ACTES DU
V^{e} CONGRĒS INTERNATIONAL DES FEMMES INGÉNIEURS ET SCIENTIFIQUES

PROCEEDINGS OF
Vth INTERNATIONAL CONFERENCE OF WOMEN ENGINEERS AND SCIENTISTS

ROUEN - **4/8** SEPTEMBRE **1978** - FRANCE

Placé sous le haut patronage de Monsieur Alain POHER. Président du Sénat
Patron: Monsieur Alain POHER, President of the Senate

1978

ICWES

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Véme CONGRES INTERNATIONAL DES FEMMES INGENIEURS ET SCIENTIFIQUES

Vth INTERNATIONAL CONFERENCE OF WOMEN ENGINEERS AND SCIENTISTS

ROUEN - FRANCE - 4 AU 8 SEPTEMBRE 1978
organisé par le Cercle des Femmes Ingénieurs de l' A.F.F.D.U.

SOUS LE HAUT PATRONAGE DE
MONSIEUR ALAIN POHER
PRESIDENT DU SENAT

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PB/MCG **SENAT**

LE PRESIDENT

République Françoise

Paris, le 9 mars 1978

Madame BECARUD
Présidentedu Cercle des Femmes Ingénieurs

Madame la Présidente,

J'accepte bien 'vlontiers que votre prochain Congrès soit placé sous mon patronage.

Ingénieur de formation, je trouve trés heureux que les femmes ingénieurs se réunissent pour examiner, à un niveau international, les problèmes que nous pose le progrès technique dans le monde actuel. La responsabilité des ingénieurs, dans les conséquences de la révolution "technicienne" est particuliérement grande et votre réflexion sur ce thème, d'autant plus importante.

Veuillez agréer, Madame la Présidente, l'expression de mes sentiments les meilleurs.

Alain POHER

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- La Préfecture de la Région de Haute Normandie, 1e Conseil General de la Seine Maritime et la mairie de Rouen
- T'Université de Rouen, la Chambre de Commerce et d'Industrie et la Fédération des Associations Régionales

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- Comite d'Etudes sur les Formations d'Ingenieurs - C.LF.I.
- CONFECTION INDUSTRIELLE de NORMANDIE
- DIRECTION GENERALE des TELECOMMUNICATIONS
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- ELECTRICITE DE FRANCE
- ESSIlOR
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- LABORArOIRES DELALANOE
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  de MECANIQUE
- S,E.I.T,A.
- VIDEON S.A.

PROGRAMME

Dimanche 3 septembre :

18 h 30 Soirée d'accueil (Hall Romée, Palais des Congres).

Lundi 4 septembre

8 h Ouverture du Secrétariat au Palais des Congrès.
10 h Séance inaugurale.
12 h 30 Déjeuner.
14 h 30.16 h 30 Travail en commissions.
17 h 30 Réception à l'Hotel de Ville par Monsieur Ie Sénateur-Maire de Rouen.

Mardi 5 septembre

9 h 30 - 11 h 30 Travail en commissions.
11h 30. 12 h 30 Groupes informels par discipline scientifique.
13 h Déjeuner.
15 h - 17 h Travail en commissions.
17 h - 20 h Visite touristique de la ville de Rouen.
20 h Diner des Déléguees nationales.

Mercredi 6 septembre

Visites techniques d'entreprises :
- Port autonome de Rouen.
- Shell, etc...

18 h 30 Réception à la Chambre de Commerce.

Jeudi 7 septembre

9 h 30 - 11 h 30 Travail en commissions.
11 h 30 -12 h 30 Groupes informels par discipline scientifique.
13 h Déjeuner
15 h - 17 h Travail en commissions.
20 h Diner de gala, «Halle aux Toiles» (Tenue de soiree recommandée).

Vendredi 8 septembre

10 h - 12 h Seance de cloture.

VOYAGES POST - CONGRES

1^0**) LA NORMANDIE :** Région riche en édifices admirables et en sites historiques.
2°) **PARIS et VERSAILLES**

PROGRAM

Sunday 3 September

18.30 Welcoming Party (Hall Romée, Palais des Congrès).

Monday 4 September

08.00 Opening of Conference Office at the Palais des Congrès.
10.00 Inaugural Session
12.30 Lunch
14.30 – 16.30 Working Sessions
17.30 Reception at l'Hotel de Ville by the Mayor-Senator

Tuesday 5 September

09.30 -11.30 Working Sessions
11.30- 12.30 Informal meetings in discipline groups
13.00 Lunch
15.00- 17.00 Werking Sessions
17.00 - 20.00 Sight-seeing tour of Rouen
20.00 Dinner for National Representatives

Wednesday 6 September

Technical Visits:
- Rouen Port Authority
- Shell, etc...

18 h 30 Reception at the Commerce Chamber.

Thursday 7 September

09.30 - 11.30 Working Sessions
11.30 - 12.30 Informal meetings in discipline groups 13.00 Lunch
15.00 - 17.00 Working Sessions
20.00 Banquet, «Halle aux Toiles» (Evening Dress).

Friday 8 September

10.00 - 12.00 Concluding Session.

POST – CONFERENCE TOURS

1) NORMANDY: A region abounding in beautiful buildings and historic sites.
2) PARIS and VERSAILLES.

5éme CONGRES INTERNATIONAL DES
FEMMES INGENIEURS ET SCIEN'IFIQUES
ROUEN 4-8 septembre 1978

LISTE DES PARTICIPANTES

AFRIQUE DU SUD

- MOUTON Anna Maria
  376 Bergkarée Avenue
  LYNNWOOD, PRETORIA, 0081

ARGENTINE

- MARITINOT Marta RUDIN
  Espora 799
  MARTINEZ (1640)

BELGIQUE

- TALPAERT Paula
  105, rue de Livourne
  Boite 3
  1050 BRUXELLES

- WEI TSIANG Amy Hua
  1, avenue Chantemerle
  1180 BRUXELLES

BRESIL

- BRAND Rosalina
  rue Almirante
  TAMANDARE 20/404

- PORTELLA Sophia
  Vise Piraia' 273.302
  IPANEMA - RIO - BRAZIL

- STENBERG Clara
  Praia de Botafogo 80 / 1202

CANADA

- ELLIS Dormer
  47 Yorkview Drive

FINLANDE

- KIVISTO Ritva
  8, rue du Cdt Shhloering
  75016 PARIS (FRANCE)

FEDERAL REPUBLIC OF GERMANY

- HERBECK Margot
  Wackenrodet Weg 2
  3400 GOTTINGEN

- KNOT'-TER MEER Ilse
  D 8 MlJNOIEN 90
  FAISTENBERGER Str 2

- Dr Ing Karl KNOTT
  D 8 MUNCHEN 90
  FAIS'TINBERGER Str 2

FRANCE

- BADOZ Jeannine
  11, rue Monticelli
  75014 PARIS

- BORIES Anne
  5, rue de Champigny
  94430 CHENNEVIRES SUR MARNE

- BECARUD Nicole
  77, rue Bonaparte
  75006 PARIS

- BLANC Helene
  31 bis route de la Borde
  78110 IE VESINET

- BORGLOTZ Anne
  136, rue Championnet 2 E
  75018 PARIS

- BRYl.INSKI Monique
  15, rue wuis Philippe
  92200 NEUILLY

- CACHELOU Josette
  8, rue des Tournelles
  92290 CHAENAY MALABRY

- CHAMBART LOIR
  135, rue d'Alesia
  75014 PARIS

- CHARLET Genevieve
  18, rue du colonel de Bange
  713000 VERSAILIES

- CLEMENT-METRAL Jenny
  La Cadenelle
  122, rue du Commandant Rolland
  13008 *MARSEILLE.* (Le Luynes)

FRANCE (suite)

- COQURELEE Christiane
  15, avenue Mozart
  59100 ROUBAIX

- CORDIER Marguerite
  19, rue du Docteur Blanche
  75016 PARIS

- DAVID Antoinette
  55, avenue de la Mobtte Picquet
  75015 PARIS

- DEVAUX Marguerite
  5, Pare de la Londe
  76130 MONT SAINT AIGNAN

- DUONG Louise
  Service de l' Inforrratique SNCF
  105, Boulevard Suchet
  75016 PARIS

- DUMONT-MANTEAU Sylvie
  Immeuble Bouvard - Résidence Flaubert
  134, rue du Renard
  7600 ROUEN

- GASTINNE Jacqueline
  112, Boulevard de Courcelles
  75017 PARIS

- GODIN Lucette
  23, rue Freidevaux
  75014 PARIS

- GONARD Alice
  30, rue Jean Rey
  78220 VIROFLAY

- HOBER Régine
  67, Boulevard Suchet
  75016 PARIS

- HOPPIILIARD Sylvia
  15, Boulevard Clarnour
  83000 TOULON

- HUGUES Gisele
  8, rue Leon Boursier
  92400 COURBEVOIE

- HURET Madeleine
  161, rue de Lourmel
  75015 PARIS

- LABERRIGUE Jeanne
  63, rue Claude Bernard
  75005 PARIS

FRANCE (suite)

- LAISSUS Catherine
  2, rue du Commandant l' Herminier
  76100 ROUEN

- LEBON Geneviève
  18, avenue Montaigne
  92160 ANTHONY

- LEVY Martine
  38, rue Desaix
  75015 PARIS

- MAYER-JACK Andrée
  8, rue Armand Moissant
  75015 PARIS

- MENISSEZ Yvette
  71, rue Damrémont
  75018 PARIS

- MONTFORT Marie-Louise
  12, Boulevard Desgranges
  92330 SCEAUX

- MORELLE Marie-Thérèse
  17, rue Gambetta
  75020 PARIS

- NONON Jacqueline
  28, rue Armaille
  75017 PARIS

- OVERLEZ Joelle
  10, avenue Scribe
  92190 MEUDON

- PECHEUR Jacqueline
  5, rue Jacques Mawas
  75015 PARIS

- PIERI Maxine
  37 Les Bosquets
  Résidence Elysee II
  78176 LA CELIE ST CLOUD

- RAJMBAULT Véronique
  23, rue Rosenwald
  75015 PARIS

- RIBEYROULES Marguerite
  15, rue de Grenelle
  75007 PARIS

- ROLLAND Monique
  2, Chemin des 22 Arpents
  93220 GAGNY

- ROUSSEAU Madeleine
  3, rue Vauquelin
  75005 PARIS

FRANCE (suite)

- TESSIER Ghislaine
  5, rue des 3
  Dauphins
  7300 CHAMBERY

- THOMAS France
  I, Allée du Haras
  92380 GARCHES

- VUILLEMIN Monique
  3, rue Boudant
  75017 PARIS

- WEBER Idelette
  50, avenue Quesnay
  93190 LIVRY GARGAN

GRECE

- KOTSIRA-DOUKAS VASSILIKI
  Nikis 16
  PARADISSOS - HALANDRI (ATHENS)

HONGRIE

- Docteur TURI Susan
  1146 BUDAPEST XIV
  MAJUS 1 U 35

ITALIE

-AMOUR Anna Enrichetta
  Corso Vinzaglio 14
  10121 TORINO

INDE

- GHOSE Ila
  2 Allenby road
  CALCUTTA 10 PIN 700020

- BALARAMAN Kamala
  10 A KAILAS ANUSHAKTINAGAR
  BOMBAY 400 094

- SULEEBKA Kamlesh
  193, Spring Wood LLadeneyrn
  CARDIFF CF 2 6UG UK

IRAN

- P. -- MONAJEMI Badri
  11 Eslami Str SOUTH FARAH AVE
  TEHRAN

- NEZRAT N. VAZIRI
  n° 22 Str 14 Neilofar Ave.
  APADANA (TEHRAN)

IRAN (suite)

- OWEN Marian
  C/o AB 11 - PO BOX 66 1437
  TEHRAN

- RAHMANI Mahin
  11 ave Shirkouh – Zaferanich
  SHEMIRAN – TEHRAN

COTE D' IVOIRE

- ACHI-BROU Marthe
  B.P. 1381
  ABIDJAN - R.C.I.

