastal waters to discharge effluent, or the air to expel emissions, is really using water and air as inputs. The consumption of these inputs must be considered as factors in decision making if the outcome is to be considered economically efficient.

externality
A side effect of production, either positive or negative, experienced by a third party who is neither a producer nor a consumer of the product.

negative externality
A cost suffered by a third party as the result of production or consumption.

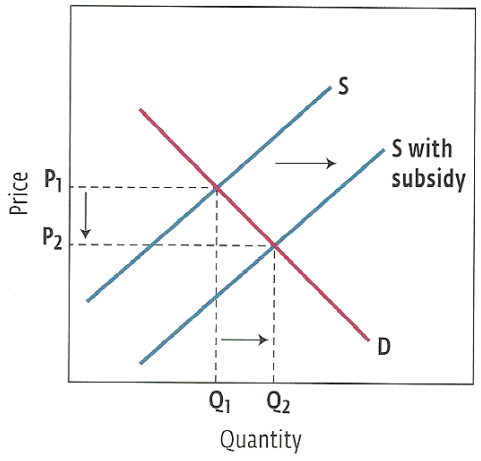
positive externality
A benefit to a third party as the result of an economic transaction; for example, an increase in the property values of homes near the construction of a new subway.

spillover costs (or neighbourhood effects)
Costs (such as those associated with cleaning up pollution) that are borne by a third party instead of the producers and consumers of the product.

DID YOU KNOW?

Kate Raworth presented an alternative model to "endless growth economics" in a 2018 TED talk. Her "doughnut model" focuses on balance instead of growth. Use of resources to address 12 dimensions of social foundation (such as health and education) radiates out of the "hole" toward a balanced "regenerative and distributive" economic "sweet spot" that is the doughnut. The doughnut edge is the ecological ceiling that, once breached, leads to environmental damage such as climate change and biodiversity loss.

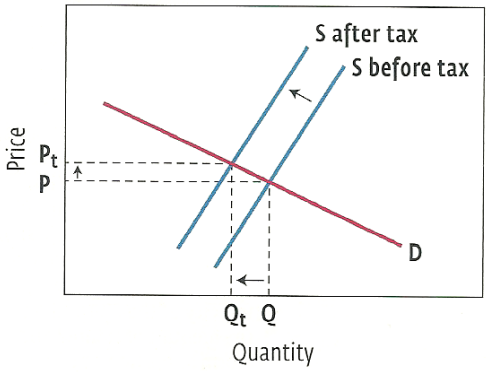
FIGURE 19.4
The effects of a government subsidy on the energy-efficient window market
The introduction of a government subsidy in this market will lead to an increase in supply, causing a decrease in price and an increase in the quantity of energy-efficient windows demanded. A more energy-efficient home will reduce the release of greenhouse gases.



SUBSIDIES

The government might provide a subsidy to firms or consumers to encourage them to take external costs into account. A **subsidy** is a payment made by the government to producers or consumers on the condition of a desired outcome. For example, if the government wants to reduce the amount of water pollution created in the production of whizbangs, it could ask the company to install technology that removes pollutants from the factory effluent. To achieve this objective, they might offer to subsidize all or part of the cost of the technology necessary to remove the pollutants. The introduction of a subsidy increases supply, causing a reduction in the market price of the good or service in question, as well as an increase in the market quantity exchanged. Examples include subsidies for upgrading windows (as demonstrated in Figure 19.4), insulation, or smart thermostats to make a home more energy efficient, thereby reducing GHG emissions. A major complaint regarding this strategy is that the producer and consumer of the product are not held accountable for the external cost; rather, the general public pays through the collection of the tax revenue necessary to pay the subsidy.

FIGURE 19.5
Passing on the cost of externalities to consumers through a Pigouvian tax
The tax shifts the supply curve to the left, resulting in an increase in price from P to P_t (price with tax) and less pollution, as the quantity exchanged decreases from Q to Q_t (quantity with tax).



TAXES

Another method that can be used to limit spillover costs is to tax the transaction. A **Pigouvian tax** (named after Arthur Cecil Pigou, the British founder of welfare economics) may be levied on production that causes a negative environmental externality. Its purpose is to force producers and consumers to consider the external environmental costs. Instead of forcing society as a whole to pay for pollution costs, the producer is forced to "internalize the externality." The effect of the tax is to shift the supply curve in the market to the left, as shown in Figure 19.5, as producers must now receive a higher price to maintain the same level of production. As a result, the equilibrium price in the market rises, and a smaller quantity is bought and sold. The smaller quantity exchanged should also be reflected in a decrease in the environmental damage that is of concern.

Using taxes to internalize externalities results in a market price that reflects the true social costs of production

and forces firms and consumers to bear the full social cost of their economic activities. However, these methods have attracted some criticism. First, the money raised through taxes does not actually go toward compensating those who are affected by the externality. For example, the lake that is being polluted in the production of whizbangs is still being polluted—albeit to a lesser degree—but the residents who are not able to draw their drinking water from the lake are not receiving any of the tax revenue to compensate them for their loss. Instead, the compensation goes to the government in the form of tax revenue.

