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# Circular Economics will Reduce Demand for Resources

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## Abstract

Economics is the study of human behaviour within the constraints of scarcity. For much of human history, scarcity was mostly the result of inefficiencies of labour within human civilizations. However, because of the Industrial Revolution, people are now able to complete laborious tasks with far less effort from human and animal labour. The Industrial Revolution was a boon for the productivity of humanity. However, the Industrial Revolution was not without side effects. This paper will address some of the effects of economic growth, specifically the natural resources required to support growing economies. It will also demonstrate that humans can improve existing systems to help protect the environment. China is already implementing measures to continue to industrialize while also taking drastic measures to protect the environment. The Green Revolution could be the next Industrial Revolution, and humans will need to continue to increase their practices of sustainability, especially as more people move out of poverty, because the demand for natural resources will increase even if populations decline. In order to ensure we protect our environment, countries must adopt environmentally sustainable methods, such as circular economic practices, in order to help reduce the demand for a limited supply of natural resources.

**Keywords:** Circular Economics, Negative Externalities, Environmental Kuznets Curve (EKC), Jevons Paradox

## 1. Introduction

Economics is the study of human behaviour within the constraints of scarcity. For much of human history, scarcity was normal, and it was mostly the result of inefficiencies of labour within human civilizations. The result was sometimes famine, because of rapid population growth civilizations were often unable to produce enough food for their people. However, because of the invention of combustion engines, which first used steam, and then the internal combustion of fossil fuels, people were able to complete laborious tasks with far less effort from human and animal labour. This Industrial Revolution was a boon for the productivity of humanity, allowing populations to flourish and thrive, drastically improving the quality of life for everyone in the developed world. However, the Industrial Revolution was not without side effects, such as pollution and climate change. Now as human populations boom, especially in the developing world, the demand for natural resources is outpacing the supply. Economists and other experts are increasingly advocating for the implementation of more sustainable consumption and development practices, referred to generally as circular economics.

## 2. Resource Usage

Demand for natural resources, which have a finite supply, will only continue to increase even as populations age and decline (Eckoff, 2020, p. 395). Figure 1 below shows the usage of various resources increased dramatically, especially beginning in the 1950s. The combination of population growth, as well as economic growth, exponentially increased the global demand for resources.

The graphs clearly demonstrate that population and resource usage correlate.

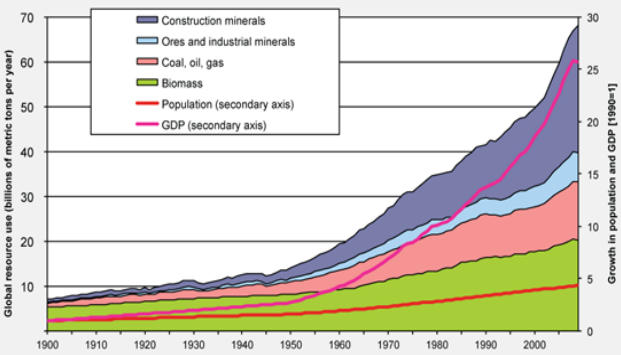


**Figure 1.**

Source: https://sites.google.com/a/geogalot.com/geogalot/myp-humanities/year-10/under-pressure---resources/001---types-of-resources

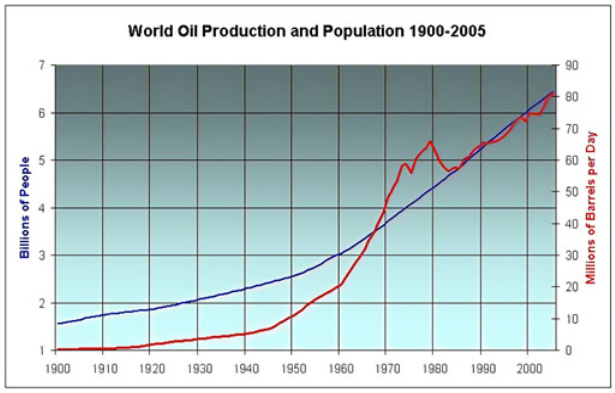


**Figure 2.**

Source: https://www.wakingtimes.com/global-population-explosion-marks-the-end-of-the-iron-age/world-population-and-oil-1900/

