

Nanotechnology and the Future Context of DG SANCO: The Role of Consumers' Perceptions

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Key Questions

- Q1. How do consumers compare nanotechnology to other technologies?
- Q2. What should be the future of research on public perceptions of nanotechnology?
- Q3. Evidence on regulatory institutions and corporate social responsibility: Do they matter?
- Q4. The future of public perceptions: How to build public trust in SANCO?

What drives public acceptance of nanotechnology?

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How do the risks and benefits of nanotechnology, as viewed by the public, compare with those associated with other technologies such as genetically modified organisms, stem cells, biotechnology and nuclear power? And when deciding to use a specific nanotechnology product, will consumers consider the risks, the benefits, or both? We report the first large-scale empirical analyses of these questions.

This is the title page from Currall, S.C., King, E.B., Lane, N., Madera, J., & Turner, S. (2006). What Drives Public Acceptance of Nanotechnology? *Nature Nanotechnology*, 1, 153-155.

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Debunking the Nanotech Myths

Public attitudes toward nanotechnology are currently pretty neutral. It's up to government and the media to provide realistic assessments of risks and rewards

by [Steven C. Currall](#)

Nanotechnology has been around for years, but the general public is just beginning to learn about it. While many other emerging technologies have been boldly presented to the world's consumers (for instance, genetically modified food), nanotechnology remains something of an enigma.

Like any other new technology, risks and benefits emerge only after time, money, and research. And research is beginning to emerge on nanotechnology and its commercial implications. This new research examines what the general public, as consumers, know about this technology and their willingness to use commercial products containing nanotechnology.

Nanotechnology involves human-designed materials or machines at extremely small sizes (atomic or molecular level) that have unique chemical, physical, electrical, or other properties. The name derives from nanometer, a unit of measurement equal to one-billionth of a meter. The opportunities to do things differently with nanotechnology have enormous potential to change and benefit society.

Together with my colleagues, I recently carried out and published the findings of three national surveys of consumers and their perceptions of nanotechnology. The National Science Foundation, through Rice University's Center for Biological & Environmental Nanotechnology, funded our work. In the first large-scale studies of their kind, we examined consumers' perceptions of risk vs. benefit when using products containing nanotechnology. The findings exposed several common myths. Here's a look at some of them, and the truth behind each.

Myth 1: Nanotechnology is a "science project" whose commercial products will only emerge some years in the future.

Nanotechnology is no longer just a science project. In fact, there are currently more than 370 products on the market utilizing nanotechnology. These range from car tires and sports equipment to electronics, clothing, and cosmetics. Reports indicated that nanotechnology-enabled products were worth over \$32 billion in 2005.

Myth 2: Consumers must fully understand nanotechnology to have opinions and attitudes toward it.

To the contrary, consumers will form opinions and attitudes despite having little information about nanotechnology. How are consumers learning about nanotechnology? Most are learning from the popular media such as newspapers, magazines, and the Internet. This means that journalists must present information about nanotechnology in an even-handed and impartial manner.

EXECUTIVE OFFICE OF THE PRESIDENT
PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY

WASHINGTON, D.C. 20502

February 20, 2007

Dear Dr. Currall,

On behalf of the Co-Chairs of the President's Council of Advisors on Science and Technology (PCAST), Dr. John H. Marburger, III and Mr. E. Floyd Kvamme, I invite you to be a member of the Nanotechnology Technical Advisory Group (nTAG). We are currently assembling this group to provide expert input and feedback to the PCAST as it conducts its second biennial review of the National Nanotechnology Initiative (NNI). Attached for your reference are the nTAG charter and the PCAST report from its first review of the NNI released in 2005 (also accessible at www.nano.gov/FINAL_PCAST_NANO_REPORT.pdf).

