randpa’s radio has grown up. So has its production process.

Electronic devices – and lots of other products as well – are becoming increasingly sophisticated. In today’s global economy, the manufacturing supply chains that produce them have become equally complex.

Calit2 academic participant Ken Kraemer and two associates, Jason Dedrick and Greg Linden from the Personal Computing Industry Center at UC Irvine’s Paul Merage School of Business, studied the manufacture and assembly of several electronic products in two categories of innovation: radical and incremental.

Radical innovation includes products that introduce new technologies or new ways to integrate core technology. Apple’s iPods fall into this category.

Incremental innovation refers to products that evolve and improve steadily, without fundamental changes in technology – laptop computers, for example.

The team dissected the manufacturing process and assigned monetary value to the many countries around the globe that participated in making the products. It used to be that a large company like IBM would design and develop its own merchandise, using internally produced components.

Today, most electronics companies buy parts from other companies around the world, outsource their manufacturing and sell globally through wholesalers and retailers located in major markets.

**Multinational Components**

The UCI research team, which is part of the Alfred P. Sloan Foundation’s Industry Centers Program, began its look at the global supply chain by examining Apple’s 30 GB video iPod. Researchers learned that numerous companies – and countries – profit from the product in varying degrees.

The team based its report on information from a company that dismantled the video iPod and identified about $164 to make. While Apple captured the largest share of the value, the source of all innovation and the majority of the profit comes from manufacturers a fraction of a cent.

The hard drive and display module were made primarily in Japan, the multimedia processor was designed in the U.S., and the mobile memory chip in Korea. But there’s more: each major part is made up of many smaller pieces, which may or may not have been manufactured in the same country in which the major suppliers are located.

Intermediate processing also took place overseas – the hard drive in China and the processor in Taiwan or Singapore.

The team found similar results when it studied two other iPod products, as well as notebook PCs from Lenovo and Hewlett Packard.

**Regional Differences**

The study indicated that “countries tend to occupy well-defined spaces in global supply chains,” with innovative countries capturing large shares of value, and developing countries, which provide low-cost manufacturing and assembly, receiving only a small slice.

Most important, perhaps, in today’s global economy, is the fact that even though many electronic products are “manufactured” in China, only a tiny percent of their value added is captured by that country. “This is important because bilateral trade statistics, which show a U.S. trade deficit with China, can be misleading if most of the value is created elsewhere,” Kraemer says.

Today, no single country is large enough to produce an entire product. Instead, companies combine low-value components that net their manufacturers a fraction of a cent. The laptop computer is made up of many parts, and each of those parts is assembled in a different country. The team of researchers determined the value captured by the supplier’s profit margins, and the researchers determined the value captured by the supplier and the companies that made the product.

**Combining Technologies to Make and Assemble**

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Kraemer says the team’s results surprised them. Not only were the profits not concentrated in one country, but they did not even originate from one component. The process of making an iPod involves hundreds of people and hundreds of components, each of which is assembled in a different country.

**Innovation Goes Global**

Study Reveals Complexity in International Supply Chain

by Anna Lynn Spitze

Some of the study’s results surprised Dedrick (left) and Kraemer.