- LOHOURY-GUIGUI Marie Laure
  B N D A - B P 2508
  ABIDJAN

MALAISIE

- SAIDIN Zahara
  3 Jalan Chemperai Danansara
  HEIGHTS - KUALA - LUMPUR

MEXIQUE

- PEREZ - LOPEZ Angelina
  CERRO DEL AIRE 52
  MEXICO 21 - DF

- VERA AVILA Luce –Eléna
  21, avenue des Gobelins
  75005 PARIS

NIGERIA

- SOYINKA (JACOB) Yeside Eniola
  PO Box 6105
  LAGOS - NIGERIA W.A.

- UGBEROR Olabisi
  Department of Mathematics University of Ibadan
  IBADAN Nigéria

OUGANDA

- NAMWANDO Elisabeth
  Markere University PO BOX 7062
  KAMPALA

- OKWAKOL, Mary Josy
  Makarere University PO 7062
  KAMPALA

PAYS BAS

- MAHALINGAM Togaranée
  I.H.E. Locker n^{O} 128
  # 95 Oude Delft
  DELFT (Holland)

PHILIPPINES

- SALONG Luz C.
  7 M VIOLA U. P. DILIMAN
  QUEZON CITU

POLOGNE

- GRABCZEWSKA Maria
  ul KARIMIEAZOWSKA
  57 / 61 M 20
  02 - 538 WARSAW

- SYPNIEWSKA Yanina
  03 - 953 WARSZAWA Al St
  ZJEDNOCZCNYCH 18 M 16

- ZACHWATWICZ Isabela
  00556 WAPSZAWA ALEJA
  POZ 8/7/A

PORTO-RICO

- ESTEVES-VELAZQUEZ Mabel
  CALLE 2150 ## 834
  Las Roma Rio Piedras
  PUERTO RICO 00921

- VELEZ-RODRIGUEZ Linda
  Cond. Segouia Apt 202
  HATO REY. PUERTO RICO 00918

SENEGAL

- BASSE Marie-Thérèse
  B.P. 10 032
  DAKAR-LIBERTE

SIERRA LEONE

- STEVENS Yvette
  Department of electrical Engineering
  FOURTH BAY COLLEGE – FREETOWN

SUEDE

- ASWALD Kerstin
  66, rue Lafayette
  69600 OULLINS (France)

- HOLM Karin
  VASTRA STILLESTORPSGATAN 17
  5 - 41713 GOTEBORG

- WALLIN Ragnhild
  AKER BY VAGEN 270
  18335 TABY

SUISSE

- HAMBURGER Erna
  93, Chemin du Levant
  CH 1005 LAUSANNE

- JUILARD Jacqueline
  Ingéniour conseil
  Case Postale 80
  CH-1292 CHAMBERY, GENEVE

- RAHM Berta
  KLOSBACH Str 46
  CH 8032 ZURICH

THAILANDE

- BOON LONG Sasithron
  Department of Chemical Engineering
  Faculty of Engineering
  Chulalonqkorn University BANGKOX 5

- KRAIRIT Ampika
  136 Yen Akas Soi 2
  Tungmahamek
  BANGKOK

- SAENGBANGPLA PHULPORN Anna
  14 Seri 8 Road
  MUBANSERI – BANGKOK

UNITED KINGDOM

- BELL Marjorie
  31 the Mail
  Southgate LONDON N 14 6 RL ENGLAND

- BUSSEL Henrietta
  12, Wiltern Court Shoot Hill
  LONDON N W *23* TY

- HARWICH Isabel
  75, IRLAM ROAD
  URMSTON MANCHESTER M 31 3 J U

- HARDWICH John
  75, lRLAM ROAD
  URMSTON MANCHESTER M 31 3 J U

- HAWLEY Philippa
  39 MIDHURST DRIVE GORINGBY SEA
  WEST SUSSEX B W 12 5 B D

- HOCGES Peggy
  41 THE 4 TUBS
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  6 Ashen Green - GREAT SHELFORD
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- HCWARD John
  6 Ashen Green - GREAT SHELFDRD
  CAMBRIDGE

- LAVERICK Elizabeth
  ARDEN 17 A watford RO
  RADLETT HERTS WA1 BLF ENGLAND

- MAPLE MAY
  32 Lindfielp Gardens
  LONDN ROAD GUILFORD SURREY

- MOORE Peter
  4, Evelyn Gardens
  LONDON SWM N. K.

- PARKER Joséphine
  6, CASTLEMILL HOUSE
  JUXON ST - OXFORD

- RISCHWSKI Irène
  3 LYMINGTON ROAD
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- SKRINNER Gillian
  LEES FARM TALATON EXETER DEVON
  EX 5 2 R L

- SPENCER Alison
  22 CARISBROOKE ROAD
  MELKSHAM WILTS

UNITED KINGDOM (SUITE)

- THOMPSON Ciceley
  14 BRANDEN DRIVE KNUTSFORD
  CHESHIRE - W A 16 8 E J

- WATKINS Maria
  PARKLANDS HENDON - WOOD LINE
  MILL HILL - LONDON NW7 4 HR

- WINSLADE Rosina
  10 F PORTMAN MANSIONS CHILTERN Street
  LONDON WIM 1 H U

UNITED STATES OF AMERICA

- Arnold MERKLEE
  RDI Box 573
  BUNKER HILL ROAD
  PRINCETON NEW JER3EY 08540

- CAVANAGH Aileen
  78 SIMPSON DRIVE
  FRAMINGHAM Ma 01701

- CHRISTENSEN Connie
  254 EVEREIT Avenue
  WYCKOFF NEW JERSEY 07481

- CARSWELL
  8752 SAND POINT WAYNE SEATTLE
  WASINGTON 98115

- DI FRANCISCO Diane
  403 COUNTRY CLUB Apts
  DALLAS, Pa 18612 USA

- GRAHAM Lois
  5901 N SHERIDAN ROAD, Apt 16 A
  CHICAGO
  ILLINOIS 60660

- HARER Kathleen
  PO BOX 672
  OAK RIDGE TENNESSEE 37830

- HARNESS Arminta
  1928 FOREST Avenue
  RICHLAND - WA - 99352

- HICKS Beatrice A.
  R. D. I DOVER
  N.J.07801

- HLEDE Amelia
  R T I BOX 1259
  BUCKLEY WASHINGTON 98321

UNITED ST'ATES of AMERICA (suite)

- KELLAR Catherine
2905 HAWTHORNE PLACE S.E.
OLYMPIA - WASHINTON 98501

- KEPITE Jacqueline
BOC 90 RR
THUSVILLE NJ

- KRENZER Bette A.
5965 CHATS WORTH Dr.
DYTON O H 45424

- LEW Winifred
1470 DANA Avenue
Paco Alto CA USA 94301

- LOCOCO David
3207 ASHWOOD Dr.
CINCTIJNATI - OHIO - 45213

- LORING Paula
30 LAKIN STREET
NEEDHAM MASS 02194

- MALOTKE Mary
7162 READING ROAD
CINCINNATI - OHIO - 45237

- MUNGER Mary
7 REDBUD LANE
GLASTONBURY CONN. 06033

- PEDEN Irène
8752 SAINT POINT MAY - N E
SEATTLE - WASHINGTON 98115

- PICART Rosario
E 7 n° 3 ST
RES OLLER – BAYAMON PR 00419

- PICKUP Lydia
15284 OAK RIVE
RENIDN W.A. 98055

- PIERCE Kay
930 Suwannee, KNOSVILLE TN 37919

- POLLAN Maria
774 ROBINHOOD ROAD
ROSEMONT PA 19010

- PRESSMAN Ada
1301 S ATLANTIC BLVD n° 536
MONTERSY PARK Ca 91754

- POULTNEY Georgine
30 EAST 9 TH, APT 355
NEUW YORK NY 10003

UNITED STATES OF AMERICA (SUITE)

- RUSSELL Mary Ellen
  3451 EVERGREEN POINT ROAD
  BELLEVUE, Wa 98004

- STEEL Mary Nan
  1218 SE DELAWARE AVE
  BARTLESVILLE OK 74003

- SUSSMAN Sally
  58-59 206TH STREET
  BAYSIDE NEW YORK 11364

- TALBOT JAN B.
  445 EAST DRIVE
  OAK RIDGE TENNESSEE 37830

- THOMAS Martha
  18, Cabot Street
  WINCHESTER MASS 01890

- THOMPSON Rose Mary
  610 THE Village # 111
  REDONDO BEACH - Ca 90277

- WEGNER Julie
  1104 HOWARD AVE
  ST PAUL - NEBRASKA - 67873

- WILSON Grâce
  306 SUNNYCREST COURT – WEST
  URBANA - ILLINOIS

- WISNIEWSKI Charmai ne
  15 North Apple Wood Court
  FAIRFIELS OHTO - 45014

U.R.S.S.