The nTAG is composed of experts in nanotechnology representing a range of academic disciplines and commercial perspectives. The fields in which you are particularly knowledgeable are key components of the NNI-sponsored research and development program. The principal means by which nTAG input will be obtained will be through occasional email questionnaires sent to the entire group. Although the nTAG will not meet as a whole, individual members may be called upon to participate in discussions with one or more PCAST members via teleconference, web conference, and/or email. We anticipate the overall time commitment to be relatively small.

I hope that you will be able to participate as a member of the nTAG. Travis Earles in the Office of Science and Technology Policy will follow up with you in the next week for a response regarding your availability to serve on the nTAG and to obtain information about your areas of expertise. In the meantime, if you have any questions, please feel free to contact me

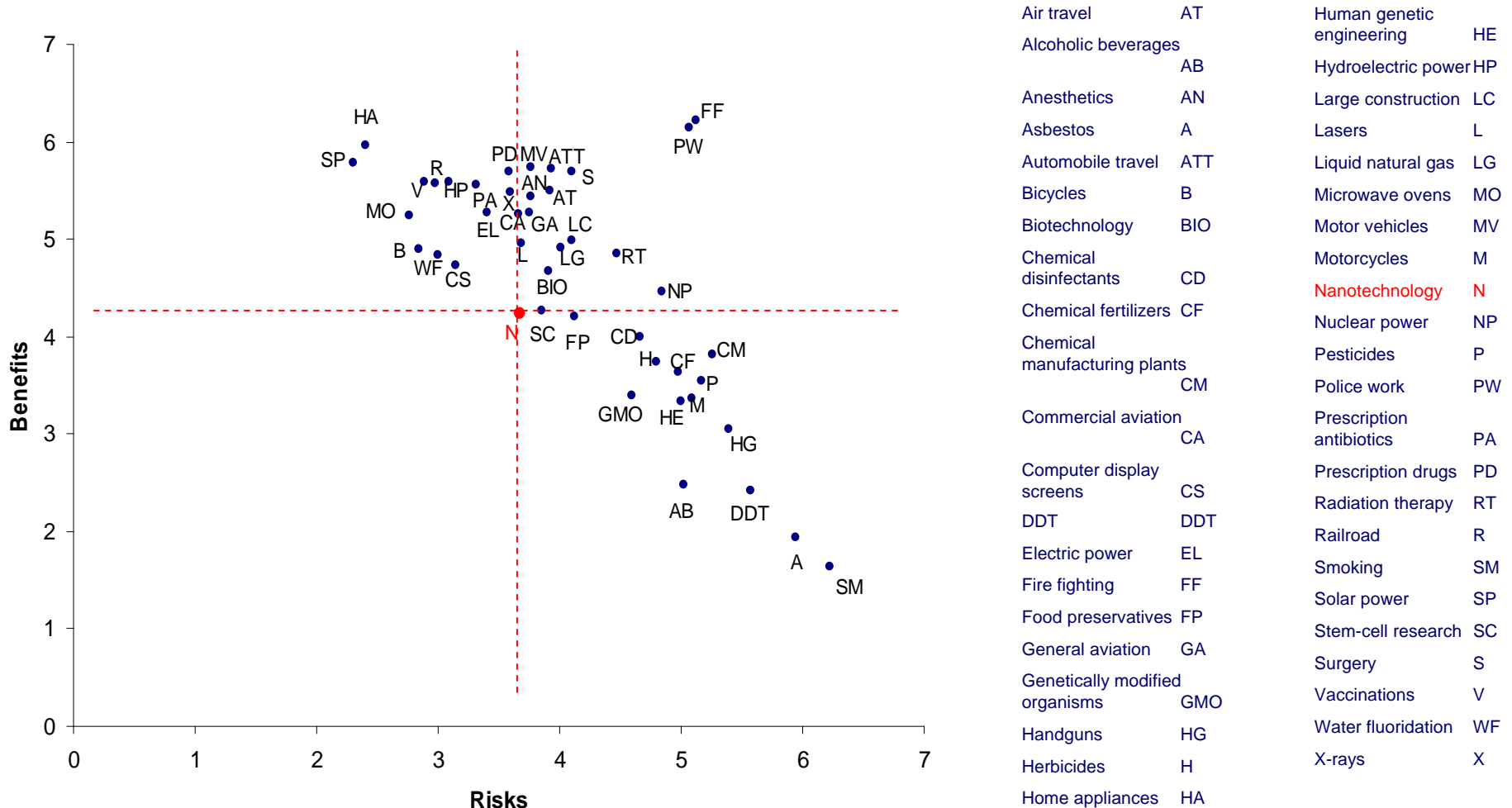
Q1. How Do Consumers Compare Nanotechnology to Other Technologies?

