

Replicating the Transistor in Occupied Japan, 1948-1954

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A trio of American physicists at the Bell Telephone Laboratories invented the transistor in 1947. The news arrived to the Japanese physicists during the difficult times of the Allied Occupation (1945-1952), making it difficult for them to gain access to information from the U.S. This paper traces the early transistor research programs undertaken at two Japanese government laboratories — the Electro technical Laboratory (ETL) and the Electrical Communications Laboratory (ECL).

From 1948, Makoto Kikuchi of ETL attended the transistor benkyokai (study group) set up by his superiors, where he scrupulously combed through the Western technical literature, and conducted experiments using crude silicon and germanium obtained from steel manufacturers. Kikuchi continued to fail in replicating the transistor effect as late as mid-1950, when Shingo Iwase of ECL succeeded in making the first Japanese experimental transistor. Although Iwase was not as well versed in transistor theory, he was a dexterous experimentalist, and later designed and built zone-refining equipment in order to make high-purity germanium.

I will argue that the early work done by government physicists during the Occupation years laid the groundwork for Japanese electronics manufacturers (such as Hitachi and Toshiba) to quickly learn transistor manufacturing techniques from American companies (such as Western Electric and RCA). By 1959, Japanese transistor production capacity exceeded that of the U.S., leading the country into the famed economic "miracle." In other words, what we now know as "technology transfer" between American and Japanese companies was, in effect, a complex and ongoing interaction between two "national innovation systems."