# Nanosim: A Role Game for Nanotechnology

Yina P. Arenas, Mona Sergi and Tamal Saha

November 2, 2009

**Abstract**

## 1 Introduction

## 2 Nanosim

NanoSim is a role-playing simulation game with a precise and carefully thought out educational purpose. These types of simulations have been used in social sciences, business, and military and political studies for a long time, but rarely do they engage on science and technology issues.

In this simulation participants are placed in groups representing the major decision shaper stakeholders in nanoscience and nanotechnology: government funding and policy regulatory agencies, industrial and academic research laboratories, and newspapers amongst others. Their tasks resemble reality and vary according the nature of the group; teams have to coordinate research and development in nanotechnology (climb over a technology tree that promotes collaboration and/or competition across the groups to achieve the final goals). The main objective of NanoSim is to enthuse self motivated research in students and the analytic comprehension of the consequences of their represented stakeholders actions in a global context, allowing the students to experience adaptive management and anticipatory governance making decisions about how societys substantial investment in nanotechnology ought to be made, and managing these investments over time.

Nanosims platform is being developed as a project for our Software engineering class.

### 2.1 Structure

The structure of the system is composed by three main parts:

- Administrative mode: used for maintenance and continuous development of the system
- Instructors mode: in which the instructors can setup the NanoSim scenario, configure groups, design the technology tree, quizes, view participants actions, assign extra budget, etc.
- Participants mode: wich depends on the different groups and provides the tools needed to run the simulation, like email, budget transactions, proposals, etc

Groups in NanoSim are broken into four general categories:

- Research (Labs)
- Government (Funding Agencies)
- Regulatory (Consulting Agencies)
- Newspaper

These four group types have different roles within the simulation but must interact in order to reach higher level system goals.

## 2.2 Groups

**Research (Labs)** Research groups (labs) develop new technologies and progress along the technology tree. Researching a new technology requires funding, time, prerequisite technologies, and occasionally specialized equipment or scientists. Research labs apply for grants from the government groups and use the funds to conduct new research. Labs are concerned with the quality of their research in addition to any associated risks. Labs can consult with regulatory agencies to better assess and mitigate risk associated with research. Once a technology has been completed, laboratories may patent or develop a product based on the technology in order to generate additional funding. The profitability of additional revenue streams depends highly on the social sentiment toward the technology. Labs must manage the aforementioned interests while competing against one another for funding and intellectual property rights. Collaboration between labs is highly encouraged; individual laboratories will have trouble developing advanced technologies without the support of other groups.

**Goverment** Government groups allocate funding in order to reach the long term goals of the simulation community. The suggested government groups are Congress, The National Science Foundation, and DARPA. Congress allocates funding to the NSF and DARPA in order to meet the scientific and defense related goals of the simulation. The NSF reads and funds grant proposals related to scientific advancement while DARPA processes defense related proposals. Congress requests a yearly budget and must grant funds wisely as they are often in short supply. Government groups are also concerned about the safety and quality of the research being conducted and the well-being of the general public.

**Regulatory (Consulting Agencies)** Regulatory groups assess the risk and community sentiment associated with new technologies. Risk centered groups consult with labs and government groups to determine the risks associated with developing new technologies. These groups research and write reports on the technologies before and/or after it has been completed. Socially focused groups help convey the general feelings of the nanotechnology community via reports about technologies and through media outlets and polls.

**Newspaper** Newspaper groups gather news from the other groups in the simulation and post articles in a central location. Newspaper groups help to keep all participants informed about the most up to date occurrences and emerging issues within the simulation. All groups are able to communicate through a built-in mail and

chat system if in-person communication is not possible. Participants may record their personal experiences in thoughts for later references as well.

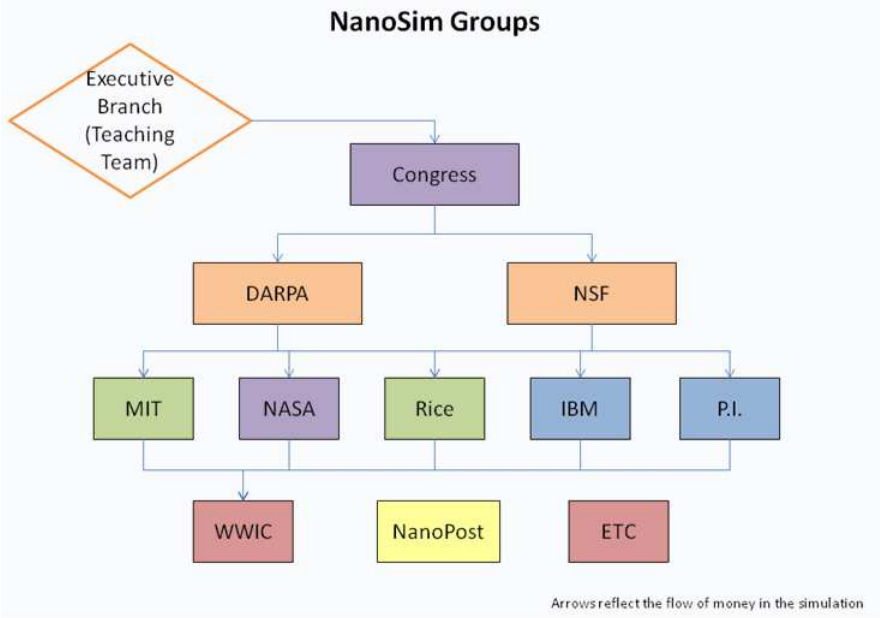


Figure 1: NanoSim Groups

# References

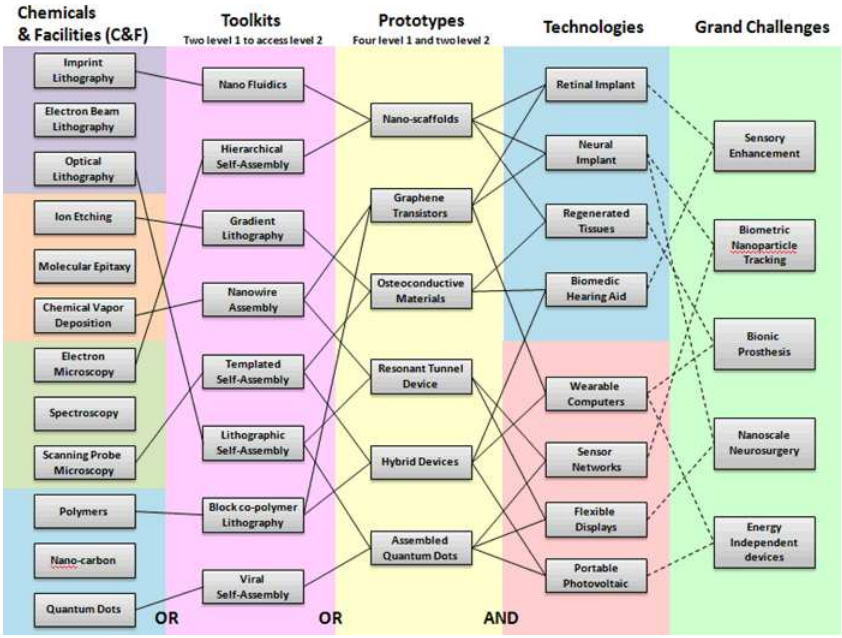


Figure 2: NanoSim Technology Tree