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Report

Re: Asian Regional Network on Materials Evaluation

(Visit of Korea Institutions, March 3 to 10, 1990)

1. Background and terms of reference

Based on the recommendations made at the "Regional Workshop on Advanced Materials Technology and Development", Minsk, 29 May to 2 June, 1989, UNIDO is supporting a preparatory phase to establish an "Asian Regional Network on Materials Evaluation". On request of UNIDO (IPC/TD/NT; CLT 90/039) Korea institutions were visited to evaluate the possibilities of establishing a regional centre in Korea with special reference to evaluation and practical application of new materials. Discussion with authorities of Korea Institutions on the structure, goals and possible modus operandi of such a centre were held. To support these discussions and the assessment, two questionnaires were worked out, which were used as guide-lines in the discussions with the authorities of the Korean Institutions (see Enclosures A and B). Mr. Bajong-Kwan Kim, UNIDO-IPS, Seoul, participated in all visits and discussions at the Korean institutes.

2. Institutions visited and main contact and discussion partners

- (i) UNIDO-IPS, United Nations Industrial Development Organization, Investment Promotion Service, Seoul
B. K. Kim (Deputy Head)
- (ii) UNDP, United Nations Development Programme, Seoul
J. Guijt (Resident Representative), P. C. Park (Programme Officer)
- (iii) MOST, Ministry of Science and Technology, Seoul
S. J. Hwang (Director, Div. Internat. Coop.)

- (iv) KIST, Korea Institute of Standard and Technology, Seoul
J. J. Jang (Manager Internat. Coop.), J. H. Cho
(Officer Int. Coop.), H. J. Jung (Director, Ceramics
Division), I. K. Kang (Metals Division), G. D. Kim
(Inorganic Materials Laboratory), D. W. Kun
(Instrumentation)
- (v) KSRI, Korea Standards Research Institute, Taejon
Ch. Rhee (President), H. Moon (Director, Materials
Science and Chemistry Division), s. Lee (Head, Office
of Int. Coop.; Head NDE Laboratory), G. W. Bahng (Head,
Materials Properties Laboratory), Ch. s. Kim (Head
Magnetics Laboratory), H. J. Eun (Director Division of
Technical Support, Head Office of Policy Studies)

3. Discussion at UNDP, Seoul

Mr. Jacob Guijt (Resident Representative of UNIDO) and Mr. Pyong-Choe Park (Programme Officer) explained the tasks and operations of the Seoul UNDP office. UNDP is supporting various regional projects, they mentioned as an example a cooperative project on carbon fibre research which is with the help of UNDP jointly performed at the Korea Chungnam National University (Taedok Science Town) and Prof. Fizer, Fed. Rep. Germany. UNDP can provide - in principle - the following financial support for regional (and possibly also international) projects and the necessary input:

- Funding of projects
- Monitoring of projects
- Sub-contracts with UNIDO
- Support of consultants and long-term experts
- Fellowships for training in overseas
- Support of equipment
- Sub-contracts with cooperative institutes in industrialized countries

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At present UNIDO is supporting for example the project "Fine instruments repair and maintenance" (performed at KSRI and a Hungarian institute) with 2 million US\$. It was briefly discussed that the network project may require at least 3 million US\$ for 5 years.

4. Visit and assessment of
KIST, Korea Institute of Science and Technology, Seoul

The institute was founded 1966 with the following objectives:

- Developing creative and innovative original seed technologies
- Performing large-scale national projects
- Carrying out basic and applied R & D
- Rendering R & D services to the industry and to other research organizations.