- POUCHOVA Zoja
  IVANOVO - UPSS

- SEKHEVINA Galina
  Interprète
  MOSCOU

SEANCE SOLENNELLE D'OUVERTURE

OPENING SESSION

PALAIS DES CONGRES - 4 SEPTEMBRE 1978

10 HEURES

- Ouverture officielle du Vème Congrès International des Femmes Ingénieurs et Scientifiques
  Isabel HARDWICH. Présidente Internationale
- Bienvenue aux Congressistes
  Nicole BECARUD. Présidente du Cercle des Femmes Ingénieurs. Présidente du Vème Congrès
- Allocution de *Monsieur Jean LECANUET. Sénateur, Maire de Rouen, Ancien Ministre*
- Allocution de *Monsieur Yvan MIROCHNIKOFF*
  Président de la Fédération Européenne des Associations d'Ingénieurs
- Allocution de *Madame Huguette FRANCOIS*
  Président Directeur Général des Etablissements TOURCO
  Représentant le Conseil National du Patronal Français
- Allocution de *Monsieur Claude PERRAULT*
  Secrétaire Général de l'Union Départementale des Syndicats F.O. de Seine Maritime
  Représentant la Confédération Française du Travail Force Ouvrière
- Exposé de *Madame Jacqueline NONON*
  Chef du Bureau "Emploi des Femmes
  à la Commission des Communautés Européennes
  sur le thème du Congrès : "Techniques et Libertés"
- Précisions pour le déroulement des travaux
  Nicole BECARUD, Présidente du Vème Congrès

SEANCE INAUGURALE OPENING SESSION

ALLOCUTION DE BIENVENUE
WELCOME ADDRESS
Par Nicole BÉCARVD

Monsieur le Ministre,
Mesdames, Messieurs,
Chères Amies,

Ce sont en effet des amies que j'ai l'honneur et la joie d'accueillir aujourd'hui en tant que Présidente du Cercle Français des Femmes Ingénieurs, des amies venues de toutes les parties du monde - de 35 pays exactement - sans compter le Vietnam et l'Uruguay dont 1es ingénieurs nous ont envoie des messages de sympathihe

Un bon nombre parmi vous , chères Collègues et Amies, étes fidèles,tous les trois ans, a nos rendez-vous internationaux ; certaines, au contraire, participent pour la première fois à nos travaux.

Aux unes et aux autres, c'est pour moi un grand plaisir de souhaiter, très chaleureusement, la bienvenue en France.

Dans cette France où vous avait invitées, en 1975, au 4ème Congrès de Cracovie, Gisèle HUGUES, alors Présidente du Cercle des Femmes Ingénieurs et qui devint peu après la Présidente Nationale de l'Association Française des Femmes Diplômées des Universités ; cette tache trés absorbante ne l'a pas éloignée de nous, et il m'est agréable de saluer ici un dynamisme et un dévouement que beaucoup d'entre vous ont eu 1'occasion d'apprécier.

Le Cercle Frantçais des Femmes Ingènieurs, en collaboration étroite avec l'Association Française des Femmes Diplômees des Universités, s' est attaché avec enthousiasme à la tàche passionnante d'organiser le 5ème Contrès des Femmes Ingénieurs et Seientifiques. Il n'aurait pu mener à bien cette lourde entreprise sans l' appui des plus hautes autorités de notre pays et sans de multiples concours.

Je voudrais nommer en premier lieu Monsieur Alain POHER, Président du Sénat et lui -méme Ingéni eur des Mines, qui a bien voulu, comme vous l'avez constaté en lisant ie programme de notre Congrès, accepter que celui-ci soit placé soit son haul patronage.

Et permettez-moi de me tourner, tout de suite, vers l'éminente personnalité qui se trouve á ce tire tribune: Monsieur Jean LECANUET, Ancien Ministre, et à ce titre plusieurs fois chargé d'importantes tàches gouvernementales. Dés le moment où nous avons choisi de tenir notre Congrés à Rouen, Capitale de la Normandie, grand port, grand centre d'industrie et d'affaires, siége d'une Université dynamique, nous avons trouvé auprés du premier magistrat de la Cité et de son équipe municipale le plus compréhensig et le plus efficace des appuis.

Que Monsieur LECANUET et ses collaborateurs reçoivent, d'ores et déjà. L' expression de notre profonde gratitude.

Le Consei1 General de la Seine-Maritime, que préside égaletment M. Jean LECANUET, a, de son coté, aidé et soutenu notre effort avec une générosité à laquelle nous avons été extrément sensible.

Toujours l'accueil des autorités administratives fut bienveillant, et nous savons tout particulièrement gre a M. BOLOTTE, Préfet de Région, nous avoir accordé son parrainage, représente par M. LAFERRIERE.

Les autorités universitaires - dont je salue iei les représentants lse sont mises à notre disposition avec une bonne gràce qui nous a beau coup touchées ; que soient particuliérement remerciés les professeurs du Campus de Mont Saint-Agnan dont les conseils judicieux nous ont été d'un si grand secours.

De la part des instances nationales et internationales, les appuis ne nous ont pas manque.

Sans procéder à une énumération qui n'aurait nulle chance d'etre exhaustive, qu'il me soit au moins permi s de citer :

- M. le Ministre de l'Industrie, du Commerce et de l'Artisanat,
  représenté par M. Thierry GAUDIN
- M. le Ministre de l'Environnement et du Cadre de Vie
  représentant par M.ESMENJAUD
- Mme le Ministre des Universités
  représentée par M. Bernard COQUET

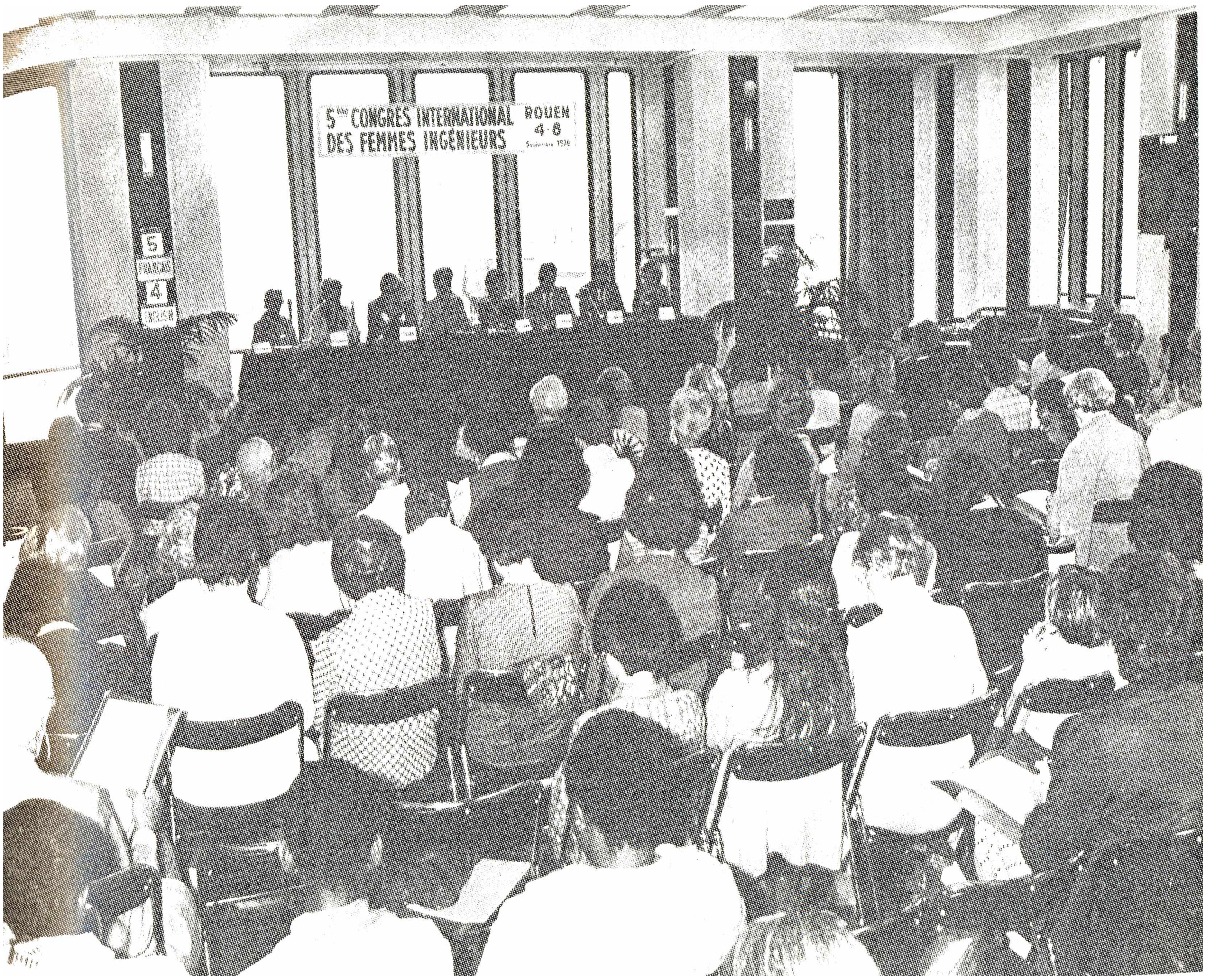
- M.le Secrétaire d'Etat à la Recherche
  représenté par Mme Odile POMAREDE
- Mme la Secrétaire d'Etat chargée de l'Emploi Féminin, que des
  obligations impérieuses ont retenu loin de no lous mais
  qui a demandé à etre tenue trés informée de nos travaux
- M. le Directeur General des Télécommunications
- M. le Président du Comité d'Etudes sur les Formations d'Ingénieurs.

Par ailleurs, la presence à cette tribune de Mme Jacqueline NONON. Chef du Bureau "Emploi des Femmes" à la Commission des Communautés Européennes, témoigne de l'intért que la Conmmission de Bruxelles porte à nos travaux et du soutien qu'elle nous a apporté. Je price Mme NONON de transmettre nos vifs remerciements à M. VREDELING, Vice-Président de la Commission de Bruxelles.

Nous devons exprimer, d'autre part, une particulière gratitude aux organes représentatis des professions et du monde du travail. Nous ne pouvions les compter tous parmi nous ce matin ; j'ai plaisir à saluer la présence de :

- M. Claude PERRAULT, représentant de la Conféderation Générale
  du Travail - Force Ouvriére
- Mme Huguette FRANCOIS, représentant le Cunseil National du
  Patronat français.


5ème CONGRES INTERNATIONAL
DES FEMMES INGENIEURS
ROUEN
4-8
Septembre 1978


5ème CONGRES INTERNATIONAL DES FEMMES INGENIEURS
ROUEN
4-8
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FRANCAIS
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ENGLISH

Notre reconnaissance va maintenant à toutes les entreprises qui ont répondu à notre appel : que ce soient des entreprises nationales ; que ce soient les entreprises de la région rouennaise qui ont bien voulu vous ourvrir leurs portes pour des visites sans nul doute passionnantes, que ce soient leurs organisations professionnelles, qui ne nous ont pas ménagé leur coopération très active, et dont je salue les représentants MM.

que ce soit la Chambre de Commerce et d'Industrie de Rouen, qui vous accueillera mercredi prochain en l'hotel consulaire,

Toutes doivent étre ici remerciées.

