

## A STUDY OF EFFICIENT EDUCATION FOR SEMICONDUCTOR EQUIPMENT TECHNOLOGY

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**Abstract**—The treatise will introduce special courses about training semiconductor equipment technology manpower that the government and related companies support and the college supervises. One of features of semiconductor industry is that average life cycle of technology is very short about 3~5 years. Therefore, flexible training is required on technology, research and development (R&D) for the human resources in the industry. In connection with this, the manpower of 4,000 people from 377 companies attended in various training courses such as regular training course from SETEC(Semiconductor Equipment Technology Education Center), seminars held in both local and overseas, workshop and consignment training during last 3 years. Education contents and its object were developed in a committee consisted of industry, college and government's specialist. It is hard to evaluate economical effect of training courses, but there was estimation about effect of training including economical effect. As the result, economical effect that was very successful and amount to about 10 times comparing in financial support of the government and the industry was reported.

**Key words**—Semiconductor equipment, Technical education Industry, Government, University, Economical effects

### Introduction

Competition of semiconductor controls a fever worldwide and technology development is accelerated, in semiconductor production, making equipment is becoming pivotal point in all of investment and manufacturing technique side. Especially, Korea has the best manufacturing technology in memory production, but considerable portion is depending on foreign equipment. To keep and develop the highest level of manufacturing technique we must manufacture equipment of high efficiency directly by ourselves and introduce equipment with superior performance and price competitive power rapidly.

Falling behind of Korean equipment industry can find the cause in weakness of manpower and foundation technology. It imports foreign equipment and concentrated effort in amount of work improvement that could accomplish big development in spite of history that Korean semiconductor

industry is short. As the result, (micro-electronics) device industry accomplished big development, but equipment industry that becomes the foundation brought structure that is very weak malformation.

Semiconductor equipment is a system that various kinds of physical or chemical processing technique and mechatronics are highly combined as crystalline of advanced technology so such special technical education is hard to handle in educational institutions' course of study such as college. Therefore, training the manpower through a professional education institution must be required.

More of necessities of semiconductor equipment technology education are as follows. First, domestic semiconductor equipment companies are mostly small and medium less than average 100 staffs and do not have their own education or training system differently with device companies. There was a survey about necessity of professional institution with 30small and medium equipment companies and with Figure1, more than 70% of the companies recognized training project of the manpower in semiconductor equipment industry.

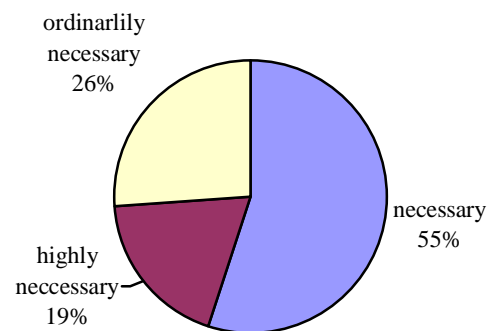


FIGURE. 1

Necessity of Training the Manpower in Equipment Industry

Second, life cycle of equipment is short because development speed and shift in generation are making rapid progress. Average technical life cycle of actual equipment is about 3~5 years. Therefore manpower that is familiar with

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old technology must be able to take some courses about new technology and the change.

Third, local semiconductor device industry is expecting that export amount is to 23.5 billion dollars this year, and demand is expect to decrease by depreciation in price of semiconductor, recession effect of semiconductor or increasing in exchange rate. However, equipment investment is predicted to end up for 2.5 dollars.

According to this trend, there are many newly established equipment companies and existed companies are spurring in equipment development, therefore, demand of semiconductor equipment technology manpower increases greatly, and request about related education is augmented. According to preceding necessity and request, SETEC (Semiconductor Equipment Technology Education Center) has been established and run a semiconductor equipment technology manpower training project support from Ministry of Commerce, Industry and Energy, 3 device companies (Samsung, Hyundai and Anam) and Korea Semiconductor Industry Association in 1997. The treatise would like to develop the semiconductor equipment technology education courses, analyze its result and show an efficient direction through SETEC

- **Supporting Committee:** 7 representatives from the industry, the government, Director of SETEC, Vice Chairman of Korea Semiconductor Industry Association
- **Working Committee:** 8 representatives from the industry, the government, Director and assistant director of SETEC, Director of Korea Semiconductor Industry Association
- **Steering Committee:** 9 professors

### Development of Education Courses

Technology composition of the equipment and training courses must be grasped and developed for the education. However, the composition of semiconductor equipment is various according to kind and technology is extensive. For example, in case wafer process equipment, applied physics and chemistry such as plasma, optics, chemical reaction and etc. are applied, and mechanical technology such as machinery mechanics is mainly applied in case of assembled process equipment. Therefore, it is preferable to derive higher technology as education contents. The contents about semiconductor manufacturing process technology and the development direction should be included beside constructed technology in the contents. Equipment developers must be grasping contents and character of manufacturing process that equipment that they develop is applied then they can understand requirement and technical level about equipment. Also, equipment developers must have knowledge about development direction of the process to have experts eye about concept of developed equipment and spec. Therefore, selection of training courses of SETEC is deciding and execute in the steering committee with the companies' opinion.