The institute has currently a total staff of 794, including 455 researchers. The officials of the institute estimated that about 50 % of the institute's total efforts are devoted to materials science and technology R & D, performed mainly at the following divisions:

- Metals (encl. Metallurgy, Intermetallics, Solidification, Alloying)
- Ceramics (Fine Ceramics, Structural Ceramics, Functional Ceramics)
- Polymer Science and Engineering (Processing, Composites, Fibres, Membranes)
- Chemistry (Organics, Anorganics, Analysis, Organometallics)

The visit of the materials divisions showed that the institute's materials R & D concentrates mainly on the processing, fabrication and synthesis of materials aiming at creating specimen samples with improved or new properties. In certain areas, e.g. in the field of functional and structural ceramics, the institute has a good scientific-technolo-

gical level. They possess all usual equipment necessary for the fabrication of various types of advanced ceramics (crystal growing, sintering, hot pressing, CVD). However, the institute is weak in the characterization of the compositional and microstructural characteristics of materials and their potential engineering properties. The gap in this area is clearly felt at the institute: KIST has recently worked out a proposal supplied to MOST to create a Center for Materials Characterization at KIST (requested budget: 25 Mio US\$). The equipment requested concerns mainly materials-analytical tools, like Auger-Spectroscopy, ESCA, SIMS, Electron microscopy, etc.

5. Visit and assessment of

KSRI, Korea Standards Research Institute, Taejon

The institute was founded 1975 with the following objectives:

- Maintaining and improving the national measurement standards
- Disseminating the national measurement standards, including calibration and standard reference data services
- Conducting R & D on precision measurement technology
- Providing technical support to industry

The institute has currently a total staff of 470, including 197 researchers. The main standards R & D work is done at the Division on Mechanical Metrology, Electrical Metrology and Quantum Metrology. Materials related R & D is performed in the Division of Materials Science and Chemistry mainly in the following laboratories:

- Materials Properties (Strength, Hardness, Microstructure)
- Materials Applications (Fracture toughness, Fatigue, Creep, Corrosion, Wear)
- Nondestructive Evaluation (Ultrasonics, Eddy current, Acoustic emission)
- Inorganic Analytical Chemistry Laboratory (incl. Surface Analysis)

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In addition, there is a division of Technical Supports and a Precision Instrumentation Center.

The visit of laboratories showed that in its original working area, KSRI has reached a scientific-technological level that can be compared in some of the measurement standards area with the level of other national institutes, like the US National Institute for Standards and Technology (NIST). The equipment in these areas is adequate. The visit and the discussion with the President and staff members showed also that KSRI has started in 1987 an initiative to increase considerably its work and equipment in materials-related area. To support this, KSRI has performed in Korea a "Feasibility study on the development of characterization technology for advanced materials" (see Enclosure C), based on questionnaires sent to 500 persons in industry and academies. In addition, a "Directory of Institutes for Materials Characterization in Korea" has been compiled (see Enclosure D). In order to receive the support necessary for these expanded activities, KSRI has submitted a "Plan of Establishing Materials Evaluation Center" to MOST, which has been approved by the Minister. With its good status and experience in their field of measurement and standardization, supported by the already existing equipment and the results of the feasibility study, KSRI appears to have a good basis for extending its activities in the direction of materials evaluation work.

6. Discussions at MOST, Ministry of Science and Technology, Seoul

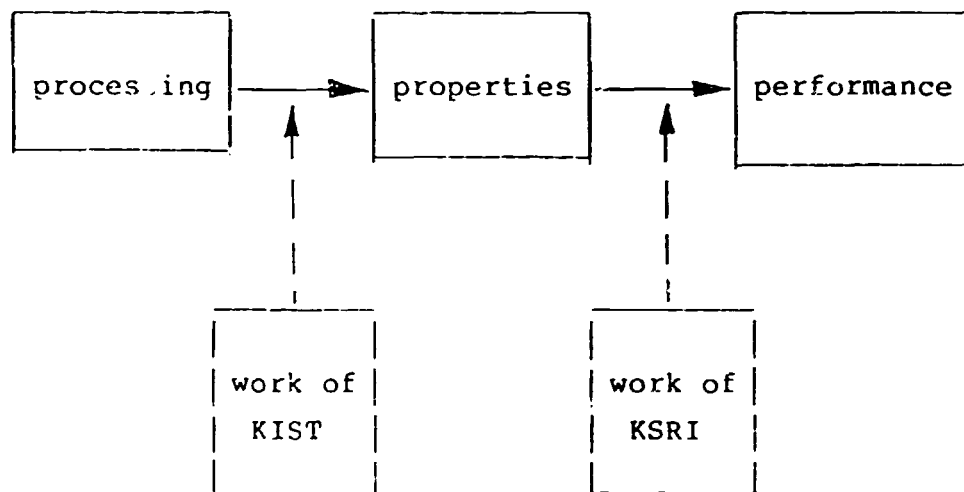
Mr. Soon-Jong Hwang, Director of the Division of International Cooperation, MOST, Office of Technology Police, explained that materials research and technology is one of the priority themes in the Korea science and technology programme 1990 to 1996. He confirmed that MOST is supporting the plans of KSRI to establish a "Materials Evaluation Centre" at KSRI. Mr. Hwang mentioned also that MOST has already written at the end of February 1990 to UNDP Seoul a letter to inform UNDP that the Government of Korea agrees to the preparatory phase for the

