

Historical Study of Technology Transfer

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Abstract

This paper discusses three categories of Technology Transfer (TT): between generations, between regions and between sectors. In order to make TT successful, it is quite important and effective to conduct historical study on technology. The study is also important as it provides engineers with suggestions to understand the essence of technology. The method of study must be conducted so that it establishes "The historical study of technology as an engineering science." The product of historical study must be continuously revised and refreshed through the study on how to face the new century and to create an ever brighter future. Taking the case of gas circuit breaker technology, the paper shows that licensing could either promote or disturb TT. Showing some activities of international cooperation in the field of historical study of electro engineering, the paper concludes the discussion by citing the necessity of organizing international cooperation in the historical study of technology for successful TT.

1. Introduction

This paper is developed by one of the panelists for the discussion on "Technology Transfer (TT)," in the historical session held in the 2000 Winter Meeting of PES, IEEE. The author would like to focus the discussion sharply on the vital importance of the international cooperation for the historical study on Technology Transfer, taking advantage of the activities promoted by the Maui Meeting and the ICEE.

The first "Maui Meeting," was held on the 7th and 8th of December, 1995, as a joint effort of History Committees in IEEE and IEEJ to initiate the international cooperation on the historical study of electro engineering. The second meeting welcomes participants from many institutes in addition to IEEE and IEEJ. ICEE (International Conference on Electrical Engineering), which is also open to the global society, is supported by four major institutes of CSEE, IEEJ, HKIE and KIEE. ICEE2K, held in the city of Kitakyushu, in July 2000, will be its 7th assembly.

This paper will provide participants of the historical session in PES/WM in Singapore in 2000 with a sound base of discussion and it will picture a scope of the issues involved in TT, particularly from an historical point of view. Every electro engineer is expected to join in the discussion and in the activities on the historical study of technology, promoted by the Maui Meeting and the ICEE, with a full understanding of its importance and effectiveness for successful TT.

2. Three Categories of TT

2.1 TT between generations

Since technology is a product of experience built up from generation to generation, there is a natural transfer of technology between generations. It is quite important for engineers to review and analyze this kind of TT from an historical point of view in order to clarify the transfer process. Such a process of clarification and analysis will guide us in developing new technology. This perspective is taught by the old oriental saying "Visit the past to know the new." Education is essential for TT, which has reached a vital turning point all over the world.

2.2 TT between regions

TT from industrialized regions to developing regions is a key factor for the successful growth of a region from economic and social points of view. But, particularly in recent days, some cases of TT meet with harsh criticism, as inappropriate transfer may bring about inefficiency and unfairness into the economy and society of the receiving end. One reason for these problems might be social and cultural differences between the donor and receptor. Surely successful TT requires mutual understanding of history and culture between donor and receptor.

2.3 TT between sectors

Several sectors in society such as public and private, civil and military, academic and industrial, maintain close relationships with each other from even a technological perspective. In the time of war, the military sector is eager to find sources of technology in the civil sector, and in the peaceful time the direction of transfer is the opposite. In a competitive market, industries conduct their own R&D activities or use the support of an academy. Problems could arise between the two sectors of academy and industry, for instance, with respect to how the R&D load should be shared between them. In this case, just like the case between the private and the public, TT can be the key to solving the problem.

3. Importance of Historical Study

3.1 Objective

As discussed above, a morally correct and practically appropriate means of TT will be found and established by way of the historical study of technology. In order to make TT successful, it is quite important and effective to conduct historical study on technology. The reason is because;

- (1) Technology is developed by the social needs and reflects the culture.
- (2) Technology is accumulated through the history.
- (3) Technology will be successfully transferred in case it is accepted by the society of the receptor that carries its history and heritage.

It is also well known that the historical study of technology provides engineers with several important suggestions to understand the essence of technology. Such suggestions will also help engineers understand human nature and establish their own identities as engineers. As a result, their standing in the eye of the public will be improved. Activities for the historical study of technology must be directed towards The New World of New Century, because the purpose of those activities is to establish the identity of electro-engineers and to make their roles better understood by the public.

3.2 Method

As technology accumulates due to the devotion of excellent engineers, the method of historical study of technology should be;

- (1) to collect "historical facts," i.e., materials describing historical events and technology,
- (2) to listen to "oral history," i.e., what is told by engineers who have been involved in the development of an innovative technology,
- (3) to analyze the historical facts and oral history, in order to find the unique technology in each culture and to get ideas leading to the development of future technologies.

"The historical study of technology as an engineering science" is a newly created concept for the study of the engineer, by the engineer and for the engineer and is a method of analysis that includes analysis by the historical model. "The historical study of technology as an engineering science" means that the historical study of technology can be a kind of engineering, by itself, which produces new fields of technology.

3.3 Product

The products of the historical study of technology can be made use of either to establish the identity of engineers or to make their roles better understood by the public. At the same time, the product must be continuously revised and refreshed through the study on how to face the new century and to create an ever brighter future. It is quite important to know that every engineer in the world should contribute to the global society by way of TT in every possible way.

4. The Case of Gas Circuit Breakers

4.1 TT in Japan

The concept of Gas Circuit Breakers (GCB) derives from the composition of SF₆ gas by Moisson et al (Paris Univ.) and its discharge experiment by Berthelot in 1900. In 1951 the W H acquired the license rights to the basic technology to use SF₆ gas as a material for the elimination of electric arc on the base of research conducted by T.E. Brown Jr. The WH first brought a 115kV GCB to commercial market in 1956.