With four general technology courses such as semiconductor basic course, semiconductor practical course I(wafer process), semiconductor practical course II (assembly process), FPD course(Flat Plate Display), SETEC has six important technical courses of equipment motor control process, vacuum technology course, heat and fluid simulation course, sensor technology course, PLC control course and plasma technology course. SETEC is frequently holding short-term courses such as seminars and patent lecture. Specially, SETEC operates trust courses that is article ordered training courses for specific company according to company's request on education details, place and time, and speaker.

## Semiconductor Equipment Technology Manpower Training

### Structure and Operation System of the Project

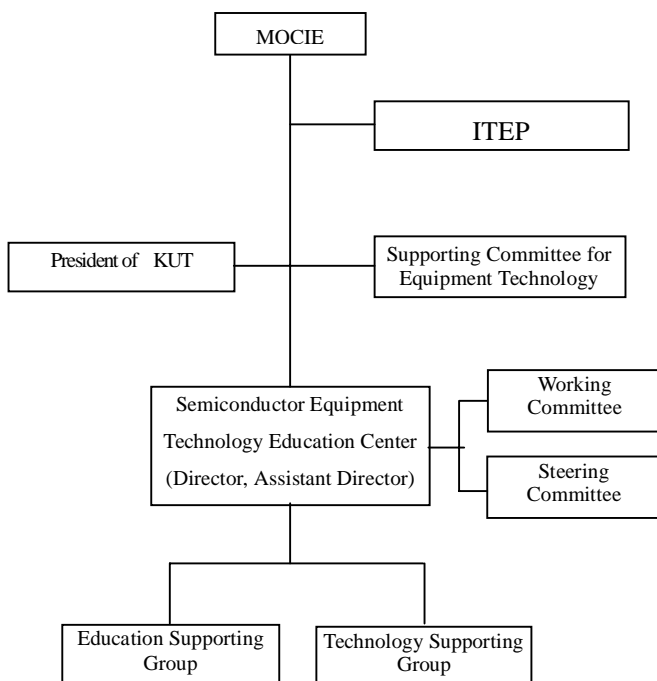


FIGURE. 2

Structure of Semiconductor Equipment Manpower Training Project

### Teaching Staff and Educatee

Selection of teaching staff is decided through a steering committee of SETEC, and among the courses, college professors shall take charge mainly of basic technology

related courses and SETEC shall select and hire experts from the companies for the courses related to semiconductor equipment and the newest process. Especially, teaching staffs of the companies and research institutes are experts with more than 5 years of practical experience or recommend by a person in charge in technology education of the companies and supplement insufficient point in courses. Figure 3 shows current distribution condition of teaching staff of SETEC 3 years.

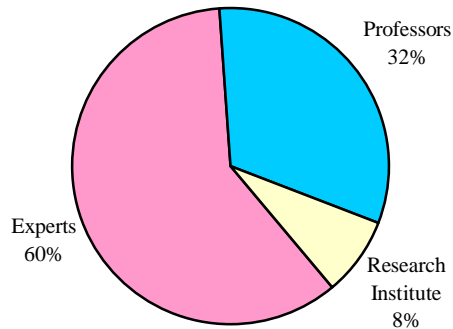


Figure. 3  
Current Distribution Condition of Teaching Staff

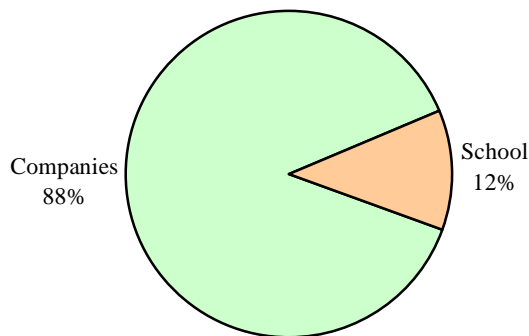


Figure. 4  
Distribution of Educatee

Figure 4 shows overwhelming number of field engineers as educatee last 3 years

### Education Administration and Evaluation

All education enforced in SETEC notifies publicly on SETEC's homepage 30 days before that each course begins, and sends education guide book and application form through E-mail to members of about 3000. Educatee will be chosen among who applied the application for admission