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Establishment of Regional Network of Materials Technology Centers and that MOST would appreciate if UNDP would make the necessary arrangements for this project to be implemented at the earliest possible date.

7. Summary and conclusions

The consideration of the function, structures, equipment and results of work showed that KIST and KSRI have in past and present different focal areas. This can be illustrated in a highly simplified manner in considering the various technological activities involved in the whole chain of the processing, fabrication and the needed characterization of the properties and the functional performance of materials and technical products:



Both KIST and KSRI have plans to extend their activities with respect to the characterization and evaluation of new materials and have provided pertinent proposals to the Korean Ministry for Science and Technology (MOST) (according to informations obtained from Messrs. Moon and Bahng of KSRI):

- KSRI: Establishment of a Materials Evaluation Centre
- KIST: Development of new materials itself and
the necessary process technology

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It may be concluded that if KSRI obtains the necessary support of MOST, this institute could be the Korean partner or even the focal point in the network of materials institutes in the Asian-Pacific region, suggested by UNIDO (Vienna Meeting, December 1987) and UNCSTD (Minsk Meeting, May 1989). This positive assessment is also supported by the answers of KSRI to the questionnaire B (see Enclosure E). Finally it may be mentioned that KSRI has also experience in organizing international workshops, because they are hosting since 1983 "Workshops on National Standards System and Precision Measurement Technology" (see Enclosure F); some of the participating institutions may be also potential partners for the network.

A. (24)

Prof. Dr. H. Czichos
BAM, Berlin

Enclosure A (Report, March 14, 1990)

Asian Regional Network on Materials Evaluation

Questions to be answered:

1. Focal partners (institutions) in the Asian countries?
2. Needs and goals of these countries? (Separate studies utilizing local experience are to be performed)
3. Purpose of the network?
4. Identification of working areas, e.g.
 - types of materials to be considered
 - evaluation techniques to be applied
 - information, training, technology transfer, data bank possibilities
5. Mode of operation of the network?

Enclosure B (Report, March 14, 1990)

Centre for Materials Evaluation
Questions to be answered:

1. Why is this Centre needed?
 - 1.1 Political arguments
 - 1.2 Economic arguments (industrial and market needs?)
 - 1.3 Technological arguments
 - potential of new materials?
 - potential of improvements of existing materials?
 - 1.4 Scientific arguments
 - 1.5 "Scientific push" or "market pull"?
 - 1.6 Analysis of potential benefits and potential efforts
2. Analysis of existing situation
 - 2.1 Consequences of the non-existence of the Centre
 - 2.2 Consequences of the existence of the Centre
 - 2.3 Analysis of existing institutions
 - 2.4 National situation
 - 2.5 International situation
3. Location of the Centre and its environment
 - 3.1 Centralization versus decentralization (advantages and disadvantages)
 - 3.2 Characteristics of the Centre's location
 - 3.3 Technological infrastructure of the region
 - 3.4 Human resources available
 - 3.5 Traffic and transport connections
4. The planned Centre
 - 4.1 Tasks & modus operandi
 - R & D
 - testing & evaluation
 - documentation, information, technology transfer
 - 4.2 Management responsibilities (Ministry, Industrial board?)
 - 4.3 Organization scheme (object-oriented, tasks-oriented, industry branches-oriented?)
 - 4.4 Personnell (Scientists, engineers, technicians, assistants)
 - 4.5 Equipment
 - 4.6 Infrastructure (workshop, library, computer facilities)
 - 4.7 Buildings
 - 4.8 Budget and financing (total "lost" budget, cost-sharing?)
5. Output of the Centre and its use
 - 5.1 Type of output (scientific papers, patents, testing certificates, data banks?)
 - 5.2 Parties interested in the output (industry, standardization bodies?)
 - 5.3 Potential of national and international cooperations
 - 5.4 cost/benefit analysis