## 3. Population Growth

Population growth in combination with industrialization led to tremendous demands on natural resources. The industrial revolution allowed countries that had industrialized to have exploding populations. "Population levels of developed countries have stabilized and they are predicted to remain at similar levels from now until 2050" (Eckhoff, 2020, p. 392). Before the Industrial Revolution, however, population growth usually led to the "Malthusian Trap." Sarah Eckhoff described Malthus' theory as, "The ability or 'power' of humans to procreate at an exponential rate will always outrun the ability to provide for that population regardless of innovations and/or technology. In other words, the population will always grow faster than the means to harvest the world's resources and inevitably, crisis, famine, and war over food would result" (Eckoff, 2020, p. 395). Eckoff, via Malthus, here refers to historical scenarios, but the same thing is happening now. However, the competition manifests in ways other than war and famine. The "Malthusian Trap" is still a condition of modern civilization because technology allows increased consumption.

Malthus was advocating for a moral imperative for birth control, and saying that the poor did not deserve a seat at what he referred to as "the feast". Obviously, this perspective is controversial, but he is correct in his theory that a population's resource demands will always outpace supply. In part because of the invention of combustion engines, which first used steam, then the internal combustion of fossil fuels, people were able to complete laborious tasks with far less effort from human and animal labour. This Industrial Revolution was a boon for the productivity of humanity, and it continues to improve the quality of living for billions of people. However, the Industrial Revolution was not without side effects.

## 4. Negative Externalities

Newton's Third Law tells us that for every action there is an equal and opposite reaction. Chaos Theory tells us that within the natural environment, reactions to actions are not always predictable, and in environmental economics, this concept is referred to as negative externalities. The online Encyclopedia Britannica says, "Negative externalities exist when individuals bear a portion of the cost associated with a good's production without having any influence over the related production decisions. For example, parents may have to pay higher healthcare costs related to pollution-induced asthma among their children because of increased industrial activity in their neighbourhood. Producers do not consider those costs to others in their decisions. As a result, they produce more goods with negative externalities than is efficient, which leads to more environmental degradation than is socially desirable" (Brown, 2018).

## 5. Consumption

In the United States, household consumption makes up about 67% of the GDP (https://www.bloomberg.

com/opinion/articles/2021-11-12/personal-finance-americans-need-to-live-more-like-europeans). In the same article the author goes on to say, "We consume much more than we used to and more than other countries. Consumption per capita grew about 65% from 1990 to 2015, compared with about 35% growth in Europe" (Schrager, 2021). Household consumption makes up only about 50% of GDP in Germany" (Schrager, 2021). "Clothing purchases have increased five-fold since 1980 and the average garment will only be worn seven times before it's disposed of" (Schrager, 2021). That kind of consumption is not environmentally sustainable, especially for growing populations in the developing world. Recently China was considered part of the developing world, but at this stage of growth, most experts consider China part of the developed world. Although its population is ageing and declining, China's economy is still growing, and it will only continue to experience increased demand for goods and services from the global economy, as well as demand for natural resources in order to sustain the population and meet demands from other countries' consumption. This level of consumption will cause negative externalities for humans and our environment.

## 6. Environmental Kuznet's Curve

Some experts theorize the negative externalities of growing economies using the Environmental Kuznets Curve (EKC).

The EKC shows that as the income of a country grows, as China still is, the effects on the environment will get worse, until at a certain point of income, at which time a country's relationship with the environment will improve. Wang Jinnan, deputy director and chief engineer at the Chinese Academy of Environmental Planning, says that an 'environmental turning point' will be reached when per-capita GDP reaches US$10,000. China is expected to reach US$11,000 by 2020 and US$20,000 by 2030.