Je ne saurai oublier les organisations d'ingénieurs - bien entendu, sans distinction de sexe - qu'elles se situent aux plans régional, national, européen ou mondial, puisque M.Yvan MIROCHNIKOF, Président de la Fédération européenne des Associations d'Ingénieurs, est présent à cette tribune.

Si la Présidente qui vous parle n'avait pu s'appuyer sur un faisceau de bonnes volontés et de dévouements à tous les niveaux, la mise sur pied de ce Congrés n'aurait pas été possible.

J'ai ainsi contracté une dette de reconnaissance, que je suis heureuse de rendre publique aujourd'hui devant vous, à l'égard de nombreuses collégues et amies, et naturellement d'abord à l'égard du Comité d'Organisation de ce Congrés - permettez-moi de saluer la présence parmi nous ce matin d'un des membres les plus éminents de ce Comité : Madame Marcelle DEVAUD, représentante de la France à la Commission de la Femme des Nations Unies.

Ma dette de reconnaissance va également à notre dévouée Commissaire Générale, Mme BORIES et à toute son équipe... et pourquoi ne pas l'étendre aussi à mon époux, dont la patience et les sages conseils ne m'ont certes pas été inuti1es.

Sans plus attendre, je céde maintenant la parole au Premier Magistrat de Rouen. M. Jean LECANUET, qui a tenu à s'adresser personnellement à vous, dans sa ville.

Nicole BÉCARUD

SEANCE D’ OUVERTURE **OPENING SESSION**

" TECHNIQUES ET LIBERTES "

par Madame, jacqueline NONON, Chef du Bureau "Emploi des Femmes" à la Commission des Communatés Européenes

Monsieur le Ministre,
Madame la présidente,
Mesdames, Messieurs,

Avant d'entrer dans le vif du sujet, je souhaiterais m'acquitter de la mission dont m'a chargée la Commission des Communautés Européenes que je représente ici : à oavoir féliciter cette vaste aseemblée de femmes ingénieurs et scientifiques qui vont consacrer quatre journées à réfléchir sur un thème d'actualité brulante, et leur transmettre des voeux pour le succès des travaux qui vont se dérouler ici. L'intérêt que la Commission de Bruxelles porte aux problèmes de la science, de la récherche, du progrès technique, de l’éducation et de la formation à l'emploi, de la qualité de la vie, pour parler de façon plus large, n'est plus à démontrer à la plupart d’ entra vous tout au moins à ceux et celles qui vivent en Europe. Que ce soit dans vos laboratoires, dons vos bureoux, dans vos cabinets médicaux, vous ne pouvez plus ignorer lea règlements communautaires qui protègent la qualité des aliments, la législation. qui veut lutter contre la pollution de 1'eau, la programme en matière de recherche et d'education, l'exietence du comité européen des consommateurs, etc... Bref, autant d’ initiatives et d'efforts pour assurer aux populations de la Communauté Européenne, une vie de qualité dans monde harmonieux tel que l'envisageaient, i1 y a 25 ans les pères de l'Europe et les auteurs du Traité de Rome.

Main où en sommes-nous aujourd 'hui? Telle est, we semble-t-il, l'interrogation que traduit le thème de ce Congrès qui se situe précisément dans une époque charnièrs , celle qui eat la nêtre. En effet, la crise que nous vivons en ce moment sous amène à faire le point de l'acquis des récentes décennies pour savoir comment prendre le virage du dernier quart de siècle. Autrement dit où en sommes-nous arrivés avec les techniques et qu'en est-il des libertés ?

Toutefois, avant d'aborder le thème que l'on a bien voulu me charger d'introduire, il importe, semble-t-il, de préciser les contours des- notions que l'on se propose de mettre en corrélation.
Qu'entend-on par ' techniques' ?
Qu'entend-on par "libertés" ?

Ce n'est qu'après avoir défini le contenu que l'on attribue aux vocables que l'on pourra traiter de la relation à établir entre les techniques et les libertés

En ce qui concerne les premières, on peut, sans pour autant remonter à mathusalem, affirmer que, depuis que le monde est monde, on listingue deux catégories de technologies :

- d'une part, les technologies d'acquisition et d'agression : c'est a'ensemble des techniques principalement destinées à se procurer nourriture, vêtement et logement ;

- d'nutre part, les technologies d'entretien, de soin et de défense: il s'agit en l'occurrence de l'entretien et du soin du bien acquis, en particulier de l'outil et de l'habitat ; il s'agit aussi do la défense contre la mort individuelle et collective - c'est la recherche d'un arsenal médical pour préserver et sauvegarder 1a santé; c'est l'élaboration d'une organisation sociale capable de protéger le groupe par rapport à lui-même et à sa survie et par rapport à l'agression violente ou non émenant de l'extérieur.

Durant des millénaires" 1eo technologies primitives, des deur catégories fondées essentiellement Sur l' énergie musculaire, subissent une évolution très lente, disons jusqu’a la Renaissance en Europe, lorsque les savants se penchent sur les applications des sciences physiques pour développer des techniques, surtout mécaniques. Ce n'est pourtant qu'avee le Siècle des Lumières et les Encyclopédistes que la confiance en la technique se concrétise et qu'une conception "technique" s'organise en un véritable Système de société et de civilisation. La Révolution Française, préparée d'ai1leurs par cette même pensée encyclopédique, libère le capital possédé par une classe sociale qui comprend l'intérêt do la technique et consent à faire l'investissement nécessaire à Son développement.

Ainsi s'ouvre le champ de la recherche et de la généralisation de ses applications. Celles-ci font leur apparition avec la révolution industrielle,qui remplace l'énergie musculaire par l'énergie charbon, puis par l'électricité Enfin, la deuxième guerre mondiale consacre le règne d 'une autre source d' énergie; le pétrole, et simultanément le monde de la technique se transforme radicalement avec la découverte dè l'atome et surtout avec l' introduction de l',électronique dans la vie de tous lie jours. Et nous voici dans une ère nouvelle, celle de l'informatique, de la "télématique’’, phénomène porteur d'un bouleversement considérable de notre société : elle va désormais s'imposer, irriguer notre société Comme l’électricité.

Alers, que sera demain ?

Compte tenu des circonstances que nous vivons aujourd'hui même lesquelles ont été engendrées, en particulier, par l'enchérissement du pétrole, ce qui implique la recherche de nouvelles sources d'énergie, nous connaitrons sans doute un nouveau tournant de l'histoire des science et des techniques.

Cependant, nous n'allons pas nous borner à contempler l'histoire du progrès technique sans nous poser des questions sur ses conséquences : Quelle influence a-t-i1 exercé sur notre vie matérielle ? Quelle influence a-t-il exercé sur notre vie sociale ?

Depuis le XIX ème siècle, la vie quotidienne se transforme chaque jour avec l'apparition de nouvelles techniques de production, de transport, de communication et d'information, avec la mécanisation du ménage, avec les progrès de l'hygiene, de la médecine, de la chirurgie, et j'en passe. L'idée ne viendrait h personne de contester la contribution des technologies au bien-3tre des populations. Les techniques sont bien un moteur de progrès pour les sociétés. Elles permettent de produire davantage, a un moindre coût, ce qui débouche sur l'élévation du niveau de vie et a été jusqu'ici un facteur décisif de
réduction des inégalités sociales.

Sur le plan individuel, les découvertes scientifiques, dans le domaine médical entre autres, et la généralisation de leurs applications, apportent un mieux-être: par exemple, une espérance. de vie accrue, une technologie contraceptive qui laisse les couples décider librement de la taille de leur famille.

Sur un plan plus large, à l'usine et au bureau, le progrès technique améliore les méthodes et les conditions de travail: des machines effectuent des travaux à la place des personnes, ce qui permet de réaménager la division du travail et de réduire le temps de travail.

Mais, si la révolution scientifique et technique nous donne un savoir et un pouvoir fabuleux, Quel en est le prix aujourd'hui ? C'est une question qu'il faut se poser. 11 y a toujours un revers à la médaille : ce sont les aspects négatifs du siècle de la technologies, qui se révèlent désormais à travers l'action des mouvements écologistes, des organisations de défense des consommateurs, de lutte contre la course aux armements, à travers la mode passéiste et de "retour aux sources".
I1 y a done un problème. Et le fait même que votre Congrès ait choisi ce thème de rèflexion prouve qu'il y a un problème.

En effet, si le développement des techniques libère l'homme, il crée aussi des servitudes, séecrète des réactions ’’boomerang’’ sur les plans économique st social ainsi que sur l'environnement.

On peut dire que la zone d'impact la plus largement touchée est le marché du travail qui a été complètement bouleversé par le progrès technique. La mécanisation de l'agriculture, par exemple, a provoqué l'exode rural et un chômage difficile à absorber, surtout dans le tiers monde, les restructurations industrielles réduisent les besoins de main-d'oeuvre et impliquent de nouvelles définitions du contenu des professions, mettant en chômage une partie des travailleurs, souvent des femmes d'ailleurs. Je n'en veux pour preuve que l'exemple du textile : la machine remplace l'homme et l'homme remplace la femme. Vous n'ignorez pas que lorsqu'une entreprise fait l'investissement d'une nouvelle machine, elle remplace les femmes par des bommes sous prétexte que celles-ci n'ont pas la formation technique nécessaire, ni
"l'esprit mécanique" préalable.

En réalité, la technique reste deliberement l'affaire des hommes. Songeons au peu de place faite aux jeunes filles et aux femmes dans les établissements d'enseignement technique.

Il en est ainsi dans tous les pays. On me citait récemment un exemple africain: le "pain de singe", fruit du baobab, était jusqu'à présent récolté par les femmes et les enfants. On est en train de mécaniser cette cueillette et les bommes vont prendre la place des femmes. La technique est le domaine des hommes.

La mécanisation de l'agriculture a provoqué l'exode rural et par voie de conséquence l'urbanisation excessive avec toutes ses implications économiques et sociales dent l'accroissement des disparités regionales, de région a région, de pays à pays et de continent à continent, les plus riches devenant encore plus riches et les plus pauvres devenant encore plus pauvres.

Que faut-il ajouter ? La destruction de la nature est en marche, les eaux sont polluées, les forets démantelées, les paysages massacrés par la construction quasi sauvage d'immeubles qui prennent la place d'une végétation essentislle : telle est l'image de la côte d'Azur que je voyais encore ces jours-ci avec au coeur le souvenir des paysages tranquilles de mon enfance.