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BAM, Berlin

Enclosure C (Report, March 14, 1990)

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BIBLIOGRAPHIC DATA SHEET		1 REPORT NO	2 PERFORMING LAB	3 REPORT DATE
4 TITLE/SUBTITLE Feasibility study on the development of advanced materials characterization technology			7 SUBJECT CATEGORY 1100	
5 AUTHOR(S) Hahngue Moon et. al.		8 PERFORMING ORGANIZATION REPORT NO KSRI-89-29-IR		
6 PERFORMING ORGANIZATION NAME Korea Standards Research Institute		9 CONTRACT OR GRANT NO		10 TYPE OF REPORT
11. SPONSORING ORGANIZATION MOST				
12. SUPPLEMENTARY NOTES				
13. ABSTRACT Survey on the demand of characterization technology of advanced materials was performed. The result indicated that the demand for the research and development on that technology is very large. Especially, the industry requested ^{the establishment of} a solely dedicated research institute for R&D and services for characterization of advanced materials. The necessary characterization technology for R&D was appeared to be the mechanical, thermal and electric properties of fine ceramics and polymer materials. Also it was suggested that a research committee consisted of industry, ^{un} iversities and research institutes is favorable for the R&D of characterization technology				
14 KEYWORDS Advanced materials, Characterization technology				
15 CLASSIFICATION		16 SCHEDULE OF DECLASSIFICATION		17 NO OF PAGES 225
				18 PRICE

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Enclosure D (Report, March 14, 1990)

86 1

BIBLIOGRAPHIC DATA SHEET		1. REPORT NO KSRI-89-35-SP	2. PERFORMING LAB	3. REPORT DATE 1989. 4.
4. TITLE/SUBTITLE Directory of Institutes for Materials Characterization			7. SUBJECT CATEGORY 0502 1100	
5. AUTHOR(S) Hahngue Moon et. al.		8. PERFORMING ORGANIZATION REPORT NO KSRI-89-35-SP		
6. PERFORMING ORGANIZATION NAME Korea Standards Research Institute		9. CONTRACT OR GRANT NO		
		10. TYPE OF REPORT		
11. SPONSORING ORGANIZATION				
12. SUPPLEMENTARY NOTES				
13. ABSTRACT <p>This directory is made on the basis of questionnaire, which were answered by those who are involved in the development of characterization technology for advanced materials.</p> <p>It includes a list of their equipments, now measurable properties and addresses. This list is classified into university, research institute and industry. Indexes are also given in the rear part of directory by organizing equipments and measurable properties for advanced materials.</p>				
14. KEYWORDS Directory, characterization, questionnaire, advanced materials, equipments, addresses.				
15. CLASSIFICATION		16. SCHEDULE OF DECLASSIFICATION		17. NO OF PAGES 83
				18. PRICE

KOREA STANDARDS RESEARCH INSTITUTE

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Enclosure E (Report, March 14, 1990)

Answer of KSRI to Questionnaire B

Project : Center for Materials Evaluation (Korea)

1. Why is this institute needed?

1.1 Political arguments

- To promote the practical application of new materials, reliable evaluation is necessary to ensure their proper performance when in use.
- Because of the difference between the testing results on the properties of new materials and the results obtained from the experience of practical use, an authoritative testing and service organization is necessary which can provide reliable test results.
- Studies on the standardization of evaluation procedure, reliability of testing methods, improvement of testing procedures, and development of new evaluation methods, etc., are not profitable research subjects which would be carried out by private companies or institutions.
- International cooperation is necessary for an effective standardization of testing procedures and there should be a representative organization which will take care of these activities.

