A Virtuous Circle

We live in a material world. The unsustainable consumption of natural resources translates into environmental degradation and increased business risk. Economic growth and raw materials need to be decoupled. Fortunately, there is a path forward

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The term *circular economy* is becoming commonplace as we seek to create economic prosperity without compromising human health and the environment. We simultaneously are striving to find a balance between society's needs and the planet's capacity to provide. All this is a complicated task, especially when one considers the numerous distinct but interlinking facets of our economy. Despite the difficulties, we need action now if we are to achieve sustainability in the future.

Domestically and globally, there is a growing consensus that economic expansion and raw materials need to be decoupled. Data from Accenture indicate that, during the 20th century, global raw material use rose at about twice the rate of population growth, and that for every 1 percent increase in GDP, raw material use has risen by 0.4 percent. Furthermore, much of the raw material used by industrial economies is returned to the environment as waste within one year. Although there has been some attempt at decoupling economic growth and natural resource use, it is insufficient to overcome the even higher demands we face with a projected world population of more than 9 billion people by 2050, not to mention the rapid industrialization in the world's emerging economies.

Ironically, the unsustainable consumption of natural resources and concomitant environmental degradation translates into increased business risks — through higher material costs and supply uncertainties and disruptions — rather than prosperity. Against this backdrop, the G7 (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) has recognized this global challenge and formed an Alliance on Resource Efficiency in response. The alliance publicly recognizes that improving resource efficiency and managing materials sustainably throughout their lifecycles are important elements of delivering environmental and climate protection, employment, social benefits, and sustainable, green growth.

In the United States, the Environmental Protection Agency, states, and other stakeholders have adopted *sustainable materials management* to address the challenge of advancing sustainable use of materials within society. The premise is simple: use materials productively while minimizing the amount of materials and all associated environmental impacts. SMM uses lifecycle analysis and systems thinking as a way to identify adverse environmental and other effects — and then to reduce them. It takes into account the entire lifecycle of material resources flowing through the economy, from extraction or harvest of materials and food (e.g., mining, forestry, and agriculture), to production and transport of goods, provision of services, reuse of materials, and, if necessary, disposal.

SMM casts a far broader net than approaches based on traditional end-of-life waste management and pollution management. SMM allows for

a more strategic use of resources and better outcomes. Without considering the entire lifecycle, negative effects can be shifted from one type of impact to another. Well-intentioned strategies can actually increase negative environmental outcomes if the big picture is not completely framed. In using SMM, such issues can be revealed, and the potential trade-offs considered and perhaps even overcome. It is important to note that SMM and other approaches (such as resource efficiency, the circular economy, and the Kobe 3Rs) are slightly different, but all share a broad agreement that materials can be better managed and used, and generally kept in productive use longer. Lifecycle-based decisionmaking represents a radical change in how environmental, social, and economic impacts and needs are thought of at all levels, from the community to the entire global economy.

SMM also offers a new view on climate change. When taking a lifecycle-based perspective, materials and land management account for more than 40 percent of greenhouse gas emissions in the United States. As the United States and other countries assess how they will fulfill their Intended Nationally Determined Contributions (commitments under the Paris Agreement made by countries that help limit global warming to under 2 degrees Celsius), systems-based approaches can help identify greenhouse gas reduction opportunities while simultaneously addressing economic development and competitiveness associated with the availability of material feedstocks. The World Resources Institute identifies reductions from the manufacturing sector as the third-largest near-term greenhouse gas abatement opportunity needed to achieve the United States' commitments beyond President Obama's earlier, regulation-based Climate Action Plan. It identifies resource efficiency and waste reduction as one of the primary levers in the manufacturing sector needed to protect the planet from dangerous heating.

Progress is being achieved. EPA is operationalizing SMM in a real way by using a range of policy instruments and stakeholder collaboration, but radical change across the supply chain is needed to truly obtain sustainable solutions to environmental impacts posed by materials. In the EPA's 2009 report "Sustainable Materials Management: The Road Ahead," specific recommendations around lifecycle thinking were directed at government stakeholders: promote efforts to manage materials and products on a lifecycle-basis; build capacity and integrate materials management approaches in existing government programs; and, accelerate the broad, ongoing public dialogue on lifecycle-based materials management. In addition, the report contained the first-of-its-kind lifecycle assessment of the U.S. economy. It identified 38 materials, products, and services that represent potentially significant contributions to adverse environmental issues and showed where approaches like recirculating materials back into the economy could be taken.