Malheureusement, cette liste des méfaits de la technologie à la portée de tous n'est pas exhaustive. C'est ce qui m'amené au second domaine d'influence du progrès technique: la vie "politique" dans l'acception première du terme, de gestion de In cité, donne de la société. Quel changement le progrès technique a-t-il engendré au plan "du politique" ?

Eh bien, il a créé une responsabilité nouvelle qui, j'en suis convaincue. constituera l'un des axes majeurs de votre réflexion. De fait, il parait difficile de traiter le theme "Techniques et Libertés" sans y introduire la dimension ‘’responsabilité.’’

Or, s'il yune responsabilité individuelle au niveau de l'imagination, de la conception et de ls proposition, c'est pourtant le role de la responsabilité collective Que j'aimerais souligner. Et ce qui importe en l’Occurrence, c’est de garder la maitrise du développement technique pour rester dans la ligne de l'objectif final qui doit être le mieux être de l'humanité et non le profit pour quelques uns. Pour chaque Etat, il s'agit d'une responsabilité nationale. tant à l'égard de sa population qu'à l'égard des autres pays, surtout ceux qui ne sont pas encore parvenus au même stade de développement.

Au plan international, cette reoponsabilité est largement reconnue, elle est même considérée comme fondamentale. Elle s'inscrit parmi les préoccuputions essentielles des organisations internationales comme l'ONU at ses institutions spécialisées, comme le Bureau International du Travail, l'OCDE et la Communauté Européenne. Cotte dernière, bien que fondée sur un Traité de nature économique, a pour mission primordiale de promouvoir, en corrélation avec le fonctionnement d'un marché commun, l'amélioration du niveau do vie des populations eoncernées.

Le niveau do vie étant par définition lié au travail et à l'emploi, la Communautè est au premier chef intéressée par le progrès technique et ses conséquences socio-économiques. C'est ainsi que dès le début des années 60, la Commission de Bruxelles organisa, evec les partenaires socieux, un colloque sur le thème "Progrès technique et murché commun".

Depuis lors, de nombreux travaux ont été développés à ce sujet et l'une des réalisations récentes à signaler est la mise en place de la Fondation Européenne pour l'amélioration des conditions de vie et de travail, à Dublin. La vocation de cette institution communautaire est précisément de mener des recherches pour une meilleure adéquation entre l' évolution technologique, le développement économique at le progrès social.

Quoi qu'il en soit, il ne suffit pas de produire des richesses pour enrichir une population. La répartition des revenus tient en effet à une décision politique, laquelle tient elle-même à l'ensemble des libertés exercées par les personnes et par les peuples.

Que peut-on ainsi entendre par "libertés”?

Je les classerai en trois catégories distinctes: le première catégorie concerne la libération ma térielle de l' homme par la machine.

La seconde correspond aux libertés acquises grâce à la technique, notamment en matière de transports, communications. information etc...; libertés qui existent done désormais et qui s'inscrivent dans le contexte général de sociétés démocratiques. Ce sont des libertés individuelles et collectives qui sont en principe génératrices de création et porteuses de progrés. Il importe par conséquent de les protéger envers et contre tous.

La troisième catégorie est celle des libertés à rechercher et à définir en fonction de la transformation de la nature même des libertés menacées par le développement de certaines technologies. Car tel est le caractère paradoxal que peut revêtir la technique: on l'a voulue libératrice et, par l'usage que l'on en fait, elle peut mettre en crise les libertés traditionnelles.

Je n'en veux pour exemple quo la nécessité da règlementer le recueil des renseignements qui peuvent, gràce à l'informatique, tre obtenus sur la vie et les activités des citoyens. La technique va trés vite dans ce domaine et les libertés téléphoniquen sont déjà dépassées. Il est désormais possible d'écouter, voire enregistrer à distance, n'importe quelle conversation privée. D'autre part, le perfectionnement de l'appareil statistique et documentaire dont disposent les administrations et les grandes entreprises est tel que notre vie privée est à la merci des ordinateurs. Autrement dit il y a un risque de bouleversement des jeux de pouvoir entre les divers acteurs sociaux.

Sans condamner le progrés technique, positif en soi, il faut cependant être très vigilant pour qu'il ne soit pas dévoyé à l'encontre des individus.

Un autre aspect des libertés à rechercher touche le droit des citoyens à l'information; cela pour sauvegarder le pluralisme politique et culturel. Il en va de même du droit à l'éducation: qui dit libertés nouvelles, dit éducation destinée à exercer les dites libertés, dans la perspective, notamment, de la recherche d'un nouvel humanisme adapté à l'avenir.

Nous avons évoqué l'avènement de la technique son évolution et son rôle dans la vie moderne. Nous avons examiné les responsabilités que son usage et sa généralisation impliquent. Nous l'avons mise en regard des libartés qu'elle engendre. Mais nous n'avons pas vu comment nait la technique; quels en sont les creusets; comment elle est financée et pourquoi? Si ces questions peuvent paraî tre déborder le cadre de notre sujet, elles n'en sont pas pour autant dénuées d'importance. Au contraire. A mon avis elles sont directement liées au théme des libertés par le biais de la participation à la décision; et en particulier au thème des libertés exercées par les femmes.

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En effet, la recherche est, comme vous le savez, effectuée dans les laboratoires u'instituts dépendant des pouvoirs publics ou des entreprises privées. L'application en ost menée par les entreprises elle-même, après avoir été décide et finances en fonction de choix "politiques" des gouvernements ou des entreprises dont les motivations ne coïncident pas nécessairement avec les aspirations des hommes et des femmes qui seront amenés à en être les utilisateurs.

Qui plus est, dans de domaine de la technique - comme dans bien d'autres d ' ailleurs – les décisions sont prises par les hommes. Jusqu'a présent les femmes en ont été complètement élimines. Elles commencent a s'y faire place, mais très lentement et le progrès est loin d' être spectaculaire.

Or, en tant qu'utilisatrices et consommatrices et en tant que citoyennes et électrices, les femmes, au même titre que les hommes ont leur mot a dire et elles devraient pouvoir le dire. En outre, leur apport revêt une spécificité précieuse puisque dans l'état actuel des choses, ce sont elles qui sont en *prise* directe sur les réalités du quotidien.

Aussi, l'une des stratégies de base consiste-t-elle a faire admettre le point de vue des femmes par les décideurs, au :même titre que le point <1'3 vue g6neralement abstrait des hommes, qui constitue toujours l'étalon des valeurs.

Je n'évoquerai que l'exemple de l'urbanisme : les immeubles sont conçus par les hommes. Qu'y trouvez-vous 7 Des éviers a hauteur du genou et des placards inaccessibles aux "moins d' un- mètre –soixante _ dix". Qu'a t-on prévu pour les enfants ? Des chambres qui ne peuvent même pas accueillir les jouets du Père Noël. N'en serait-il pas autrement, si les femmes avaient été représentées dans les organes consultatifs a tous les niveaux de la conception et de la réalisation des projets 7

On note un phénomène analogue da~s l'agriculture. On a modernise l'exploitation, sans prévoir que l'agricultrice, libérée par In technique et sollicitée a l'extérieur par la vie corporative et sociale, aurait besoin de garderies d'enfants, d'aides pour soigner les persOrJ1e3, âgées, da transports mieux conçus.

Une meilleure participation des femmes à la décision passe par un rôle de catalyseur et de multiplicateur.

Le rôle de catalyseur peut se jouer par une présence accrue des femmes dans la technique. Non pas au ni venu subalterne, comme c'est souvent le cas, mais au plus haut niveau, aux fins de participer à la décision - que ce soit dans les structures de l'entreprise ou des administrations publiques. Une fois vaincues les résistances, on sera obligé de reconnaî tre que le point de vue des femmes peut être bénéfique à tous. Lés ouvrièrs de la Fabrique lie Nationale d'armes de Herstal en Belgique, lors de leur grève fameuse de 1964 (pour l'égalité salariale) obtiennent 1a création d'une commission paritaire d'entreprise pour les conditions de travail. Les ouvriers que j'ai eu 1'occaoion de questionner à ce propos, sont unanimes à reconnaî tre que les femmes leur; ont ouvert les yeux sur certaine détails des conditions de vie dans les ateliers, qui avaient toujours échappé aux hommes. Le résultat ?

L’amélioration des conditions de travail pour tout le personnel, masculin et féminin.

Quant au rôle de multiplicateur, je le pressens à travers les associations féminines qui sont un vecteur de progrès en matièré d’éducation psychologique et sociale. Des associations comme celles que vous représentez doivent être des stimulants. Non seulement pour les femmes déjà en place, mais surtout pour les plus jeunes qui auront encore bien des obstacles à franchir et surtout à contourner.

Puisque vos associations sont des agents dé multiplicateurs de l'information. je souhaiterais les mettre à contribution, à travers vous ici présentes naturellement.

Nous venons de toucher la question de la responsabilité des femmes qui est directement liée à la place que celles-ci occupent dans la société et surtout dans la vie économique. C'est à ce propos que je voudrais vous dire quelques mots des Perspectives que la communauté Européenne leur a ouvertes dans le domaine de l'emploi, en particulier. C'est le message que je vous charge de transmettre autour de vous.

Comme je l'ai indiqué au début de cet exposé, l'une des préoccupations majeures de la Communauté -a fortiori dans la conjoncture actuelle- est l'emploi ; le plein emploi: le meilleur emploi. cosidérant que l'emploi des femmes mérite une attention particulière et une action spécifique, la commission de Bruxelles adresse en 1975 au Conseil des ministres des Neufs un mémorandum accompagné d'une proposition de Directive sur l'égalité de traitement des hommes et des femmes en ce qui concerne l'accès à l'emploi, à la formation professionnelle et la promotion, les conditions de travail. Le 12 février 1976 le Conseil adopta cette Directive qui est en quelque sorte une loi-cadre européenne que les Etats membres s'engagent à faire appliquer chez eux. Pour cela ils doivent transcrire dans leur législation nationale les disposition contenus dans la Directive européenne. Compte tenu des délais accordés aux Etats pour ce faire, la Directive est entrée en vigueur le 12 août1971. Autrement dit, les Etats doivent désormais avoir pris les mesures nécessaires pour se conformer à la Directive. Qu' en es t-il dans la réalité ? Nous ne savons pas encore. La Commission rassemblera incessamment les informations quo vont lui communiquer les gouvernements cet égard, et elle fers le point. Si les Etats n'ont pas respecté leurs engagements, la commission a tout pouvoir de les mettres en demeure de le faire ; ce traité l'autorise même à présenter contre un Etat membre en infraction, un recours à la Cour de Justice européenne de Luxembourg. Pour votre information j'ai apporté un stock du texte de cette Directive, qui est è votre disposition.