1.2. Economic arguments (Industrial and market needs?)

- Industrial needs : It is not easy for small and medium size companies to procure testing equipments which are not frequently used in general. Also hiring highly educated and well trained experts to operate the testing facilities and analyze the results is another additional problem for small and medium size companies.

Example : Korea Fine Ceramics Industry Association
The necessity of an organization for testing and evaluation services have been strongly argued by this association. It has surveyed the necessary testing/evaluation equipments among the members of KFCIA to figure out the situation more clearly.

- Market needs : There appears frequent arguments between the makers and users of new materials because of the differences in the testing results about the properties which were obtained by them. Therefore, a third party which can provide acceptable testing results to both parties of makers and users is necessary for the enhancement of marketing of new materials.

Example : Korea Electronic Materials Industry Association
This association established a plan to build a small testing laboratory for their use. The main purpose of this laboratory is to overcome the trouble which was mentioned above. They are going to submit this plan to the Ministry of Trade and Industry for financial support.

1.3 Technological arguments

- Potential of new materials : According to the forecasting made by the Ministry of Science and Technology at the year of 1984, the market size of new materials alone in Korea would be almost 5.7 billion US dollars at the year of 2000. In addition to this, it is expected that the technological impact of new materials to its related industry will be very large and this is more important point than the market size of new materials itself.
- Potential of improvement of existing materials : Progress on the improvement of existing materials will also be made along the development of new materials since the new materials can not substitute all of the existing materials. They are making up for each other. According to the forecast made by a study group in Japan on the industrial structure, the market size of existing materials which will be developed by the practical application of new materials is 4800 billion yen at the year of 2000. The market size of new materials itself is expected to be 5400 billion yen. The total market size related with new materials including new products will reach 63 trillion yen based on that forecasting.

1.4 Scientific arguments

- For the development and practical application of new materials, the characterization and evaluation on the properties and structures is a due course to follow. Especially, in case of new materials, it usually have new properties and hence new or advanced evaluation technologies are necessary in many cases. Nowadays there appears a tendency that the evaluation technology becomes the bottleneck on the development and application of new materials. This is an indication that evaluation technology is very important as much as the process technology for new materials manufacturing.
- Therefore a specialized organization which will study on the development of new evaluation technologies as well as improvement of existing technologies is necessary. The existence of this kind of organization will enhance the development, production, and practical application of of new materials.

1.5 "Scientific push" vs "market pull"?

- New materials related industry in Korea shows unbalanced level of technology development. As a result, both "scientific push" and "market pull" are necessary depending on the level of technology at this time.
- Development of evaluation technology with "scientific push" without considering "market pull" can result in a development of useless or non-practical technology. Therefore maintaining harmony between the "scientific push" and "market pull" is very important in the development of evaluation technology. This implies that a unique development of evaluation technology which is suitable to the situations in Korea is possible.

1.6 Analysis of potential benefits and potential effects

- Acceleration of new materials development through R&D on evaluation technology
- Enhancement of new materials application via providing reliable test results as an authoritative organization within a reasonably short time
- Effective management of expensive testing facilities and research funds
- Training of experts in evaluation and testing
- Playing a major role in international cooperation for standardization of testing/evaluation technologies as a representative institute of Korea in this field

2. Analysis of existing situation

2.1. Consequences of the non-existence of the institute

- It is impossible to fulfill the demands from the industry on the testing and evaluation of new materials.
- Most of the researchers will confront with the difficulties in the development of new materials because of the lack of testing/evaluation abilities
- No central resource of new testing/evaluation technologies which are necessary for the development of new materials.

2.2. Consequences of the existence of the institute

- Formation of service network composed of several universities and research institutes for materials evaluation is possible. The Center for Materials Evaluation can be a coordination organization of this network.
- Industries and other users can receive quick and systematic services for materials evaluation. This will result in the effective development and application of new materials.
- R&D of new materials evaluation technology can be carried out more effectively without repeating studies on the same subject by cooperation between the related institutions.

