What Are the Economic Advantages of Triple-Helix Innovation?

by

Brooks B. Robinson, Ph.D.
Senior Research Economist for Analysis
Triple Helix Institute
Overview

• Economic framework – prospective advantages of Triple-Helix Innovation: Efficiencies and positive externalities (spillovers).

• Statistical research program: MegaTrend Analysis and analysis of research projects.
Advantages

• What are all of the advantages of Triple-Helix Innovation?
• Uncertain!
• Expectation is that material well-being is enhanced through positive externalities (spillovers) and efficiencies are engendered by Triple-Helix Innovation.
Production of Goods & Services

• Goods and services are produced using a production function:

\[ Q = f(K, L, E, M, S, I) \]

Where \( K \) is capital, \( L \) is labor, \( E \) is energy, \( M \) is materials, \( S \) is for purchased services, and \( I \) is innovation.
• The production of innovation, too, can be characterized by a production function:

\[ I = f(K, L, E, M, S). \]
Three types of institutional units produce Triple-Helix innovation: Academia (a), Industry (i), and Government (g):

\[ I = f(K_{a,i,g}, L_{a,i,g}, E_{a,i,g}, M_{a,i,g}, S_{a,i,g}) \]
Efficient Production

• Efficient production means optimal mixes of KLEMS and optimal contributions to production processes by a, i, and g.
• KLEMS inputs are produced through specialization.
• Specialists use KLEMS inputs to produce goods and services and innovation.
• Goods, services, and innovation are exchanged (traded) to enhance material well-being.
The institute is conducting research to determine which combination of inputs (KLEMS) and of contributors (a,i,g) produces innovation optimally.

The following types of measures should provide insights concerning optimal combinations of inputs and contributors:

\[
\frac{\partial Q}{\partial I} \frac{\partial I}{\partial K_{a,i,g}} ; \frac{\partial Q}{\partial I} \frac{\partial I}{\partial L_{a,i,g}} ; \frac{\partial Q}{\partial I} \frac{\partial I}{\partial E_{a,i,g}} ; \\
\frac{\partial Q}{\partial I} \frac{\partial I}{\partial M_{a,i,g}} ; \text{and } \frac{\partial Q}{\partial I} \frac{\partial I}{\partial S_{a,i,g}}
\]
• Production processes that embody innovation may supersede those that do not, because innovation is an additional factor input, and because the returns-to-scale parameter ($\lambda$) is expected to be greater under innovation than otherwise: i.e.,

$$Q_I = f(K,L,E,M,S,I)^{\lambda_I} > Q = f(K,L,E,M,S)^{\lambda}.$$  

• Innovations may be adopted in unanticipated ways to produce other goods and services.
Advantages of Triple Helix Innovation

- Optimal production of innovation and of downstream goods and services implies efficiency.
- The transfer of innovative technology and its adoption in unexpected ways represent positive externalities (spillovers).
Innovation: Production, Use, & Advantages

- Growth
- Productivity
- Profitability
- Enhanced Well-Being

New Knowledge, Products, & Services
New Patents, Trademarks, & Copyrights

Innovative Input

- R&D Expenditures
- R&D Personnel

Adapted from Debackere, Veugelers, & Bouwen (2000)
Statistical Research Program: I

- MegaTrend Analysis is designed to assess technological, economic, demographic, and ecological trends in six locales: The states of California, Hawai’i, and Washington; and the nations of China, Japan, and Singapore.
- Jue Wang, a University of Hawai’i cybrarian, is collecting 46 time series for each locale = 276 series.
- Data collection is 60 percent completed.
Statistical Research Program: II

- Analyze research projects’ outcomes and impacts by:
  - Identifying 21 projects in each of the six locales = 126 projects.
  - Circulating questionnaires to the 126 projects and 630 of their principal and lead researchers.
  - Assessing project characteristics: Funding; competitiveness; capital use; institutional attitudes toward innovation; institutional collaborations; technology use; and the production of intellectual property.
Expected Outcomes

• The analysis will:
  - Identify patterns that are unique to innovative research.
  - Characterize successful helix mixes.
  - Identify underlying factors for efficient innovative research and for producing positive externalities.
We await the results of this research.
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