Toutefois, nous sommes bien conscients à Bruxelles de ce qu'à elle seule, la loi ne résoudra pas les problèmes de l'emploi des femmes. Tant que les mentalités ne changeront pas et tant que les résistances psychologiques tant de la port des hommes que de la part des nombreuses femmes, d'ailleurs, ne céderont pas, l'égalité restera une utopie. Or,si dans la foulée du progrès technique vous voulez conquérir des libertés, non seulement matérielles et physiques, mais surtout poli tiques et socialer si vous voulez que la condition féminine soi t équivalente à la condition masculine, soyez présentes partout; exigez de participer aux responsabilités; deveuez des partenaires de plein droit. Un tel effort doit s'accomplir dans un esprit de solidarité et non de rivalité avec les autres femmes; il doit tendre Vers les autres femmes, au-delà des frontières - celles qui ne sont pas. h même do se défendre, faute d'education par.

exemple-, il doit tendre vers les femmes de toutes générations et surtout vers les générations à venir pour qui nous avons la mission de préparer les fondements d'une vie de qualité. Vous, en particulier, qui exercez des responsabilités dans le domaine de la science et de la technique, vous devez veiller à ce que les femmes ne soient pas des laissés pour compte de la technologie. Au contraire, vous devez toujours avoir en tête la dimension "femme" à introduire dans les projets qui vous sont confiés.

Ainsi, je conclurai par une conviction personnelle : ce n'est qu'à cette condition que nos sociétés aborderont sainement l'an 2 000. En effet la transition d'un siècle a l'autre ne se fera bien qu'avec les femmes; si elle se fait sans les femmes, elle sera ratée : ce sera un rendez-vous manqué avec l'histoire. Le contexte social est prêt. La demande des femmes existe ; elle est irréversible. Le contexte économique n'est pas favorable. N'est-ce pas l'occasion de lui lancer un défi ?

Jacqueline NONON

REUNIONS DES DELEGUEES NATIONALES
MEETINGS OF NATIONAL REPRESENTATIVES
MARDI 5 SEPTEMBRE 1978
11 H... 20 H

LISTE DES PARTICIPANTES

			CHAIRMEN EMERITUS	
AFRIQUE DU SUD		Anna- Maria MOUTON	1964 NEW YORK	B.A. HICKS (+)
ARGENTINE		Marta MARINOT	Deputy	M. FOX
BELGIQUE		Paula TALPAERT	1967 CAMBRIDGE	J.C. THOMPSON
BRESIL	(	Sophia PORTELLA,	Deputy	R. WINSLADE
	(	Clara STEINBERG		
CANADA		Dormer ELLIS	1971 TORINO	Anna AMOUR
FINLANDE		Ritva KIVISTO	Deputy	C. BOROONE SACERDOTE
France	(	Nicole BECARUD		
	(	Monique BRYLINSKI	1975 CRACOVIE	I. ZACHWATOVICZ
GRANDE BRETAGNE	(	Henriett3 BUSSEL	Deputy	M. GRABCZEWSKA
	(	Isabel HARDWICH		
GRECE		Vassiliki KOTSIRA		
HONGRIE		Susan TURI		
INDE		Il a GHOSE		
IRAN		Mahin RAHMANI	Comité de 1iaison: Isabe1 HARDWICH	
ITALIE		Anna AMOUR		
MALAISIE		Zahara SAIDIN		
MEXIQUE		Angelina PEREZ-LOPEZ		
NIGERIA		Yeside SOYINKA (JACOB)		
OUGANDA		Mary-Josy OGUAKOL		
PHILIPPINES		Luz SALONGA		
POLOGNE		Isabela ZACHWATOWICZ		
PORTO RICO		CLAVELL		
R.F.A		Ilse KNOTT-TER MEER		
SENEGAL		Marie Therese BASSE		
SIERRA LEONE		Yvette STEVENS		(+) Died
SUEDE	(	Ragnhild WALLIN		
	(	Kerstin ASWALD		
SUISSE	(	Erna. HUMBURGER		
	(	Berta RAHM		
THAILANDE		Anna SAENGBANGPLA		
U.R.S.S	(	Zoja POUCHOVA		
	(	Galina SETCHEVINA		
U.S.A.	(	Beatrice HICKS (+)		
	(	Lydia PICKUP		
	(	Paula LORING		

REUNIONS DES DELEGUEES NATIONALES
MEETINGS OF NATIONAL REPRESENTATIVES
5 SEPTEMBRE 1978

- COMPTE RENDU
- MINUTES

- Las réunions avaient pour but d'étudier la manière la plus efficace d' assurer la continuité des Congrés et de transmettre l'expérience des organisateurs précédents.

- Aprés discussion, 1es décisions suivantes ont été prises a la majorité des déléguées présentes:

1) Au cours de chaque Congrès, est constitue un Comité International chargé d'assurer la liaison entre le Contrès en cours et le Congres suivant.

2) La composition du Comité est la suivante :
   - 1a présidente du Congrès en cours assure la présidence : elle se fera aider par les présidentes et organisatrices des précédents Congrés.
   - une représentante des grandes régions, en principe définies comme suit :
     - Afrique
     - Amérique du Nord
     - Amérique du Sud
     - Asie - Moyen Orient
     - Asie - Extrême Orient
     - Europe

- Les membres du Comite seront désignées par région, par les délègues nationa1 es résentes au Congres en cours.

3) Ce Comite es t charge de susciter et d' étudier 1 es candidatures, pour le Congres suivant.
   - Trois propositions ont été formulées pour un Congres en 1981.

Les décisions suivantes ont été adoptées a la majorité des déléguées présentes

- La proposition faite par la déléguée de l'INDE est acceptée sous reserve de confirmation avant le ler novembre 1978.

- Au cas où la proposition de I' INDE ne pourrait pas se concrétiser, deux; propositions restent va1ables, celle des PHILIPPINES et celle des U.S.A I1 est décide que la proposition des U.S.A. serait 1a première retenue celle des PHILIPPINES venant en deuxième rang.

Conformément aux décisions prises le 5 septembre 1978, 1a proposition formulée par 1a délègue de l 'INDE a été acceptée. Le VI ICWES se tiendra, donc à BOMBAY, du 7 au 14 septembre 1981.

ALLOCUTION DE Nicole BECARUD
Présidente du Congrès

Madame et Messieurs les Présidents,
Chères Amies,

Nous parvenons aujourd'hui au terme de notre Congrès.

Avant de nous dire au revoir, et bien que le temps m'ait manqué pour une synthèse élaborée, je voudrais revenir sur nos travaux en rappelant les idées principales qui se sont dégagées au cours des séances de Commission.

Mais tout d'abord, merci à vous toutes d'être venues des quatre coins du monde, d'avoir travaille dans les Commissions, d'avoir présenté des communications.

Merci d'avoir accepté de présider des séances de travail et aussi d'improviser des traductions.

Je sui s particulièrement reconnaissante aux anima tri ces et aux auteurs de communications de la discipline dont elles ont fait preuve, avec beaucoup de naturel, en limitant la durée de leurs exposes de manière à permettre de nombreux échanges et une discussion nourrie.

Merci enfin aux responsables des Commissions qui ont fait un gros effort de préparation, d’animation et de synthèse.

Je vais maintenant reprendre aussi fidèlement que possible les travaux des différentes Commissions.

La COMMISSION l, animée par Jacqueline GASTINE, Jacqueline RJMBAULT et France THOMAS
a centré sa réflexion sur la production industrialisée et
a en quelque sorte planté le décor dans lequel doivent évoluer
et travailler les femmes ingénieurs et scientifiques.

Alors que les progrès de la technologie ne se ralentissent pas, le bilan que nous pouvons dresser aujourd'hui de l'évolution accomplie est bien différent de celui que nous aurions établi lors de notre premier congrés à NEW YORK.

A l' èche lle mondiale, la croissance industrielle a pris un tour nouveau, notamment en raison des problèmes poses par l'approvisionnement en ressources énergétiques.(A noter que l'insécurité croissante a par contre-coup développé un besoin de sécurité dans l'entreprise et plus généralement dans la société).

Les difficultés accrues que rencontre l'industrie la conduisent à évoluer, voire à se transformer, afin d'utiliser plus efficacement les les aptitudes techniques et l'imagination créatrice.

Il en résulte une nouvelle politique de produits et de fabrication:
- produits plus adaptes :
 .d'une part aux possibilités économiques des pays ou des régions du monde,
 .d'autre part, aux besoins et aux aspirations des consommateurs ;
- procédés de fabrication choisis de manière :
 . a éviter les gaspillages, les pollutions, etc.
 de manière aussi :
 . a améliorer les conditions de travail.

La Commission a particulièrement étudie comment semble se dessiner l 'évolution du rôle que les femmes ingénieurs pourront jouer dans l'industrie.

Pour que ce rôle se développe, il faut qu'il soit reconnu par l'ensemble du personnel de l'entreprise, par les dirigeants comme par les exécutants.

De l'avis général, les femmes ingénieurs 'seront elles-mêmes les principaux artisans de leur réussite.

Si on les rencontre fréquemment dans les laboratoires, dans les services d'études et de documentation, ce n'est pas seulement par le volonté des chefs d'entreprise.

Elles ne feront carrière dans l'industrie qu'à la condition:
- de réfléchir à leur projet de carrière et de s'y tenir,
- à cette fin, de saisir toutes les occasions de formation continue entretien des connaissances, perfectionnement, ouverture à d autres fonctions : gestions, marketing, relations humaines.

Seule cette volonté d'élargissement de leurs compétences permettra aux femmes ingénieurs d'accéder comme leurs collègues masculins à des postes de responsabilité majeure.

La COMMISSION 2, animée par Mme Monique BRYLINSKI et par Mme Geneviève CHARLET a examine les problèmes que posent les transferts de technologie.

La présence dans cette Commission d' ingénieurs de pays développés, ayant l'expérience de transferts, et de représentantes éclairées de pays receveurs, a permis un dialogue très ouvert et une remarquable continuité dans la discussion.

L'accent a été mis sur plusieurs conditions qu'il est indispensable de satisfaire si l'on veut réussir une opération de transfert de technologie:

- Il faut prendre le temps de préparer patiemment l'opération par une connaissance mutuelle des parties intéressées - le donneur et lc receveur - connaissance approfondie portant sur la technologie certes, et l'environnement, mais aussi sur le vocabulaire utilisé par l'un et par l'autre, sur leurs habitudes sociales, sur le personnel qu'il sera possible de recruter, de former, etc...
- I1 faut "partir du bon pied", en étab1issant d'emblée des relations de partenaires, qui excluent les rapports de force.
- I1 faut définir de façon rigoureuse et précise les conditions du contrat, la responsabilité des parties,. pendant 1 'opération et aussi longtemps que le fonctionnement n'est pas parfaitement assuré.