2.3. Analysis of existing situation

- As is explained in the examples of section 1.5, the demand for the materials evaluation from the industry is fairly large. However, there is no solely dedicated institute for this purpose.
- Korea Institute of Science and Technology (KIST) is mainly concerned on the development of new materials itself and process technology. Korea Institute of Machinery and Metals (KIMM) focuses their activity on the development of process technology.
- Korea Standards Research Institute (KSRI) has carried out researches on the development of high precision technologies to establish national measurement standards from the beginning. Since the construction of foundation for national measurement standards has been almost completed, KSRI is now expanding its activities to the materials evaluation and testing with the understanding that it is a measurement related technology. Also it can utilize most of its high precision equipments which are being used for the establishment of national measurement standards to develop evaluation techniques of materials.

2.4. National situation

- The demand from the industry becomes urgent as the level of new materials related technology is going up. To analyze the problems and to derive out an optimum solution, "A feasibility study on the development of characterization technology for advanced materials" was carried out by KSRI at the year of 1989 under the financial support from the Ministry of Science and Technology.
- The conclusion was that the establishment of the "Center for Materials Evaluation (CME)" is necessary and the Minister of MOST have approved the establishment of CME at KSRI in January, 1990.
- KSRI have recently agreed to cooperate with several universities in Korea to conduct R&D and exchange experts.

2.5. International situation

- KSRI have been offering workshop on the "National Standards System and Precision Measurement Technology" for developing countries from the year of 1983. The 7th workshop was offered last year and the participants were usually from the measurement, calibration and standards related organizations. By this activity, KSRI keeps very close relations with those countries, especially, in Asia including Indonesia, Philippine, Thailand, Bangladeshi, India, Pakistan, Malaysia, Singapore, etc.

- KSRI and Center for Measurement Standards of Taiwan organize a ROK-ROC metrology symposium to exchange experiences and knowledges on the measurement technologies every other year.
- KSRI and National Research Institute of Metals and Electrotechnical Laboratory in Japan have agreed to cooperate on the development of new materials evaluation technology. Also KSRI and Japan Fine Ceramics Center have verbally agreed to cooperate on the development of fine ceramics evaluation technology.
- KSRI has also exchanged mutual agreements on the cooperation with PTB in Germany, NIST in America, NPL in England.

3. Location of the institution and its environment

3.1. Centralization versus decentralization

- Both methods have advantages and disadvantages as is in many other fields. The institute is going to adopt both methods according to the level of the evaluation technology. By formation of network, routine evaluation services can be provided through the member organizations of the network and this is a utilization of the advantage of effectiveness of quick service of decentralization method.
- CME will take care of the standardization and the maintenance of testing/evaluation reliability through performing round robin test. Also it will perform R&D on the development of new evaluation technologies and improvement of existing technologies. In addition to this, very expensive or special facilities will be operated at CME. This is a utilization of the advantage of effectiveness of centralization method.

3.2. Characteristics of the institutes location

- KSRI is located at the Taeduk Science Town which is in Taejon City. This city is located in the middle of south Korea and 150 km southward apart from Seoul. Therefore, KSRI is within a few hours of drive from any place in south Korea.
- In this science town, there are 11 government supervised research institutes, 2 universities including Korea Advanced Institute of Science and Technology (KAIST), and several private research institutes and other related organizations. Hence they stimulates each other on the R&D by easy exchange of informations and visiting.

3.3. Technological infrastructure of the region

- In Taeduk Science Town, each research institute is as specialized in its activity as can be known from its name. Examples are Electronics and Telecommunication Research Institute, Korea Research Institute of Chemical Technology, Korea Atomic Energy Research Institute, Korea Institute of Energy and Resources, etc. Hence it is quite easy to obtain supports from these institutes for the materials evaluation related to those areas. These institutes cooperate with each other very actively, especially on the researcher level.
- Eventually the number of research institutes of private company will be about 50, and this will be another benefit for KSRI because of the easiness of technology transfer to them.

3.4. Human resources available

- As is mentioned in the sections of 3.2 and 3.3, human resources is plentiful in Taeduk Science Town. In addition to this, 2 universities in this town, KAIST and Chungnam National University, can supply well trained specialists in the fields of materials science. Both institutes have formal cooperation agreements with KSRI.

