

Small science, big impact on the U.S. economy!

By Mike Kiley

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An independent study focusing on the aggregated revenues of a select list of nanotechnology companies has estimated that the 2022 economic impact of nanotechnology on the U.S. economy was between \$67 billion and \$83 billion and **close to a trillion dollars over the past two decades**. This dwarfs the U.S. Government's **investment of around \$40 billion** over that same timeframe, which corresponds to the nation's prioritization of the field through the National Nanotechnology Initiative (NNI).

The NNI investment has been used to explore the potential of nanoscale science, to capture societal benefits of nanotechnology, and to establish and sustain U.S. leadership in this critical field, both scientifically and economically. While it is difficult to fully capture the economic impact of the NNI's sustained focus, these numbers hint at the tremendous multiplier effect that nanotechnology investments have had on the economy and the Nation.

As impressive as these numbers are, they only represent a relatively small number of companies that are clearly classified as nanotechnology. This limited approach ignores the field's critical supporting role in several large commercial sectors. Therefore, the study also explored the impact of one closely related industry – microelectronics and semiconductors – to provide anecdotal evidence of the full magnitude of nanotechnology on the nation's economy.

Examining the impact of the addition of the microelectronics and semiconductor industry to the study resulted in an estimate of **\$268–297 billion in 2022** alone. While significantly higher than the initial analysis, the authors recognized that this estimate still does not capture the full scope of the nano-economy, since microelectronics and semiconductors are only one of many commercial areas that substantially benefited from the nation's leadership in the field.

Zooming in on the Not-So-Nano Numbers

In late 2022, the U.S. Census Bureau released data from its 2017 Economic Census. In the classification code of Nanotechnology Research and Development (R&D), the data revealed that over 3,700 companies, employing more than 171,000 people, reported \$42 billion in annual revenue and \$20 billion in employee salaries. As noted in a previous [NNCO blog post](#), released on Nov. 28, 2022, these numbers also suffered from a limited scope, as the Bureau only included companies that self-identified as primarily being in the business of nanotechnology R&D. This limited scope led to a desire to better understand the full picture.

In early 2023, the NNI commissioned the Parnin Group (Alexandria, VA) to conduct a more complete [economic impact analysis of nanotechnology to the U.S. economy](#). To conduct this analysis, the report identified a variety of nanotechnology products, including nanomaterials, intermediate nanotechnology products, and finished products in the marketplace. These products were organized into four categories: (1) core nano (e.g., carbon nanotubes), (2) nano tools (e.g., nanoscale etching tools), (3) integrated nano (e.g., mRNA vaccines), and (4) nano-

enabled (e.g., pharmaceuticals). Once products and their parent companies were identified, Parnin examined Bureau of Labor Statistics data, value-chain analysis, product categories, public companies' Securities and Exchange Commission filings, and patent filings to establish the collective economic value produced by these companies.

Clearly, capturing the economic impact of nanotechnology is not trivial. Products used every day are enabled by nanotechnology, but "nanotechnology" is not seen in the packaging of some of the most ubiquitous items in our lives, like a smartphone, e-reader, or television. Companies and products seldom draw attention to nanomaterials used to make them, for various reasons, including protecting proprietary formulations and practices. As a result, many large companies and related commercial areas – including microelectronics and semiconductors, healthcare, pharmaceutical production, oil and gas refining, and cosmetic products – that have operations and products in the nanotechnology space, but not exclusively so, were excluded from this economic analysis, leading to conservative estimates of the economic impact of nanotechnology.

The report explored the omission of these major areas through an analysis of nanotechnology's contribution in one of these sectors: microelectronics and semiconductors. While it represents one of the clearest examples of how nanotechnology is used to drive the U.S. economy, the microelectronics industry was mostly excluded in the initial analysis since, historically, it has been unclear what percentage of companies' portfolios were related to nanotechnology. However, by 2022 every competitive product in the sector features nanoscale dimensions created through nanotechnology tools, creating confidence that this area can defensibly be included in an analysis of the nano-economy.

As indicated earlier, when the microelectronics and semiconductor segments were included, the estimated impact jumped to between \$268 billion and \$297 billion annually. While other sectors are not as clearly connected to the field of nanotechnology, they are a part of the story and this exploration provides a glimpse into how sizeable the field's impact might be.

Caveats and nuances abound, because seeing the impact of nanotechnology to the U.S. economy would be like seeing a 10-nanometer object in the palm of your hand; it is there, but you need special tools to see it! And regardless of the exact number, the message is clear: The United States' leadership in the field has certainly paid off.

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