Les congressistes des pays en voie de développement ont insisté sur la nécessité d'agir avec prudence et réalisme, en s'efforçant d'envisages toutes les conséquences des transferts envisages.

Dans les pays en voie de développement, il s 'agit d'abord de libérer l'individu de travaux pénibles, qui prennent beaucoup de temps. Ces travaux sont principalement accomplis par les femmes, à la maison et dans les champs. C'est par elles que passe le progrès dans la culture, la récolte, 1a conservation de la récolte.

A des technologies lourdes, chères, difficiles à entretenir il y a Souvent lieu de préférer des technologies simples, qui parfois existent dans d'autres pays depuis des millénaires (comme les éoliennes) ou que l'on vient de mettre au point dans d'autres pays. Il faut procéder lentement en utilisant autant que possible ce qui existe sur place?

Un danger a été longtemps ignoré ou sous-estimé : celui de provoquer un changement brutal des modes de vie par 1 'utilisation soudaine des technologies avancées. Or, les coutumes, les habitudes alimentaires font partie de la culture d'un pays et de son identité. Oter brusquement à la femme son travail traditionnel engendre le besoin d'une autre activité, peut provoquer l'exode rural, engendrer le chômage, etc...

Pour limiter les risques d'erreur, il faudrait que les pays en voie de développement puissent déterminer les technologies qui leur sont nécessaires et, dans un second temps, créer eux-mêmes des technologies adaptées à leurs besoins et à leurs possibilités.

Cette situation se rencontre dés maintenant ; mais trop souvent le receveur n'est pas en mesure d'exercer un choix réel, car il manque de structures, de techniciens, de capitaux.

La COMMISSION 3. animée par Mme Gisèle HUGUES et par Mlle Marguerite CORDIER s'est préoccupée de la formation et de l 'information des femmes sur les, carrières scientifiques et techniques.

Parmi les congressistes, nombreuses, inscrites à cette Commission l'evis dominant a été que, même dans des pays développés, les jeunes filles discernent mal l'intérêt des carrières scientifiques, cal' elles restent insuffisamment conscientes de l'importance de la science dans le monde.

Il apparaît donc nécessaire de les éclairer. Aux Etats-Unis et en Grande-Bretagne, les associations d'ingénieurs ont fait des efforts très importants pour donner le goût des études scientifiques aux jeunes gens et aux jeunes filles. Au Brésil, ce sont des étudiants ingénieurs qui sont mobilises pour donner le goùt des sciences à des groupes de lycéens.

Ces jeunes filles demandent encore a être particulièrement encouragées, notamment par l'exemple de femmes ayant réussi.

Une politique d'information ne doit pas négliger non plus 1es enseignants, qui connaissent généralement mal le milieu industriel. Des associations d'ingénieurs peuvent les inviter à des séminaires ou à des débats sur de grandes questions scientifiques (énergie, pollution etc..) ou sur des problèmes tels que l'emploi ou la formation professionnelle.

Plusieurs communications ont eu trait à la carrière des femmes ingénieurs.

Dans 1 'ensemble des pays, il semble qu'il n'y ait pas ou qu'il subsiste peu de discriminations dans les organismes publics et dans l'enseignement. C'est la que vont en général les femmes ingénieurs des pays en voie de développement et qussi de pays développés, comme le Canada, ou la misogynie des employeurs ne faiblit pas.

En revanche, aux Etats-Unis, les femmes ingénieurs cherchent à faire carrière dans les entreprises privées, où les salaires sont sensiblement plus élevés.

On observe depuis quelques années un certain accroissement des effectifs féminins dans les formations scientifiques et techniques, et ce développement autorise des espoirs pour la carrière que ces femmes feront demain.

Force est toutefois de reconnaître qu'aujourd' hui seule une petite minorité de femmes ingénieurs et scientifiques accède à des postes de responsabilité élevée.

Les raisons invoquées pour expliquer cette situation ont conduit la Commission a émettre une série de voeux :

- Que les études soient rigoureusement les mêmes pour les garçons .et pour les filles dans tous les pays, et que, si possible, i 'enseignement soit mixte.

- Que les femmes ingénieurs et scientifiques s'efforcent de développer 1 'information sur les sciences,
- Que les professeurs de mathématiques et de physique soient bien informes sur les carrières scientifiques et techniques ouvertes aux femmes,
- Que l'initiation aux sciences et aux travaux de l' ingénieur intervienne dans les programmes assez töt pour éclairer les choix d'orientation des éléves,
- Que les femmes aient la volonté de faire carrière,
- Que les femmes, en cours de carrière, pratiquent entre elles une solidarité active,
- Que les femmes refusent le bénéfice de mesures discriminatoires : les formules d d'aménagement du travail doivent être prises dans 1 'intérêt des hommes aussi bien que des femmes,
- Que les femmes ingénieurs interrompant leur travai1 pour raisons familiales veillent à entretenir par tous les moyens, leur savoir technique et une culture personnelle.

L' Association brésilienne exerce sur les femmes ingénieurs et architectes p de son pays une action stimulante que je n'évoque pas, car elle rejoint les recommandations que vous fera tout à l'heure Mme DEVAUD.

La COMMISSION 4, animée par Mme Marguerite RIBEYROLLES et par Mlle Emma HAMBURGER s'est interrogée sur les responsabilités du chercheur scientifique.

Il lui est apparu nécessaire de développer dans le public un vaste courant d'intérêt pour la science et les techniques, de manière à susciter le goût des études correspondantes.

Trois types d'actions ont été recommandés pour leur caractère réaliste :

a) dans les écoles (garçons et filles), demander (par une démarche auprès du, Ministre de l'Education) que les cours de sciences physiques et de chimie soient illustrés par des travaux pratiques portant sur le fonctionnement d'appareils de 1a vie courante, et particulièrement d'appareils ménagers.

b) auprès des foyers, que les associations de femmes ingénieurs, associées à d' autres organisations féminines, entreprennent une campagne d' information tendant `a rendre un service évident puisqu'il s'agira d'expliquer le fonctionnement des appareils en usage dans ces foyers de manière `a éviter les erreurs de manipulation qui pourraient provoquer des accidents.

c) auprès du public en général, faire un effort important de vulgarisation du qualité. Pour cela, une organisation féminine (de femmes diplômées) devrait créer des contacts entre les chercheurs des différentes disciplines afin de susciter des chroniques scientifiques susceptibles de faire sentir l'impact de la science et de la technique dans la vie moderne, chroniques `a diffuser avec le concours des mass media

Examinant ensuite la situation des femmes dans 1es activités de recherche, la Commission note que les qualités requises du chercheur ne dépendent pas du sexe, qu'il s'agisse de l'enthousiasme, de 1 'imagination, de la rigueur, de la patience, etc...

Les femmes se heurtent cependant `a une pierre d'achoppement : l'insuffisante disponibilité :

- Disponibilité psychique : trop de femmes manquent encore de confiance en leurs capacités ; déformation ancestrale, qui régresse; mais lentement,
- Disponibilité matérielle : trop de femmes ont encore `a assumer le plus clair de la charge du foyer; hommes et femmes doivent reconsidérer ensemble le partage de leurs attributions et faire évoluer 1 'organisation de la vie sociale de manière à mieux traiter les problèmes du foyer.

Sans minimiser l'évolution à accomplir au sein du couple, la femme doit se persuader que c'est à elle de prendre l'initiative du changement.

La Commission a enfin réfléchi à la finalité de la recherche:

- au regard e l'économie, naissance d'un produit, sa protection industrielle par le brevet, et l'utilité de la normalisation pour 1es échanges internationaux ;
- au regard de l' individu et de 1 a société, i1 entre dans 1a, responsabilité de l'ingénieur de s'assurer qu'un produit conçu en fonction du résultat d'études de marketing ne risque pas d'avoir un effet nocif sur la vie humaine ou sur la collectivité.

La COMMISSION 5, animée par Mme Antoinette DAVID avait pour domaine d'étude le développement technique des moyens d’ information

Elle observe que la communauté des ingénieurs et des scientifiques a la resronsabi1ité de rendre les progrès en matière de technologie accessibles aux utilisateurs des différents niveaux: des gens très bien formés et très avertis en matière de technologie à la foule des gens qui n'ont reçu qu'une formation rudimentaire.

La Commission affirme sa conviction (et je me permets, comme vous toutes, j'en suis certaine, de partager cet avis) que des femmes ingénieurs et scientifiques, se rencontrent dans des congrès qui leur sont propres, ont, du fait qu'elles sont moins nombreuses, une occasion particulièrement favorable d'échanger leurs vues entre spécialistes des différentes disciplines.

Il importe d'exiger de l'ensemble des ingénieurs et des scientifiques qu'i1s fournissent un effort accru pour coordonner les multiples technologies dans l'intérêt du travail de chacun.

La Commission recommande d'attacher une attention particulière à la manier"e cant l'information technique est transmise a des non - techniciens et aux risques d'erreur d'interprétation. I1 faut de nos jours une formation pour savoir choisir et utiliser les moyens d'information.

Nous devons prendre conscience du fait que I' information s'est décumulée à un rythme plus rapide que ne pouvait croître notre aptitude à utiliser cette information.Il en résu1te que nous devons contribuer à faire comprende l'importance de la formation et de l'entraînement tant des méthodes de classification et de diffusion de l'information qu'aux technologies de stockage, accumulation et diffusion à travers les banques de données.

On a exprimé l'espoir que celles qui ont participé à nos réunions internationales aient la volonté de faire connaître ces activités d'importance capitale et en particulier qu'elles fassent des efforts tout particu1iers pour appeler l'attention dans leur pays et dans leur environnement professionnel, de notre Congrés en particulier.

De ce survol des exposes et des discussions qui nous ont retenues cette semaine pendant une cinquantaine d'heures, deux idées au mains se sont imposées a notre attention:

- Tout d'abord le souci de diffuser une information de qualité est apparu comme fondamental dans notre activité de femme et d'ingénieur.

Ce souci implique la nécessité de se préoccuper de "l'autre".

Si l'on veut être compris, il importe de ne pas transmettre à tous le même contenu d'information scientifique et technique dans les mêmes termes ; il est indispensable de s'adapter aux différents publics à qui l'information est destinée.
La même règle vaut pour toute campagne d'information, d'explication.
Elle vaut aussi pour le dialogue entre donneur et receveur dans le cas des transferts de technologie.

Cette ouverture à autrui, cette imagination humaine qui pousse à essayer de comprendre "l'autre", les femmes n'en sont assurémpnt pas moins capables que leurs collegues masculins.