Governments, businesses, and other organizations have numerous instruments to select from to operationalize SMM throughout our supply chains. Just some of these options include: regulations, collaboration, standards development, economic incentives (e.g. taxes, subsidies), procurement programs, research, grants, goal setting, tools and measurement, education, technical assistance, and other voluntary efforts. Given the range of instruments available, it is not always easy to know which one is best, and the most effective is likely to be situation specific. In the United States, EPA has found four of them — collaboration, standards development, goal setting, and regulation — to be effective ways to advance SMM. Particularly in the context of electronics, food, and hazardous materials, these instruments have already achieved tangible successes.

In 2001, EPA collaborated with stakeholders, including the electronics industry, and determined that the development of voluntary standards would challenge companies to meet industry-leading sustainability measures. The effort resulted in the Electronic Product Environmental Assessment Tool, which is now a global rating system that helps purchasers identify environmentally preferable electronics products. EPEAT-registered products meet standards that cover their lifecycle, including criteria that encourage manufacturers to reduce or eliminate environmentally sensitive materials, and to design their products for reuse.

Over their lifetime, compared to products that do not meet EPEAT criteria, the more than 114 million EPEAT-registered products that were purchased in 2013 will reduce the use of primary materials by 4.5 million metric tons, which is equivalent to the weight of 14 Empire State Buildings. In addition, nearly 2.2 million metric tons of greenhouse gas emissions will be prevented, which is

equivalent to taking more than 1.5 million average American passenger cars off of the road for a year. This global rating system is already a tremendous example of how the selection of the right instrument can affect not only domestic materials, but also reverberate throughout the worldwide flow of materials.

Goal-setting and collaboration have been key components of advancing EPA's work to decrease food loss and waste. The agency developed the Food Recovery Challenge, a voluntary partnership that spurs businesses and organizations to improve their sustainable food management practices and report their results on an annual basis. In 2014 alone, almost 800 Food Recovery Challenge participants prevented and diverted nearly 606,000 tons of wasted food from entering landfills or incinerators; these results showcase the power of simply challenging people to set goals. More recently, in alignment with Target 12.3 of the United Nations' Sustainable Development Goals, EPA and the Department of Agriculture have announced a national goal to reduce food loss and waste by 50 percent by the year 2030. The agencies are catalyzing change through a collective call to action across the food system and are looking to public and private-sector leaders to implement robust actions to increase food recovery and decrease waste.

Regulations are another opportunity for operationalizing SMM in society. EPA's recently revised Definition of Solid Waste Rule incorporates circularity of materials into the structure of the Resource Conservation and Recovery Act, which governs hazardous waste management, including recycling. The revised regulation encourages safe and environmentally responsible recycling by affirming that in-process recycling (returning industrial residues to the manufacturing process in which they were originally generated) is legitimate recycling and by streamlining the applicable requirements. It also contains a new, targeted regulatory exclusion for certain higher-value hazardous spent solvents that are remanufactured into commercial-grade products. For example, pharmaceutical manufacturers use at least 100 kilograms of solvents to make 1 kilogram of a particular active pharmaceutical ingredient. After use, these solvents are only lightly contaminated and need minimal processing to be returned to a commercial-grade product. Benefits of the rule include energy and resource savings, as well as a reduction of greenhouse gas emissions; estimated future cost savings for the industry are as high as $59 million per year. The underlying principle of the rule was recognition of the manufacturers' economic incentive to maximize recirculation and reuse materials. This example demonstrates that regulations can be crafted to protect communities and at the same time leverage economic advantages for sustainable recycling and recovered-materials manufacturing.

On an international level, the G7 Alliance on Resource Efficiency was established to share best practices on using natural resources more efficiently. Increased efficiency will protect jobs and create new ones, strengthen economies, and protect the environment. To date, the alliance's activities have focused on collaboration among the G7 countries, the business sector, and international organizations. Workshops and conferences in Asia, Europe, and North America have provided the perfect setting for sharing, discussing, and forming new and unexpected partnerships.