We assessed respondents' perceptions of risk and benefits of nanotechnology versus 43 other technologies (see Slovic, 1987; 1994)

“In general, how risky/beneficial do you consider each of the following items to be for the United States society as a whole?”

Item response scale: 1 = “Not at all” risky/beneficial” to 7 = “Very” risky/beneficial

Perceived Risk versus Benefit of Nanotechnology and Other Technologies



This figure was published in Currall, S.C., King, E.B., Lane, N., Madera, J., & Turner, S. (2006). What Drives Public Acceptance of Nanotechnology? *Nature Nanotechnology*, 1, 153-155.

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Implications: The Window of Opportunity

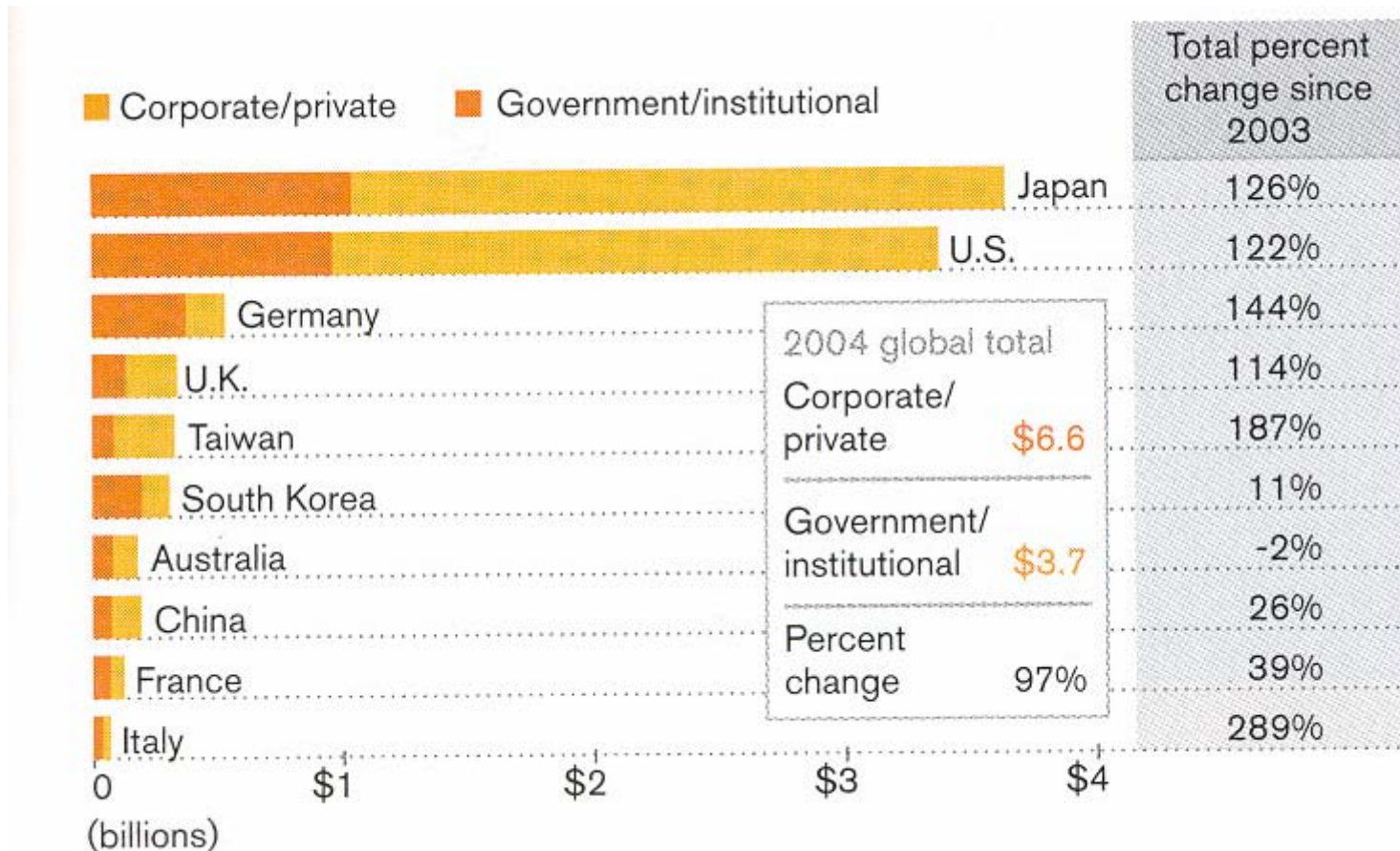
Findings suggest that the public is relatively neutral about nanotechnology

