Title: A Critical Review of "The Commercialization of the Transistor radio in Japan: The Functioning of an Innovation Community"

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Author(s): A. Khanna

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Abstract: A paper titled "The Commercialization of the Transistor radio in Japan: The Functioning of an Innovation Community" is critically reviewed in this individual report.

A Critical Review of "The Commercialization of the Transistor radio in Japan: The Functioning of an Innovation Community"

Anil Khanna

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Introduction and concepts

Japanese technology – these two words have become synonymous with "latest technology and high quality". Today, Japan is regarded as one of the world leaders in electronics technology. This is the same nation whose two cities were devastated by the atomic bombs in the World War-II a little more than 50 years ago. These explosions also brought a wave of bans on many areas of research and also resulted in isolation from international flow of information for more than a decade How did then Japan involve itself in what is most certainly one of the pivotal electronic inventions of this century – the transistor. Japan not only became one of the few forefront countries in this technology but also successfully commercialized this invention in the form of a transistor radio, in direct replacement for the earlier vacuum tube radios.

This paper deals with the commercialization of the transistor radio by Japan. It also explores the conditions that led to Japan's success in this market in spite of having a competitor in the United States, the country that pioneered this technology. This paper dispels the common notion that Japan was merely an imitator, which did not have the potential to come up with this technology and they had just copied it from the United States. This is done with references from research papers in Japanese. Initially, the author, Leonard Lynn, briefly outlines the history of the transistor both in Japan and USA on a parallel scale. This is done so that the reader has an ease of comparison and can effectively map the course of the diffusion of technology. The concepts studied in this paper are the layout of the Japanese society/community during that time and its relation

to technology. Leonard uses the term "innovation community" to identify the key organizations that are connected to the development, spread and commercialization of technology. This paper also talks about the difficulties most American vacuum tube companies faced when they transitioned to the transistor technology while their Japanese counterparts undertook this transition with reasonable ease.

Some challenges faced by earlier researchers and what is different in this paper

Researchers who have written on this topic already mainly relied on publications in Western languages. But the problem was that little had been published on this topic. Moreover what little is published is seriously misleading [4]. In order to get a fuller, clearer picture of the happenings, Leonard also refers to Japanese-language materials. Also, to strongly dispel the belief that the Japanese had done no homework on the transistor technology, Leonard has generously dealt with chronologically tracking the birth of the transistor technology in Japan. In fact, the happenings are neatly tabularized (Table 1[4]) and a quick look at it will give the reader an idea of the technological gap between Japan and USA.

The layout of the paper can be classified into these sections.

- History of the transistor – talks and convinces the reader that Japan was not far behind in the research for the transistor.

- Innovation communities – sub-classified into substructure and superstructure organizations. These are the organizations that provide the collective resource and finally also help in commercializing the product.
- Theoretical and policy issues

What do the others say?

Numerous researchers dismiss the Japanese feat as nothing more than an art of imitation and once done, the Japanese successfully commercialized this technology. For others, this remains a mystery [2]. But detailed analysis suggests that in order to commercialize such a technology, major input is required from a variety of fields that includes solid-state physicists, materials scientists, suppliers of scientific and precision instruments and potential users [1]. Emphasis on speed in moving to a newer technology is shown with the case of the US and European vacuum tube companies' delay in changing over to the transistor technology. Later, as the transistor technology had completely entrenched itself, the older companies continued to steadily lose their share in the market. Newer firms based on newer technology entered the market and reigned supreme. The case was worst with Europe where the inflexible market structure prevented this and eventually they lost out to foreign firms. Authors like Tushman support this behavior in their research [1] [7] on the observation that discontinuous or radical change in technology is likely to be made by new entrants into the industry rather than by the existing ones. He argues that this is because the radical change in technology is "competence-destroying" and in saying so he is also supported by Henderson and Clark [3]. Tushman says that the technological changes tend to "destroy the value of old skills, abilities and knowledge in

the development and production of the firm's products. According to Henderson and Clark, the structural changes involved in bringing about the innovation result in high costs to the firms.

Findings of this paper and comparisons with the other research publications

Leonard and his colleagues propose a conceptual framework called the "innovation community" which could have played a major helping role in the technological advancement of the nation [5]. This community is taken as comprising a "superstructure" and a "substructure". The superstructure consists of organizations that provide the collective resources. In Japan, the organizations that featured in this superstructure included the Government laboratories, U.S libraries in Japan, the Physics Society and the MITI. The substructure consists of organizations that first commercialized the innovation. Among the substructure organizations are firms like Sony, Toshiba, Hitachi and NEC. Leonard also says that despite a lack of support from the top-level management, midlevel managers were involved in bootleg research on transistors. Going back to the superstructure, the government played a very important role in diffusing information about the transistor in Japan. The MITI on the other hand was a link between the Japanese firms and Western Electric, RCA, GE and the other Americans firms. MITI carefully reviewed the applications for technology imports and even made sure that the Japanese firms did not end up paying "too much" for the technology. At first this might seem to be a very interfering aspect, but as will be later seen, these interventions by the MITI provided a net benefit to the Japanese economy. Along with ensuring quality standards, MITI even imposed restrictions on exports to allow slow and stable growth.

The substructure organizations worked in commercializing the technology as a product. While some provided a competitive stimulus, others provided inputs to the already existing products developed by Sony. Even though Sony was the first firm in Japan to enter the transistor field, others like NEC, Sanyo and Fujitsu also joined in quickly. In comparing this with the firms in USA, Leonard says that even though the large electron-producers showed an early interest in transistors, it was the new entrants like TI, Motorola and Fairchild that dominated this new industry. However, this was not the case with Japan. Even though the entry and success of Sony shocked the older electron tube firms like Toshiba and NEC, they did not waste any more time and joined this new market immediately. This is also in contradiction with the research findings of Tushman and Anderson [1].

To an extent, the author agrees with Tilton in saying that the liabilities of the incumbent firms in USA might have been more than of those in Japan, but this is not the exact and the only reason. Leonard hints that various factors outside the firm were an important part of the successful transition to semiconductor technology. In contradiction to the theory put forward by Christenson and Rosenbloom that "in introducing changes that met the perceived needs of their existing customers, the incumbent firms failed in introducing innovations that served newly evolving markets", Leonard puts forward this statistic. In 1955, the year Sony introduced Japan's first transistor radio, the total Japanese electronics exports were valued at only 3.5% of total output. But by 1960, the value of exports had increased to 16% of production! In brief, he says, the Japanese electron-tube

producers responded not to current customers but to potential customers. This was possible due to the actions and orientations of the organizations at the superstructure and the substructure level. The policies introduced by the Japanese government, the tax-free incentive on technology export, the emphasis on quality and finally the intense level of interfirm monitoring and competition within the Japanese electronics industry seems to have been a factor.

Conclusions

In conclusion, it can be said that Leonard has taken a look at the "full" picture of the surroundings in the commercialization of the transistor in Japan. By this, I mean to say that he has also researched into the Japanese community and explored the links between each of the crucial organizations and their role in the diffusion of the transistor technology. This case can serve as a very strong example for the impact of the society and its structure in the success of any business. With an encouraging support from the various key organizations, Japan surged forward in the electronics industry and has enjoyed a favorable position ever since.

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