during the application period. In case the number of applicant is much greater than the fixed number of openings, employee from a semiconductor equipment company will be enlisted by precedence. When the number of applicants is exceeded, applicants from the same company will be limited into 3 persons to give more opportunity to as many companies as possible. A person who is in charge of general course will decide suitable number of educatee according to condition of lecture room and lab. Attendance of each educatee will be checked in every course, and educatee who completes more than 80% of total education time will be awarded a certification. After completion of every curriculum, the result of education evaluation will be reflected in the contents, policy decision, selection of curriculum and teach staff. Education evaluation in teaching materials, lab equipment, teaching level, result of education, degree of difficulty of education and etc. will consist of discussion and survey after the completion.

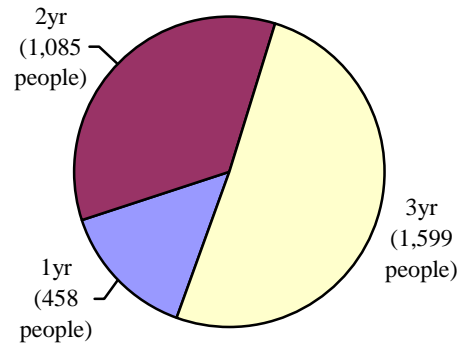


Figure. 5  
No. of Educatee

Figure 5 shows number of educatee for last 3 years, and actually 377 companies has taken lectures and 88% of total educatees are from companies, and 48 companies out of 50 semiconductor equipment companies has participated in the courses as well as most other equipment companies.

### Consequences and Impact

Korea Institute of Industrial Technology Evaluation and Planning (ITEP) announced findings about the result of semiconductor equipment technology manpower training project in April 2000. ITEP analyzed economical result from companies that took the courses related to semiconductor equipment more than 6 times as well as non-economic result.

From economical effect side, there was enlargement effect in total sale amount. Enlargement in net sales of companies by taking the courses in SETEC was more than 4.5 billion Won, and expected increase in sales amount for 1

year hereafter by taking the same courses was reported more than 19.7 billion Won. The enlarged sales amount from domestic, export and import substitute were reached up to 2 billion Won, 1.2 billion Won and 1.4 billion Won.

Job creation and its maintenance is the second effect. The survey said that the effect of employment creation and maintenance, which was derived from the result of semiconductor equipment technology education, has been reached to more than 1 billion Won. When it took into special situation under IMF, while employment creation effect was insignificant, employment preservation effect was construed that was big relatively.

Third effect has been appeared on curtailment purpose and productivity improvement effect for total cost of production. Curtailment effect and productivity improvement effect for total cost of production that happened by taking advantage of semiconductor equipment education courses were examined that reached to 5 billion Won.

Non-economic effect was from quality improvement and decrease in badness. The relevant companies can increase production efficiency at new product development by understanding principles by taking the courses and selecting suitable parts, and claim from user decreased sharply after delivery of goods, and damaged parts and mistake in design drawings were improved sharply by selecting correct parts and design drawing which decreased badness.

Second, the government established SETEC to further project that is based on technology to let companies can be educated with reasonable cost which had curtailment effect of investment amount on education and enlargement effect that invest more on education.

The third result is acquired for 12 patents, practical new devices and 6 treatises, and 3 rewards and authentication marks.

## Conclusion

As stated above necessity of semiconductor equipment technology education, semiconductor equipment technology education center, which found to Korea University of Technology and Education by support of industrial circles with government by necessity of semiconductor equipment technology education achieved the original goal effectively and showed desirable result. However, if part to improve clearly yet exists and presents efficient direction must propel forward as follows;

First, it must extend by system techniques and equipment professional technology field and solidify professional technology education to equipment development manpower. It is because training of equipment development manpower is needed to meet technology and request that change with haste degree.

Second, it is construction of education environment such as professional equipment lab for more efficient

equipment technology education. Professional equipment lab for various experiments of educatee about professional equipment technology education to be added forward beside existed lab is required.

Third, total development environment must be constructed through Internet. Through Internet, if a network connecting related equipment companies and the related technology specialists is constructed to supply more opportunity of education and information in on-line, there may be much effects more than previous off line education.

As previously stated, we need propulsion of more special and systematic education for development of equipment industry. Link of equipment technology specialist, education practical use and education environment construction which bring together learned circles, research institute, industrial circles are urgent matters to be settled without delay. For this, there may have to be much effort and active support such as industry, government and many more.

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