The full extent of the consequences of pollution and the number of resources that the United States and China are using is not fully known. Often the projections of demand and supply prove inaccurate. For example, the concept of "peak oil" is yet to be known, even though we do know that the United States and China are the greatest oil consumers worldwide. In 2019, daily oil consumption in these countries amounted to 19.4 million barrels and 14.1 million barrels, respectively (Statista, 2019). It is also possible to measure the amount of carbon and pollution

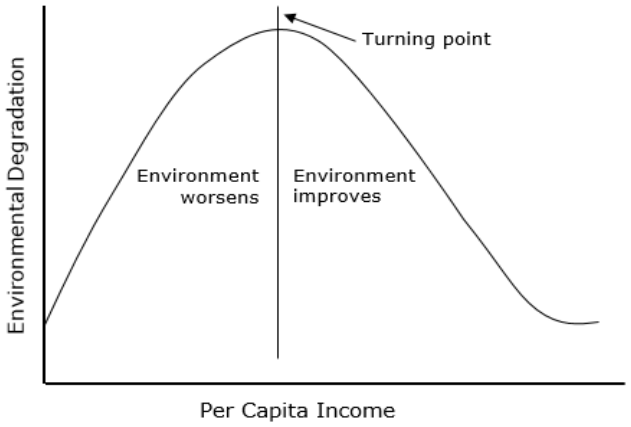


**Figure 3.**

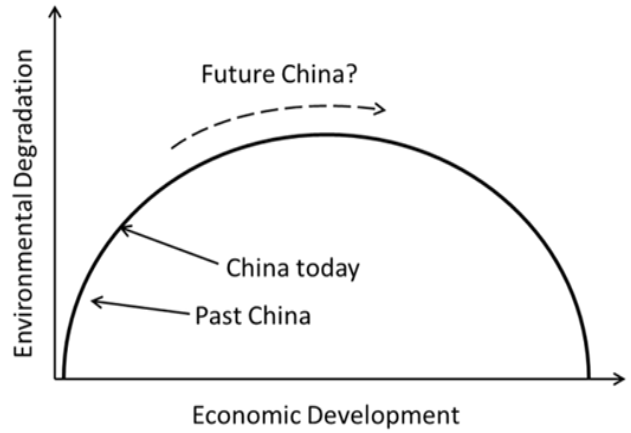


**Figure 4.**

Source:https://chinadialogue.net/en/business/7959-can-china-hit -a-2-25-turning-point-in-its-pollution-fight/?amp

in the air, but the full extent of these effects remains theoretical. Despite the incalculable chaos in these theories, there are enough obvious negative externalities to motivate individual firms and states to clean up their acts. The next section of this paper will demonstrate that in fact, China is doing just that, attempting to clean up its act by enacting sustainable environmental and economic practices.

## 7. Sustainability

"In the past half-century, while the world's population has more than doubled, the amount of material flowing through the economy has more than tripled" (Kunzig,

2020). That is unsustainable, because the current economy moves linearly, meaning that those materials come from the earth and are consumed, and the majority are not reused or recycled. This means that humans are not living in harmony with their environment. Some experts refer to this as an inability to adapt or evolve. "A very general perspective arising from evolutionary thinking is that human-induced environmental degradation can be interpreted as the human species being maladapted to its current natural environment. Maladaptation may even get worse since the environment is not exogenous but is being transformed by humans at an unprecedented rate (van den Bergh, 2007, p. 6). Humans' inability to adapt to the environment is obviously unsustainable, but what, if anything, is the solution?

## 8. Regulations

Some experts might suggest that regulating industries and individual behaviour can help, and most often these regulations come from governments rather than from the industries or individual firms. "For example, between 1970 and 2006, the United States inflation-adjusted GDP grew by 195%, the number of cars and trucks in the country more than doubled, and the total number of miles driven increased by 178%. However, during that same period, certain regulatory changes and technological innovations led to decreases in annual emissions of carbon monoxide from 197 million tons to 89 million, nitrogen oxides emissions from 27 million tons to 19 million, sulfur dioxide emissions from 31 million tons to 15 million, particulate emissions by 80%, and lead emissions by more than 98%" (Du Pont, 2006). These statistics prove the validity of the EKC, as well as the Jevons Paradox because demand increased with innovation.

While reducing pollution is a great start, eliminating it is the only sustainable solution, but often governments and even firms find there are economic roadblocks preventing them from implementing fully environmentally sustainable practices. "Last year the World Bank announced that it was softening its own environmental and social safeguards, in a move that was widely seen as an effort to remain competitive with the AIIB" (Laurance, 2017). If the World Bank is willing to ease environmental restrictions, then it is no surprise that other industries and firms, even governments, often oppose regulations. Regulations can stifle economic growth, which is vital to improving the quality of life for most people.