3.5. Traffic and transportation connections

- Taeduk Science town is in the middle of south Korea and the main railways which connect southeast-Seoul, and southwest-Seoul meets at Taejon City. Also Kyungboo highway, Honam highway, Chungboo highway branches near Taejon City. In short, Taejon is the center of traffic and transportation connections in South Korea.

4. The planned institute

Refer to "A Plan of Establishing Materials Evaluation Center", which you received at KSRI.

5. Output of the institute and its use

5.1. Type of output

- R&D-Scientific papers, Patents.
- Standardization-Standardized testing procedures, Specifications.
- Databank-Properties, Applications, Characteristics, etc.
- Training courses-Engineers, Technicians, etc.

5.2. Interested in the output

- New materials related industry.
- Standardization related organizations, e.g., Korea Standards Association, and other servicing organizations, like Fine Instrumentation Center, and testing laboratories of industry and universities.
- R&D related institutes including universities.

5.3. Potential of national and international cooperations

- Can participate in VAMAS activity.
- A regional international network for materials evaluation and exchange of experts and informations will enhance the trade of new materials and its related products among those participating countries.
- National network will stimulate R&D and application of new materials as well as cooperations in new materials evaluation.

5.4. Cost/benefits analysis

This needs separate study to get some details.

Enclosure F (Report, March 14, 1990)

1. Workshop 개최현황(총괄)

회	기 간	주 야	참 가 국 및 인 원
1회	1983.10.13 - 10.22	길이, 질량, 전기, 온도 등	7개국 15명 Indonesia(2), Malaysia(2), Philippines(2), Thailand(4), Pakistan(2), India(2), Kenya(1)
2회	1984.10.16 - 10.29	길이, 전기, 온도	7개국 14명 Indonesia(2), Malaysia(2), Thailand(2), Singapore(2), Pakistan(2), Bangladesh(2), Sri Lanka(2)
3회	1985.10.15 - 10.28	질량, 압력, 힘·경도	11개국 14명 Indonesia(2), Thailand(2), Singapore(1), Pakistan(2), India(1), Bangladesh(1), Cyprus(1), Saudi Arabia(1), Tunisia(1), Ghana(1), Suriname(1)
4회	1986.10.20 - 11. 1	길이, 전기, 음향	11개국 14명 Indonesia(2), Malaysia(2), Ghana(1), Philippines(2), Thailand(1), Sri Lanka(1), Iraq(1), Jordan(1), Barbados(1), Brazil(1), Jamaica(1)
5회	1987.10.19 - 10.31	전기, 질량	9개국 10명 Indonesia(1), Thailand(1), India(1), Sri Lanka(1), Iraq(1), Suriname(1), Colombia(1), Ecuador(2), Nigeria(1)
6회	1988. 6.14 - 6.26	힘, 압력·진공	6개국 6명 Indonesia(1), Malaysia(1), Philippines(1), Thailand(1) Iraq(1), Brazil(1)
7회	1989. 6.15 - 6.28	길이, 온도, 슬도	8개국 8명 Colombia(1), India(1), Malaysia(1), Philippines(1), Indonesia(1), Saudi Arabia (1), Solomon Islands(1), Thailand(1)

2. 참가국별 인원현황

가. 아시아 지역

국명	1983	1984	1985	1986	1987	1988	1989	계	비고
Indonesia	2	2	2	2	1	1	1	11	
Malaysia	2	2		2		1	1	8	
Philippines	2			2		1	1	6	
Thailand	4	2	2	1	1	1	1	12	
Singapore		2	1					3	
Pakistan	2	2	2					6	
India	2		1		1		1	5	
Bangladesh		2	1					3	
Sri Lanka		2		1	1			4	
Solomon Islands							1	1	
합계	14	14	9	8	4	4	6	59	

나. 중동, 아프리카, 남미지역

국 명	1983	1984	1985	1986	1987	1988	1989	계	비 고
Saudi Arabia			1				1	2	
Iraq				1	1	1		3	
Jordan				1				1	
Cyprus			1					1	
Kenya	1							1	
Tunisia			1					1	
Ghana			1	1				2	
Nigeria					1			1	
Colombia					1		1	2	
Brazil				1		1		2	
Ecuador					2			2	
Suriname			1		1			2	
Jamaica				1				1	
Barbados				1				1	
합 계	1	-	5	6	6	2	2	22	

