

How to achieve sustainability through manufacturing innovation



VIEWPOINT
Nabil Nasr

When we talk about sustainability, we tend to talk about climate change. This conversation has led to many good policies to combat its worst effects by funding renewable energy and cutting greenhouse-gas (GHG) emissions. But these efforts alone are not enough to secure our future prosperity because they don't address the elephant in the room: manufacturing. And that means thinking about resources.

Most people would be surprised to learn that, even if all electricity was produced by renewables, it would reduce GHG emissions in the United States only by 25 percent.¹ Industry, transportation, and the commercial and residential sector together account for 63 percent of total U.S. emissions.² These are released as companies extract raw materials, manufacture goods, and distribute them, and as businesses sell products that are consumed and thrown away.

More people, less resources

Ninety-eight percent of the world's population growth over the next 25 years will take place within developing countries. The world's economy will expand dramatically with it. The subsequent surge in consumer demand is expected to double the amount of raw material mined or harvested for industry by 2050. The majority of that material going into the economy, if existing practices continue, will end up as waste or in landfills: only about 9 percent of the 92.8 billion tons of minerals, fossil fuels, metals, and biomass that enter the economy each year is reused in any way.³

The reality posed by the depletion of resources worldwide has been front and center for me as a member of the International Resource Panel (IRP), a global scientific panel sponsored by the United Nations Environment Programme (UNEP). The IRP was created to contribute a better understanding of sustainable development from the perspective of natural resources. Its research has found that our demand for natural resources is increasing at an unsustainable pace. World consumption of primary materials has grown from seven billion tons in 1970 to 90 billion tons in 2017. The panel projects that this figure will reach 186 billion tons by 2050 at the current rate. Consumption is also severely imbalanced between rich and poor—the top one-billion richest people on Earth consume 72 percent of the planet's natural resources.⁴

These figures are distressing, but I don't quote them out of pessimism. In fact, I'm optimistic about what's possible. That's because I believe that, between how we use resources today and a sustainable future, there is incredible opportunity. For much of my career, I have worked to show that economic growth and environmental degradation don't have to go hand-and-hand—the two can be *decoupled*. That is, an economy that contributes to our prosperity and well-being without depleting the environment of its essential resources is achievable.

I'm not alone. As founding director of the Golisano



Photo by David Lamb Photography
Golisano Institute for Sustainability

Institute for Sustainability (GIS) at Rochester Institute of Technology, I have the privilege to work with some of sustainability's brightest minds every day. We apply emerging and advanced technologies in new ways to rethink manufacturing from the ground up. A theme runs through all of our research: we seek circular solutions to linear problems.

Towards sustainable manufacturing

For much of the world, manufacturing begins when raw materials are extracted from the earth, then they are processed, transported, and used to produce commodities that are purchased and consumed. This story ends when those products are discarded or thrown away at the end of their useful life (if not earlier). Sustainable manufacturing aims to change this story, asking how resources and value can be recovered from end-of-life products and waste materials to feed what's known as the "circular economy."

RIT became an early pioneer of sustainable manufacturing with the opening of the Center for Integrated Manufacturing Studies (CIMS) in 1992 and the Center for Remanufacturing and Resource Recovery (C3R) in 1996. The establishment of GIS in 2007 further accelerated the university's global leadership in this area. We are now on the verge of unveiling the RIT Remanufacturing Test bed, the only resource of its kind in the United States where companies can research, develop, and validate remanufacturing and resource-recovery technologies and processes.

I feel very optimistic about what's possible through innovation and creativity because I have seen the results we have achieved at RIT. We have partnered with hundreds of companies here in Rochester and further afield to realize not only sustainable processes and products, but also cost savings that make their businesses more profitable. Our work also impacts policymaking: I recently participated in the creation of eight detailed recommendations for driving sustainability within Monroe County as part of its 2020 transition report. The county's clear commitment and willingness to make positive changes in this area is laudable.

The REMADE Institute

The innovations we are pursuing at RIT are essential to solving the resource crisis. But they won't make a difference if they are never put into practice by large-scale manufacturers. This is one reason why I led the efforts to establish the Reducing Embodied-Energy And Decreasing Emissions (REMADE) Institute in 2017 and now serve as its CEO.

Based in Rochester, REMADE was created as an initiative of the U.S. Department of Energy to assist manufacturers with the development and deployment of technologies that cost-effectively reduce material consumption. With more than \$140 million in funding, it is the largest research program in the U.S. to focus on energy efficiency, recycling, and remanufacturing. It is a platform for advancing manufacturing technologies that promise greater material efficiency and value retention from end-of-life products. REMADE leverages multiple points of expertise as a member-based, research-and-development consortium, working with industry leaders such as Nike, John Deere, Michelin, and Caterpillar, and with national labs, universities and nonprofit organizations.

Sustainability is about putting a vision for a better world into practice, and that's probably the hardest part. But that's exactly what we aim to do at RIT. By focusing our innovation in technology on those areas with the most impact on our world, like manufacturing, we are able to drive true, lasting results.

Nabil Nasr is associate provost and founding director of the Golisano Institute for Sustainability as well as CEO of the Reducing Embodied-Energy And Decreasing Emissions (REMADE) Institute.

¹ www.gatesnotes.com/Energy/My-plan-for-fighting-climate-change

² www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

³ circulareconomy.europa.eu/platform/en/news-and-events/all-news/2019-circularity-gap-report-reveals-world-only-9-circular-and-trend-negative

⁴ www.resourcepanel.org/reports/resource-efficiency-sustainable-development