Corporations such as General Motors, Johnson Controls, PepsiCo, Toyota, Tarkett, and Werner & Mertz have shared their success stories about establishing systems to maximize the reuse and reengineering of materials in a way that advances their bottom line. The G7 countries, the EU Commission, the World Economic Forum, the Organization for Economic Cooperation and Development, the World Bank, the United Nations Environment Program, the United Nations Industrial Development Organization, the International Resources Panel, the World Trade Organization, the International Labor Organization, and others have identified multilateral cooperation as a key component of fostering resource efficiency. All stakeholders hold the view that the alliance should prioritize activities, work closely with private industry, and promote resource efficiency and SMM and its best practices. Many note the importance of engaging countries beyond the G7 because of the global nature of material flow.

The most recent workshop, held in Washington, D.C., last March, explored using lifecycle concepts in supply chain management to achieve resource efficiency. The automobile sector was used as a case study because it is an important part of the industrial economy that also bridges the service economy. Auto supply chains are global and contribute significantly to global GDP, in part because of the tens of thousands of individual parts that make

up a vehicle; many recycled materials are used in the manufacturing process. The collective insights from the workshop transcended all sectors, not just the auto industry.

There were a number of key areas that were identified as opportunities for closing the manufacturing and supply chain loops. For example, being able to share information without triggering antitrust or proprietary issues is one way to move SMM forward. Technology transfers and making technology assistance and best practices available to small or medium-sized businesses that may not have the resources to invest in SMM development could drive wider implementation. Similarly, ensuring that data are available and transparent allows for informed decisionmaking, and application of lifecycle analysis across the supply chain. Metrics and measures drive action by showing tangible progress. Even the concept of a *product* is important. Who owns it — the company or the consumer? Is its end-of-use also its end-of-life or are there opportunities beyond recycling and the reuse of individual parts?

Secondary-materials markets represent another opportunity to maximize materials at the product's end-of-life. A secondary materials market can be characterized as directly linking used or "wasted" materials from one manufacturer into the feedstock of another. In the United States, non-hazardous waste management is administered at the state and local levels. Historically, these programs have been managed in a way that does not result in adverse public health or environmental effects. The next generation of policy and program development should examine how state and local requirements can simultaneously maximize the amount of materials destined for reuse. This could include aligning or reexamining state take-back laws, reorienting municipal and state waste management programs toward materials reuse, financing and lifecycle-costing of local programs, and rigorous and transparent data collection. EPA will publish a findings report that describes the observations and opportunities identified during the U.S. workshop, but it is already clear that there are many more steps that can be taken by all stakeholders to improve SMM within the supply chain.

A sustainable economy requires successful models and the business activities based on them that achieve fundamental reductions in energy, materials, and water throughput in its delivery of necessary goods and services. We need to ask ourselves a number of challenging questions: how can procurement officers, designers, engineers, and accountants work together to enhance sustainability within an organization? Should the policies of their organization be aligned with those of other organizations to achieve even greater sustainability gains, even greater competitiveness, or are differences in policy inherently necessary? How do we ensure that public and private-sector policymaking becomes holistic and systems oriented?

The Organization for Economic Cooperation and Development has recently issued a report analyzing resource efficiency policies of the G7 countries. The OECD notes that all G7 countries have programs to support innovation in resource efficiency; however, more upstream parts of the value chain did not receive the same attention as end-of-life materials management. The OECD recommended that governments conduct sector-by-sector analyses of policy misalignments to identify the most important drivers of resource inefficiency and ways to address them. The OECD also noted that while there is growing recognition of the economic benefits of recirculating materials within the economy, a more focused effort is necessary at the level of the individual business. In particular, work is needed on aligning government policies and assisting small and medium-size firms in the supply chain.

To achieve SMM we must continue to collaborate, innovate — and change. We must embrace a more systems-based and lifecycle-based approach to decisionmaking by using the full range of policy instruments at all levels of society. While EPA, the G7, businesses, international organizations, NGOs, and others are working collaboratively to address the issue, radical change and disruption is needed by all stakeholders and must occur if we are to achieve SMM. Much is at stake. We live in a material world. How our society uses materials is fundamental to our economic and environmental future. Everyone — consumers, businesses, educators, governments, nonprofits — can make a difference. What will you do? **TEF**

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