다. 총 참가국수 및 인원 : 24개국 81명

3. 1993년 12월 31일 현재

가. 1993년

국명	성명	직위, 소속기관, 주소
India	Mr. S. Chandrasekharan	Director, Indian Standards Institution
	Mr. Krishan Dayal Baveja	In Charge, Thermometry Section National Physical Laboratory
Indonesia	Mr. Dede Erawan	Mr. Dede Erawan Research Engineer National Institute for Instrumentation
	Mr. Suryadi Hadiwinarso	Research Engineer National Institute for Instrumentation
Kenya	Mr. James Aggrey W. Samo	Senior Standard Officer Kenya Bureau of Standards
Malaysia	Mr. Mohd Zain B. Bashim	Research Officer Standards and Industrial Research Institute of Malaysia
	Mr. Chen, Soo Fatt	Research Officer Standards and Industrial Research Institute of Malaysia

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4. 국가별 참가 기관명

국 가	참 가 년 도	기 관 명
Bangladesh	1984, 1985	Bangladesh Standards Institution
Barbados	1986	Barbados National Standards Institution
Brazil	1986 1988	Laboratories of the Physical Testing Sector, CETEC Center of Industrial and Scientific Metrology of INMETRO
Colombia	1987 1989	National Superintendence Industry Commerce Colombian Institute for Technical Standardization-ICONTEC
Cyprus	1985	Ministry of Commerce and Industry
Ecuador	1987 1987	Ecuadorian Institute of Standardization Escuela Politecnica Nacional
Ghana	1985, 1986	Ghana Standards Board
India	1983 1983, 1985 1987 1989	Indian Standards Institution National Physical Laboratory (NPL) Bureau of Indian Standards Central Labour Institute
Indonesia	1983, 1984, 1985 1986, 1988 1989	National Institute for Instrumentation (Lembaga Instrumentasi Nasional-LIPI) Centre for Industrial Standardization, Ministry of Industry Institute for Research & Development of Materials and Technical Products Ministry of Industry
Iraq	1985, 1987, 1988	Central Organization for Standardization and Quality Control (COSQC)
Jamaica	1986	Jamaica Bureau of Standards

국 가	참 가 년 도	기 관 명
Jordan	1986	Ministry of Industry and Trade
Kenya	1983	Kenya Bureau of Standards
Malaysia	1983, 1984, 1986, 1988, 1989 1984	Standards and Industrial Research Institute of Malaysia (SIRIM) Defence Research Centre, Ministry of Defence
Nigeria	1987	Nigerian Standards Organization
Pakistan	1983, 1984 1983, 1985	Pakistan Standards Institution National Physical and Standards Laboratory (NPSL)
Philippines	1983, 1986 1983, 1986, 1988, 1989	National Institute of Science and Technology (NIST) Product Standards Agency (Bureau of Product Standards)
Saudi Arabia	1985 1989	Research Institute, University of Petroleum and Minerals Saudi Arabian Standards Organization
Singapore	1984, 1985	Singapore Institution of Standards & Industrial Research (SISIR)
Solomon Islands	1983	Ministry of Commerce & Primary Industry
Sri Lanka	1984, 1986, 1987	Sri Lanka Standards Institution
Suriname	1985 1987	Bureau of Standards Ceramic Development and Training Centre
Thailand	1983 1983 1984, 1985 1986, 1989 1987, 1988	Thai Industrial Standards Institute Ministry of Science, Technology and Energy (National Research Council) Department of Science Service Central Bureau of Weights and Measures Ministry of Commerce Thailand Institute of Scientific and Technology Research (TISTR)
Tunisia	1985	Technical Center of Electrical and Mechanical Industries

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- Central Bureau of Weights and Measures, Ministry of Commerce		
- Thailand Institute of Scientific and Technological Research (TISTR), Ministry of Science, Technology and Energy		
23) Tunisia	-----	79
- Technical Center of Electrical and Mechanical Industries (CETIME)		