However, "The circular economy doesn't aim to end growth; it aims to bend how we do things back into harmony with nature so that growth can continue" (Kuznig, 2020). Implementing circular economic practices will be one of the best solutions for developing environmentally sustainable economies in China and the United States. It won't be easy. In that same *National Geographic* article, Robert Kuznig notes that natural resource usage could double by 2050, and he said, "Building a circular economy will require an enormous cultural shift, on the scale of the industrial revolution".

## 9. Circular Economics

Economies are often described as a circle (Discovery Education, 2001), although most economic theories are illustrated in linear graphs, because that is how humans consume, in a linear fashion. Materials are taken from the earth, sometimes used only once, and then discarded. Building materials make up the largest waste stream flowing into landfills (Kuznig, 2020). Considering how much building is happening in places like China and the United States, that is an enormous amount of material going to landfills, although it could become a resource cache.

Many economists and other experts advocate for this exact model, because, as we have already discussed, when industrial economies grow, they consume more, and have

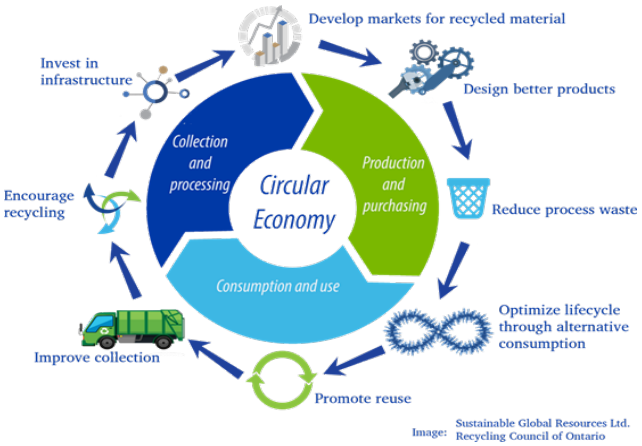


**Figure 5.**

https://www.fractracker.org/a5ej20sjfwe/wp-content/uploads/2019/11/CircularEconomy.png

increasingly detrimental effects on the environment. "On the whole, the arrival of industrial capitalism has been associated with profoundly positive results. Food has become cheaper and more abundant; extraction of resources has grown, and their prices relative to wages have plummeted. Early experiences of pollution and environmental degradation have been reversed. Scientific and medical breakthroughs of the first order- anaesthesia, antibiotics, vaccines- have relieved humanity from age-old burdens (although those breakthroughs are not yet universally shared). China in particular is emerging as a leader in building renewable energy industries and advancing the frontier of resource efficiency technology" (Mathews, 2015, p. 5). Mathews is explaining that industrial capitalism has helped humanity in many ways, so it makes sense that moving forward states would want to adopt those practices as part of their development.

In his masterwork, Mathews goes on to say, "[China's] current Twelfth Five-Year Plan provides as close a template as one is likely to find for greening an industrial economy" (Mathews, 2015, p. 6). Mathews advocates that China is establishing sustainable economic and environmental practices of their own volition. He said, "China's national leadership appears to have understood that continued development in the traditional linear manner, starting with resources taken from nature at one end and proceeding via production processes to the creation of wastes disposed in nature at the other end, is simply no longer feasible. It is destructive to the point of ruin, at both ends; it is costly to both secure fresh resources all the time and loses resources in the form of waste. It is also geopolitically dangerous to scour the world for." (Mathews, 2015, p. 120-121). China is seeking sustainability because it is not only good for them economically and environmentally, but it is also good politically, even within a system which is able to easily implement drastic measures.