Second, it is difficult for the government to set a tax that makes up for the difference between the marginal cost and the marginal social cost. The best strategy for a government to take is to set a tax rate that slowly creeps upward, called a "ratchetting mechanism," until the pollution is reduced to an acceptable level. Note that this does not mean that the level of pollution will necessarily fall to where marginal social cost is equal to marginal benefit. Political concerns may limit the shift of the marginal cost curve.

Third, pollution still occurs. The only difference is that the new level of pollution is efficient, as long as the Pigouvian tax shifts the marginal cost curve so that it is equal to the marginal social cost curve. One advantage of the Pigouvian tax is that it may cause some producers to adopt a technology that reduces external costs. Firms with cleanup costs that fall below the level of the tax will implement the required technology to avoid the tax.

In 2004, France implemented a Pigouvian noise tax on airplanes taking off from its nine busiest airports. The tax is set at 2 to 35 euros per departure depending on the plane's size, the amount of noise the plane makes, and the time of the departure. The revenue is dedicated to soundproofing homes around the airports.

subsidy
A grant of money from a government to a producer to achieve some desired outcome, such as the installation of pollution-control equipment.

Pigouvian tax
A tax levied on the production and/or sale of any good or service that causes a negative externality such as pollution; named after economist Arthur Pigou.

REGULATION

The federal and provincial governments may use direct regulations to limit externalities. Regulation is usually necessary when the production of a good or service results in a highly toxic or dangerous by-product. For instance, the use of chlorine in bleaching pulp for paper production results in a waste by-product that contains dioxins and furans. These highly toxic compounds have been associated with reduced reproductive capabilities in fish-eating birds that live around the Great Lakes. Therefore, it is necessary for the government to regulate the allowable levels or amounts of these substances permitted to enter the environment. Many environmentalists argue that no dioxins or furans should be allowed from industrial sources. On the other hand, industry advocates argue that there are safe levels that the environment can absorb. For extremely dangerous pollutants, the government has little choice but to use regulation to protect the public interest. Regulation 347 of Ontario's Environmental Protection Act of 1990, which governs rules related to hazardous waste, is an example of direct regulation of harmful externalities.

The government might also use regulations to protect renewable resources such as fish and lumber. Quotas—such as restrictions on the amount of fish that can be caught within territorial waters—are designed to help manage public resources that would otherwise be overused. Critics claim that these regulations

DID YOU KNOW?

- Canada's CO_2 equivalent emissions (a measure used to convert the emissions of different GHGs into a common unit) in 2016 were 704 Mt, down from a peak of 745 Mt in 2007.
- CO_2 emissions per capita in Canada peaked in 2000 at 23.8 tonnes. In 2016, they had fallen to 19.4 tonnes.
- In Canada, heating an average home for four months creates 1 tonne of CO_2 emissions. Commuting 10 km (each way) to work in a Honda Civic creates 1 tonne of CO_2 emissions in one year.

are often treated as taxes, in the sense that those who break the law are fined; if offenders feel that paying the fine is cheaper than taking the action necessary to prevent the external cost, they may just pay the fine. Another problem is that such regulations can be costly and difficult to administer. In times of budget cuts, the policing of regulations may be cut back. This complaint was levied against the Ontario government during the Walkerton water inquiry in 2001, convened after the deaths of people who drank municipal water that was contaminated with E. coli bacteria. It has been suggested that economic tools, such as taxes and subsidies, tend to be more efficient than regulation because compliance is built in through market pricing mechanisms.

Source: Bolotta, A. et. Al, *Economics Now* (2nd ed.) Thompson, Toronto, 2018, pp. 408-418.

Questions: *Including the Environment in Economic Decisions*

Answer the following based on your knowledge of economics and the reading*: "Including the Environment in Economic Decisions"*

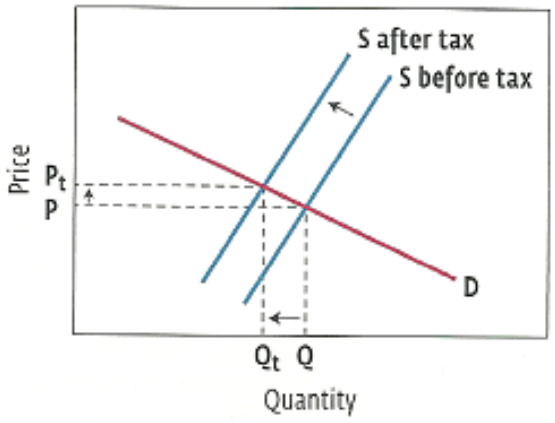
1. How are the concepts of sustainable development, carrying capacity and drawing down related?

2. Explain why producers do not include the negative effects of their private production activities, such as pollution, in the calculation of profit?

3. Explain the difference between a positive and negative externality. Be sure to provide an example of each.

4. Create a table that compares the advantages and disadvantages of subsidies, taxes and regulation as differing methods of controlling pollution.

5. Study the diagram below:



Analyze and explain how the use of a tax is curbing the levels of pollution emitted by a firm and thus forcing it to *'internalize the negative externality'*.