This presents a window of opportunity for government and business to provide credible evidence

Over time, the public's view will become either more positive or negative...

Q2. What is the Future of Research on Public Perceptions: 2004 Was a Transition Year

In 2004, more than \$10 billion was devoted to nanotech research, of which two-thirds came from corporate and private funding, whose share was closer to one-half in 2003.



The Future of Research on Public Perceptions

- I call for an end to research on public perceptions of “nanotechnology.”
- The concept of “nanotechnology” is abstract and involves only “**distal**” risks and benefits to consumers.
- We must now focus on perceptions of nanotechnology products: Products are specific and involve “**proximal**” risks and benefits to consumers.

Research on Commercial Products Containing Nanotechnology: Product Scenarios

“A for-profit start-up company recently developed a new medical product that increases the speed of drug delivery because it contains nanotechnology. Use of this product will prevent cardiovascular disease in 100 out of every 1,000 cases, and there will be significant side effects in 100 out of every 1,000 cases.”

Response scale: “How likely is it that you would use this product?” (1=extremely unlikely; 7=extremely likely)

Benefit/Risk Importance as a Function of Respondents' Knowledge of Nanotechnology

- For respondents who had some knowledge of nanotechnology, they placed greater weight on the benefits of the nanotechnology product, as opposed to its risks, when deciding whether or not to use the product
- For respondents who had no knowledge of nanotechnology, the pattern was the same; they too placed greater weight on the benefits of the nanotechnology product, as opposed to its risks, when deciding whether or not to use the product
- Based on web survey in the United States during September 2004 (n=4,543).

Q3. Evidence on Regulatory Institutions and Corporate Social Responsibility: Do They Matter?

Laboratory experiment to study:

- Decision to use commercial nanotechnology product:

“How likely is it that you would use this medical product?” (1=extremely unlikely; 7=extremely likely).

Effect of Corporate Response to Public Health Threat From Nanotechnology Product

MULTIPLEXA CORPORATION RESPONDS TO THE FDA

Washington D.C. (Associated Press) — Multiplexa Corporation responds after the FDA linked nanotechnology to liver damage.

THE COMMENTS came after the FDA announced that a series of tests demonstrated that nanotechnology might cause liver damage.