Further explaining why the government seeks a green economy, Mathews said, "… China has both motive and means. It has the motive of wishing to clean up its environment and avoid the endless geopolitical conflicts that a continuation of the fossil-fueled pathway promises. And it has the means in the form of a strong (in this case, authoritarian) state that is prepared to make tough decisions and implement them. I make this statement as an observation, and not as an endorsement of authoritarian rule." (Mathews, 2015, p. 9). It is difficult to argue with the success that China has demonstrated using a planned economic model, pulling 500 million out of abject poverty. It should also be noted China's Belt and Road Initiative (BRI) is a means by which the country seeks to secure natural resources abroad. However, Mathews notes there are critics, saying, "Now the free-market environmentalist critics respond that all this is unnecessary; if there is a profit to be made in the new RE [renewable energy and resource efficiency] sectors, then capitalist interests will dictate that entrepreneurial initiatives flow in these directions. The flaw in this assumption is that it ignores time and scale" (Mathews, 2015, p. 9). China has demonstrated the ability to industrialize in less than one-quarter the time it took the rest of the planet, albeit often stealing technology and benefitting from the research and development that has gone before them.

However, China's rise is unmistakable. Mathews said,

"The key point to highlight is that while China has been expanding its fossil-fueled energy system at an unprecedented rate, at the same time it has been expanding its alternative renewable energy systems and resource-efficient circular economy, also at an unprecedented rate. From 2005 it was doubling its wind power capacity each year and is now continuing to double it every two to three years, creating by far the world's largest wind power sector (turbines and components) and the largest land area of wind farms. It has been scaling up its solar Photovoltaic (PV) systems in a similar way so that its solar PV production industry is by far the largest in the world. In the period of the Eleventh Five-Year Plan (2006–2010), its investments in a strong and smart electric power grid that can collect and distribute power from a variety of fluctuating renewable sources were doubled, so that they outranked investments in power generation; this process is accelerating under the Twelfth Five-Year Plan. By 2013 China had by far the largest renewable energy industry in the world, outranking the entire German and French power systems" (Mathews, 2015, p. 10).

The immense scale China can achieve with any project is incomparable. The Three Gorges Dam literally changed the length of a day, because it held enough water to change the circumference of the earth, thereby measurably lengthening the earth's rotation.

China's ability to develop its economy and seek resource independence in the global community should be good news for the US and the rest of the West. "China has a clear interest in avoiding resource-based confrontations (at least away from its immediate neighbourhood) because it has a strong commitment to achieving standards of living comparable with those of the West through peaceful development, without the waste of

war. If resource confrontations are to be avoided, Beijing realizes that renewable energy industries will need to be built as fast as is physically and technologically possible" (Mathews, 2015, p. 11). However, traditional East-West rivalries and sentiments that cause arms races are still prevalent, as well as the geopolitical tensions resulting from BRI.

Whether in spite because of these sentiments, China is still finding incentives to go completely green, while still maintaining a flourishing economy. Mathews said,

"China is specifying a range of means, including the implementation of circular economy- through interconnecting the chains of resource and energy utilization so that wastes from one process can be captured and used as raw materials for another, with energy generation being shared along the value chain… This makes the idea of the circular economy far more ambitious and effective than mere recycling, which simply calls for the redirection of expended articles from waste to industrial input; the circular economy, by contrast, envisages the interconnection of all industrial processes, particularly those that lead up to the final product" (Mathews, 2015, p. 119).

In 2008 the Chinese People's Congress passed a national circular economy law, the Law for the Promotion of the Circular Economy, which took effect on 1 January 2009 (Mathews, 2015, p. 119). "While inspired by legislation in other countries, such as in Japan and Germany, the law in China seems to be the first in the world putting circular economy as a national strategy of economic and social development" (Mathews, 2015, p. 119). Obviously, China is taking seriously their push toward green economic development.

In a recent interview, US President Joe Biden said, "We welcome the competition. We're not looking for conflict" (Horowitz, 2021). Hopefully, that is the case and these two major world economies will continue to develop peacefully, thereby improving the lives of everyone on the planet.

## 10. Conclusion

Humans will continue to evolve, developing new technologies and new methods by which to use them. In doing so humans will continue to have a high demand for resources. The competition to use them more efficiently is a good thing, especially if it leaves in place the economic systems that have helped humans progress thus far, and enjoy the high quality of life billions of people have today. Circular economics will lead to increased renewable energy and resource efficiency, which will improve the lives of billions of people now and in the future.

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