CALIFORNIA IN THE NANOTECHNOLOGY ECONOMY

Stacey Frederick [a], Rich Appelbaum [b], and Barbara Harthorn [b]

Center on Globalization, Governance & Competitiveness, Duke University [a];
Center for Nanotechnology & Society, UC-Santa Barbara [b]

Project Overview

Project: use the value chain approach developed in previous years to examine California's footprint in nanotechnology across multiple indicators. Results are available on a California in the Nano Economy website.

Objectives:
1) Develop a database of firms working in each stage of the supply chain from nanomaterials through end-markets
2) Compile information on economic development in California related to nano including policies, education, and workforce
3) Present results on a website
4) Create interactive visual tools to analyze and depict results.

Method: Value Chain Approach

A value chain research approach is used to analyze how relationships between stakeholders affect the development and competitiveness of a firm, industry, or location's value chain. Developing and applying this methodology is the focus of project collaborators at the Center on Globalization, Governance, & Competitiveness.

The value chain approach is composed of two parts:
➢ **Structure:** a visual of the input-output process and geography of actors in the global economy including the supply chain (physical transformation) plus value adding, non-production activities.
➢ **Framework:**
  ➢ **Mapping:** identify activities and stakeholders in the structure (who & what)
  ➢ **Analysis:** identify relationship between dynamics & stakeholders (how & why)

The website represents an interactive, web-based version of applying all parts of the approach to a specific location and industry. (Fig. 1). Value chain mapping can be visually depicted along the value chain structure (Fig. 2) or geographically (Fig. 3)
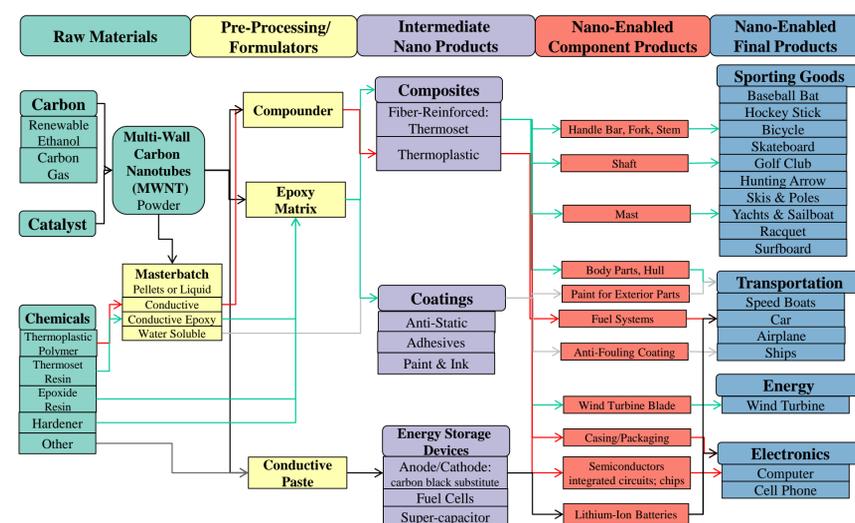

Figure 2: Example of value chain mapping for MWNTs

Results

Figure 1: California in the Nano Economy website home page

Website Sections
➢ Overview
➢ Education & Workforce
➢ Value Chain
➢ Company Profiles
➢ Public Policy
➢ Maps
➢ Resources

Firm & Organization Database Development

➢ Gathered data from 17 datasets focused on nanotechnology-related firms and organizations
➢ Resolved conflicting data issues from variables in multiple datasets
➢ Locations determined out of business or lacking focus on nanotechnology were removed with the reason documented
➢ Similar types of information were placed into tables with a link to the original source. Broad data categories include: (1) general information (2) physical address information, (3) positioning (value chain division and stage, activities, and industry sectors) (4) products, and (5) relationships with other firms
➢ Information for locations in California was extracted to form the basis of content created for the website and visuals
➢ At present, there are ~450 firm locations and 200 supporting organizations, plus additional research groups & projects.

Geographic Visual Mapping
➢ Each location can be viewed by multiple parameters including:
  ➢ Position in the value chain
  ➢ Industry sectors
  ➢ Value adding activities
  ➢ Number of datasets it is listed in
  ➢ Physical location
  ➢ Year established
  ➢ Ownership
➢ When the cursor is placed on a location, the information associated with that location appears. Additional information is also included in the value chain section.
➢ All visuals are interactive; the user is able to turn any of the variables on or off.
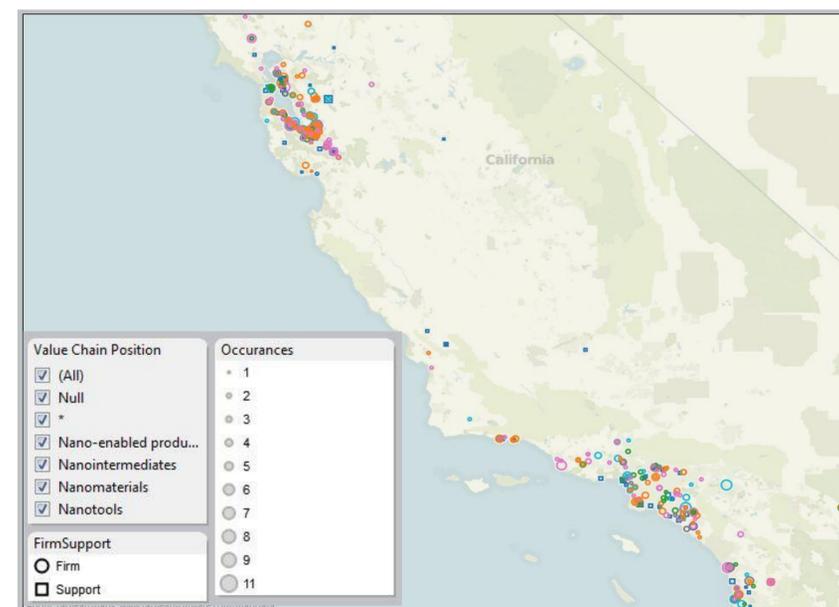

Figure 3: Example of value chain map using shape, color and size

Significance

➢ The website provides a more holistic picture of the nanotechnology landscape by presenting data on firms from the entire value chain rather than one industry or sector.
➢ Includes data on value chain positioning not available in most other sources.
➢ Provides a new, original concept to disseminate industry information and academic research by combining an established research methodology with interactive visualization and information management.
➢ Education/Outreach: the approach has been used to guide the CNS summer internship project and can be used in the future to teach or research topics related to societal dimensions.

Future Work

➢ Expand the project to other states, the entire United States, or other countries
➢ Refine and expand data for California locations
➢ Map the relationships between firms throughout specific product life cycles
➢ Use website tools as the basis for teaching students and interns about the nanotechnology value chain

Acknowledgements