Once the connection was made between the nanotechnology and reported liver damage, Multiplexa Corporation, a producer of nanocontainer drug delivery, conducted an immediate product recall from the entire country, with a loss to the company of millions of dollars. Additionally, they halted all advertisements for the product / **denied that their nanocontainer drug delivery product might cause liver damage. Multiplexa Corporation is not considering a recall of the product because it will cost millions of dollars and Multiplexa is determined to fight any possible lawsuits.**

The CEO of Multiplexa Corporation said, “We are determined to prevent any possible harm that nanocontainers may create.” He stated that the company’s responsibilities were to the consumers and medical professionals using its products, as well as employees, the communities where its people work and live, and the company’s stockholders.

The company will change the method of producing nanocontainers by adding a coating, so that the nanocontainers will not damage the liver. / **The company will develop an advertising campaign that will focus on the safety and uses of nanocontainers.**

Effect of Corporation's Response to Health Threat

- Participants were more likely to use products after a corporation took responsibility for the public health threat than after corporation denied responsibility
- These results controlled for previous feelings toward nanotechnology and likelihood of using a new medical product
- Study based on 160 Rice University students

Effect of Warning or Endorsement From Federal Regulatory Institution

THE FDA **WARNS**/ENDORSES **ABOUT** NANOTECHNOLOGY

Washington D.C. (Associated Press) — The U.S. Food and Drug Administration **warns about**/endorses the use of nanotechnology as a method of drug delivery.

THE COMMENTS came after a series of tests demonstrating that nanotechnology may be more harmful than helpful.

One challenge to effective drug treatment is getting the medication to exactly the right place. To that end, researchers have been investigating a myriad of new methods to speed delivery of pharmaceuticals. Findings published in the current issue of the journal *Science* indicate that tiny nanocontainers composed of polymers may distribute drugs to specific locations within individual cells. Some drug companies are now using nanocontainers, which can deliver treatments directly to targeted sites that standard drugs cannot reach. Drugs using nanotechnology have been shown to successfully treat cancer.

However, recent studies demonstrate that nanocontainers used to deliver treatments directly to cancer cells may also damage the liver. Residue from the nanocontainers creates a toxin that may damage the liver.

A top official at the FDA said, **“The probability that nanotechnology may help treat cancer is very low while the probability of liver damage is very high.”**“The probability that nanotechnology may help treat cancer is very high while the probability of liver damage is very low.”