Since Melco maintained the contract with WH for the technological cooperation as a whole, Ushio et al in Melco started basic research on the electric arc in

SF₆ gas in 1955. The test equipment of 240kV GCB was put to many kinds of experiments to produce the Japanese first commercial GCB fixed in the Sinkobe SS in 1965. But the other manufacturers in Japan had to wait until 1969 when the license agreement between WH and Melco expired. As the result the introduction of GCB in Japan was rather limited in its earlier stage.

4.2 Issue of License

Due to the high degree of land use GCB is critically effective and useful as equipment for power systems in Japan. The timing of GCB introduction into the market coincided with the period when Japanese power systems had to meet the need of a growing economy by establishing reliable bulk power transmission. Even though power utilities and manufacturers, including Melco, cooperated with each other in the development of GCB, the above mentioned license agreement was, no one can deny, a kind of negative element for the progress of GCB technology in Japan. On the other hand it is quite reasonable that none will take the risk of development, if the new technology is not protected by the license right until he recovers the cost of taking risks. The balance between the negative and positive element of the license right must be carefully examined for successful TT.

5. International Cooperation

5.1 ICEE 97(Matsue)

One of the important achievements in the field of international cooperation in the historical study of technology is the discussion by the Panel, held in ICEE 97 in Matsue. The Panel was entitled "The New Role of Electrical Engineers towards the 21st Century," moderated by Dr. Suzuki, H. (Melco/IEEJ).

Prof. Ishii, S. (TIT/IEEJ) reported on the educational status of the historical study of technology in Japanese universities, pointing out the importance of establishing a system of historical study for engineers. Dr. Pugh, E. (IBM/IEEE) presented a report on the activities of the IEEE History Committee under the title of "The IEEE and the History of Electrical Technologies," with Dr. Nebeker, F. (History Center/IEEE) as a discussant. Mr. Nedderman, J. (IEE Japan Center) also reported on the activities of IEE under the title of "The History of IEE and its International Activities." Dr. Popov, A. (IAES/Russia) discussed electro-thermal waste recycling as an example of TT from the military to the civil sector. Dr. Wu, Y. (CEPRI/CSEE) spoke about how TT is effectively made use of in establishing domestic Chinese technology. Prof. Park, J. K. (SU/KIEE) discussed the issue of education in connection with the shortage of electrical engineers in Korea.

5.2 ICEE 99(Hong Kong)

ICEE 99 organized three Panels in the programme in order to feature the ICEE activities. Among those

three the subject of "Technology Transfer---Past, Present & Future" particularly addresses the basic needs of ICEE participants because TT is a productive procedure of social and economic development. At the same time the international conference is an opportune occasion for TT by way of discussion and information exchange. These two points were referred to and confirmed by the Panel in ICEE 97, held in the city of Matsue.

The Panel on "Technology Transfer---Past, Present & Future" was co-moderated by Dr. Nam, M-H (KU/KIEE) and Mr. Arakawa, F. (EPDC/IEEJ), who jointly signed in the Memorandum of Understanding, with panelists of Ir. C.C. Chen (UOH/HKIE), Dr. C.C. Liu (UOW/IEEE) and Dr. Suzuki, H., all in personal capacity. The MOU identifies the necessary action items for the promotion of historical study as follow;

- (1) Each institute participating in ICEE is to establish a History Committee for a possible joint effort with the Society for History of Technology (SHOT) and the IEEE History Centre.
- (2) The joint effort for the Milestones Program, particularly in Asia, is to be promoted.
- (3) Participants of the Panel are advised also to participate in the open session on history study, organized in the Winter Meeting of PES, IEEE, held in January 2000 in Singapore.
- (4) ICEE 2K, to be held in Kitakyushu City, Japan, from 24th to 27th July 2000, is to organize a similar Panel to discuss the implementation of the above mentioned understanding.

5.3 Maui Meeting

The "Maui Meeting," held on the 7th and 8th of December, 1995, as a joint effort of History Committees in IEEE and IEEJ, was made possible thanks to the devotion of Mr. Okita, Y. (Toshiba/IEEJ) and Dr. Aspray, W. (History Center/IEEE). The Panel in ICEE 97 was a product of the Maui Meeting, since several key participants from the Maui Meeting played an important role in organizing the Panel and the Action Items from "Maui Declaration" read;

- (1) To define the objectives, program, format, and venue for the next Maui Meeting, which we hope to hold within two years;
- (2) To determine ways of expanding the participation of future Maui Meetings, consistent with the objectives established in (1). New participants might include other Japanese or American professional societies dedicated to electrical or electronic engineering, or to computer science; national professional societies of other countries dedicated to similar purposes; or other appropriate organizations, such as the Society for the History of Technology:

- (3) To make the Maui Meeting and its achievements known to the public;

To materialize these action items, the second Maui Meeting (Maui-II) is to be held in January 2000, in Singapore, taking full advantage of IEEE PES Winter Meeting. In parallel with the Maui-II the "open session" on the historical study of technology is to be held in the Winter Meeting, one session of which discusses TT from historical point of view.

5.4 ICEE2K(Kitakyushu)

To follow the discussion in ICEE 99 in Hong Kong there will be another Panel in ICEE2K, to be held from 24th to 28th July 2000 in the city of Kitakyushu, Japan. Under the moderation by Mr. Okita (Toshiba) the Panelist will discuss the issue of education, TT, museum & archives, oral history and web based history under the title of "The New Millennium Issue in Electro Technology."

6. Conclusion

As the result of study on history of TT and the review on international cooperation on the historical study of TT, the author would like to conclude the discussion by stressing;

- (1) TT will be successful if it is done with mutual understanding of history and culture between donor and receptor.
- (2) Successful TT requires organized and systematic international cooperation in the historical study of technology.

Current effort of each institute in the field of electro engineering for the promotion of historical study will make it possible for the electro engineer to internationally cooperate with each other for successful TT. **(end)**