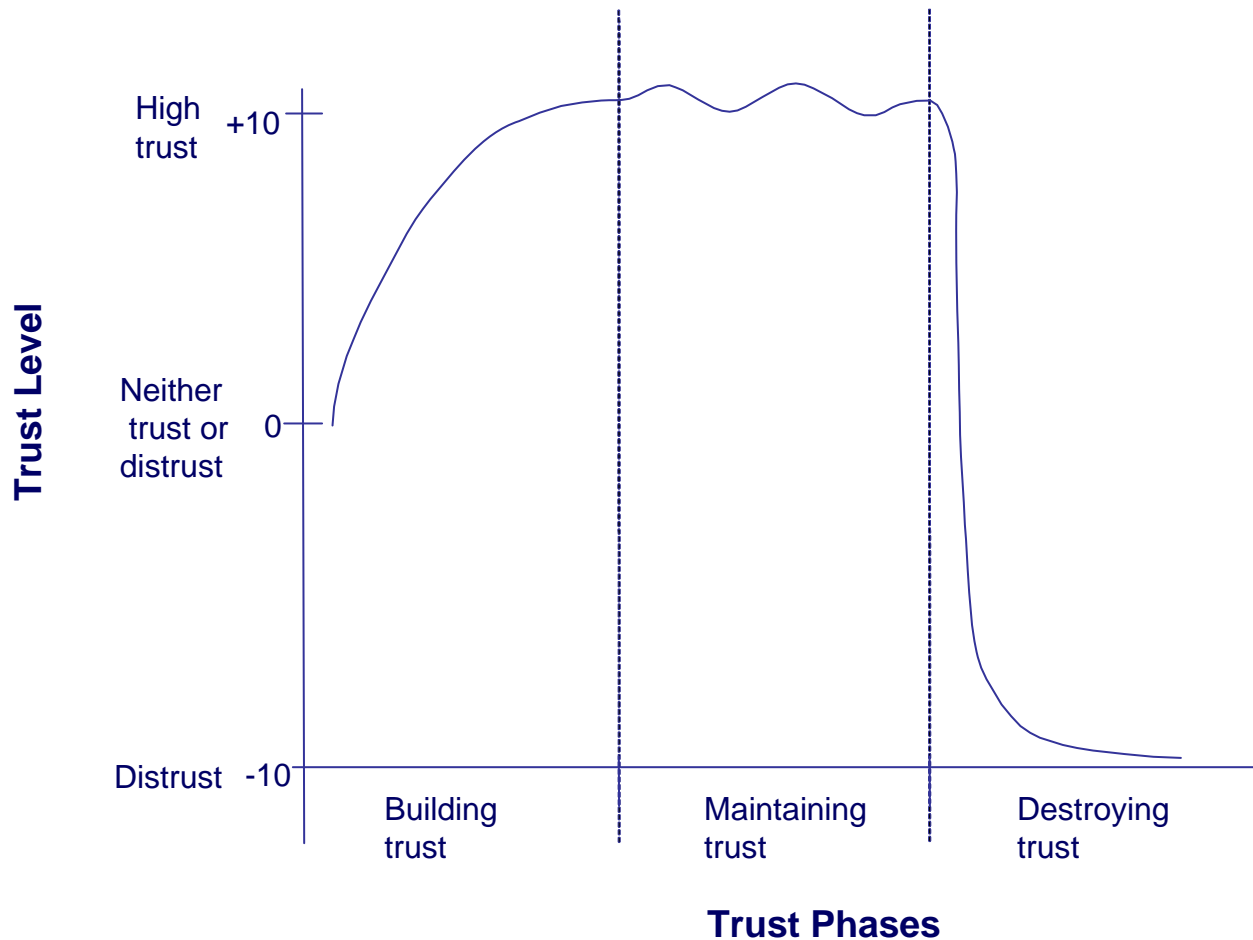
Effect of FDA Warning or Endorsement on Willingness to Use Product

- Participants were more likely to use products after the FDA issued an endorsement of the product than after the FDA issued a warning
- These results controlled for previous feelings toward nanotechnology and likelihood of using a new medical product
- Study based on 160 Rice University students

Q4. How to Further Enhance Public Trust in SANCO?

- Trust is defined as “**the decision by members of the public to rely on SANCO under a condition of risk.**”
 - Risks are particularly influential in health-related trust decisions (i.e., drugs, skincare).
 - By promoting transparency in communication about risk of new technologies, SANCO builds public trust.
- Research has shown (e.g., Currall & Epstein, 2003) that **trust is a function of three dimensions:**
 - **Benevolent aims:**
For example, SANCO’s charter to protect the public from harmful nanotechnology products.
 - **Technical competence:**
SANCO’s impartial assessment of toxicological findings on nanotechnology products.
 - **Commitment to be trustworthy:**
SANCO’s unwavering motivation to safeguard the public.

Public Trust in SANCO and the Trust/Distrust Continuum



This figure was published in Currall, S.C. & Epstein, M.J. (2003). The Fragility of Organizational Trust: Lessons from the Rise and Fall of Enron. *Organizational Dynamics*, 32, 193-206.

Recap of Key Questions

- Q1. How do consumers compare nanotechnology to other technologies? **Relatively neutral in terms of risks and benefits.**
- Q2. What should be the future of research on public perceptions? **Focus on proximal risks and benefits of nanotechnology products.**
- Q3. Do regulatory institutions and corporate social responsibility matter? **Yes, therefore public trust in SANCO is vital.**
- Q4. How to build public trust in SANCO? **Concentrate on benevolent aims, technical competence, and commitment to be trustworthy.**

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