- D'autre part, vous rappelez que, lundi dernier, dans la séance d'ouverture, Mme Jacqueline NONON no us a engagées à nous faire une place partout; mais, ajoutait-elle aussitôt, cet effort doit s'accomplir dans un esprit de solidarité et non de rivalité avec les autres femmes.

Cette solidarité, qui nous apparaît si naturelle entre nous dans ce Congrés, il faut qu'elle nous anime dans les relations avec l'ensemble des femmes qui n'ont pas bénéficié des mêmes chances de formation que nous et que nous la fassions rayonner au bénéfice de celles qui nous suivent ; les jeunes filles qui ont besoin de notre concours pour s'orienter à bon escient, les jeunes femmes qui font leurs débuts dans la vie professionnelle, les femmes moins jeunes qui cherchent à reprendre une carrière interrompue.

En pratiquant à l'égard de ces collègues une solidarité active nous témoignons qu'un nombre croissant de femmes est désormais assez sûr de lui pour faire confiance à d'autres femmes.

Madame la Présidente, Monsieur le Directeur, Mes Chères Amies, j'ai parlé longtemps et je m'en excuse, mais la richesse des débats m' y obligeait.

Mahin RAHMANI, au nom des participantes, remercie chaleureusement le Cercle des Femmes Ingénieurs, sa présidente et touts les organisatrices d'avoir assure la réussite de ce Congrés.

Nicole BÈCARUD répond a Mahin RAHMANI et aux Congressistes.

Mes chères Amies,

Mes amies française du Comite d'Organisation de ce Congrés comme moi-même sommes extrêmement touchées des paroles si aimables que Rahmani Mahin vient de prononcer au nom de vous toutes et, de tout coeur, je vous en remercie.

Il me reste le devoir de vous parler de l'avenir.

last but not least

Enfin, mais ce n'est pas le moins important, je pense vous faire part de la décision que nous avons prise de mettre en place un Comité Permanent de 9 membres représentant toutes les parties du mande pour assurer la continuité de nos rencontres internationales et pour aider le pays qui s'est chargé de l'organisation du prochain Congrès.

J' ai le plaisir de vous annoncer que nos amies indienne ont pris une option très ferme sur le 6éme Congrés, mais nous avons eu aussi une invitation de la part des femmes ingénieurs et scientifique des Philippines - et aussi de la Society of women Engeneers aux Etats-Unis.

Au nom de toutes je remercie nos collègues de reprendre le flambeau et d'accepter la tàche d'organiser le 6éme Congrés International des Femmes Ingénieurs et Scientifiques.

Et maintenant, Chères Amies, il me reste à vous souhaiter un heureux retour dans votre pays, beaucoup de succès dans vos entreprises
et surtout je souhaite très vivement que nous nous retrouvions toutes dans trois ans.

Je déclare clos le 5éme Congrés International des Femmes Ingénieurs et Scientifiques.

TECHNIQUES ET LIBERTẺS

Commission 1 (C1)

LA PRODUCTION INDUSTRIALISẺE, POURQUOI?

Responsible: France THOMAS
Jacqueline GASTINNE

Grâce aux immenses progrès de la science et de la technique au cours des derniéres décennics, les modes de production ont subi une évolution considérable, que l'on peut constater dans tous les domaines de l'activité humaine: agriculture, industrie, urbanisme, transports, etc...

L'amélioration de la productivité, nécessité du monde moderne, pemet de satisfaire le, besoins de plus en plus diversifiés d'un nombre d'individus de plus en plus grand. Cependant ce monde en mutation doit rester aux dimensions humaines; les femmes ingénieurs et scientifiques peuvent y contribuer. Tel est l'objectif des travaux de cette commission.

C 1 - 1 Bilan de l'évolution récente des modes de production
par exemple, dans l 'agriculture, l 'industrie, l 'urbanisme, les transports, etc...

C 1 - 2 Productivité et qualité de la vie

C 1 - 3 Détection des besoins et choix des produits à fabriquer

C 1 - 4 Choix des procédés de fabrication
prenant en compte la lutte contre le gaspillage (énergie, matières premières ...) et contre les pollutions.

C 1 - 5 Responsabilités techniques et humaines des femmes ingénieurs et scientifiques
dans l 'évolution à venire de la production.

TECHNOLOGY AND FREEDOM

Commission 1 (C1)

INDUSTRIALISED PRODUCTION. WHEREFORE?

Convener: France THOMAS
Jacqueline GASTINNE

Owing to the immense advances in science and technology during the last few decades, methods of production have undergone radical changes which can be observed in all spheres of human activity: agriculture, industry, town-planning, transportation, etc...

The improvement in productivity, so necessary for today's world, makes possible the satisfaction of the yet more and more varied needs of a yet larger and larger number of individuals. However, this changing world must retain its human values. Women engineers and scientists can help in this. Such is the subject of the studies of this Commission.

C1 - 1 Evaluation of recent developments in methods of production.
e.g. in agriculture, industry, town-planning, transportation, etc...

C1 - 2 Productivity and the quality of life.

C1 - 3 Detection of needs and selection of products to be manufactured.

C1 - 4 Selection of manufacturing processes
taking into account the fight against waste (energy, raw materials ...) and against pollution.

C1 - 5 Technological and human responsibilities of women engineers and scientists
stemming from developments in production.

COMMISSION 1

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Commission 1

TECHNIQUES ET LIBERTES

LUTTE AU GASPILLAGE ET RECUPERATION DES DECHETS

Par Anna E. AHOUR

Préambule

Rien ne se crée, rien ne se détruit, tout se transforme.

Ce principe bien connu je l'avais entendu énoncer il y a plus de cinquante ans au gymnase, comme une affirmation, voire même une exaltation, des possibilités de In science et de la technologie de trouver les systèmes et les moyens de transformar la matière a volonté pour l'adapter aux besoins de l'homme, sur le chemin du progrès.

Ua progrès poursuivant un bien-être qui se réalise dans la capacité d'acquérir de nouveaux et plus perfectionnes moyens pour satisfaire des exigences toujours croissantes et de plus en plus sophistiquées: transports routiers, par mer et aériens, systèmes de communications radio-TV par satellites, appareils pour soulever de la fatigue les hommes dans les champs et dans les usines et les femmes dans les maisons, remèdes pour combattre les infirmités et prolonger la durée de la vie.

Dans les derniers 50 ans le progrès est avance e un rythme sans precedents, jusqu'a 1& grande conquête du siècle: l'homme qui se promène dans l'espace et lance des missiles interplanétaires dan Il espace pour la connaissance de mondes lointains.

Quelles limites pourrait-on songer de mettre au génie de l'invention et de la transformation de la matière pour atteindre d'autres conquêtes?

Rien ne se crée

La voici la première limite: rien ne se cree. Le Créateur a distribue les ressources sur la surface et dans les entrailles ‘de la terre en quantités bien définies.

L'espace occupe par "la biosphère, les constituants de l'air, les eaux, les éléments qui composent l'écorce de la terre, ou se cachent en profondite, forment un système a soi, en continue transformation sous l'effet de l'irradiation solaire, mais invariable dans la quantité totale de ses, composants.

Le seul apport extérieur au système du globe te1'restre c'est l'énergie provenante de la fusion therronucleaire du soleil, origine et garantie du renouvellement de la vie végétale et animale, mais dont on ne sait pas encore évaluer dans son ensemble l'action, ni la quantité de matériel organique produit dans notre écosystème, quantité qui est probablement supérieure i celle de toutes nos industries.

L'homme a étendu son domaine sur tous les règnes, s'est multiplié au cours des siècles à un rythme exponentiel (nous sommes près de 4 milliards tandis que près de 300 espèces d'animaux ont disparu en conséquence de l'activité humaine) et jouit, au moins dans les pays industrialisés, d'un bien-être matériel toujours plus étendu, grâce aux moyens fournis p science et la technologie.

Mais le règne minéral n'est pas renouvelable, il ne peut pas suivre le rythme de la population: la quantité des ressource disponibles est limitée et sa reperibilite est inégale dans les continents et les régions la du globe.

Dans le passe, In recherche des matières premières nécessaires nu progrès de la technologie a bien souvent déclanche' des guerres entres nations plus ou moins camouflées sous étiquettes idéologiques et patriotiques, et mis sen danger leur liberté. Comme il arrive du reste aussi de nos jours, dans plusieurs pays.

Le fait est que les ressources sont limitées, que les gisements connus vont s'épuiser dans un délai plus ou moins long, et que d'autre cote les pays *en* voie de développement imposent des; restriction aux exportations, pour no pas se priver trop tôt de leur biens et en tir le plus Grand avantage économique possible.

L'exemple le plus éclatant est celui qu'on a nomme "crise de l'énergie", crise évidemment pour les nations industrialisées, qui avaient ronde leurs économies sur un certain ni veau de prix du brut, sans prévoir une hausse de prix qui a durement frappe l'équilibre économique des pays importateurs et ralenti leur développement, soit la marche du progrès.

Mais déjà avant la crise de l'énergie plusieurs savants et groupe d'études avaient envisage les perspectives auxquelles le développement technologique et industriel aurait du faire face a moyen terme, a cause de la limitation des ressources naturelles de notre univers, le vaisseau qui, comme l'Arche de Noé, ne contient plus que tant et sur lequel nous désirons vivre autant que possible, i notre satisfaction.

Nos ressources

Trop facilement on perd de vue que l'activité économique humaine dépend de In capacité de la terre de produire les aliments, de fournir eau pure et combustibles, végétaux et poissons, d'offrir minéraux et autres matières premières et d'absorber nos déchets.

Ressource indispensable pour la vie de la végétation et des animaux est l'eau: eau pure pour boire, eau propre pour l'irrigation des champs pour les opreations industrielles et pour la production d'énergie.

L’autre ressource indispensable est la terre elle-même, cotte écorce d’humus qui nourrit la végétation dont tous les animaux, et nous avec, tirent leurs aliments.

Soit l'eau qua la terre, non feulement sont disponibles en quantité limitée, mais elles ressentent de plus en plus de In pollution, soit du manque de considération dans leur usage, au service des besoins individuels et collectifs, toujours croissants.

On ne peut pas dire a combien de personnes la terre pourrait donner la. nourriture, car cela dépend du choix entre les alternatives de cultivation. Actuellement la terre D'est cultivée qu'a moitie. Mais on peut facilement imaginer que, si la population continuait a augmenter exponentiellement, le jour viendrait ou toute la terre De serait plus suffisante a nourrir toute la population.

Dès à présent on peut souligner la possibilité d'accroître la productivité du terrain améliorant les systèmes de cultivation. Un exemple significatif est représente par la "révolution verte", c'est a dire la creation de nouvelles espèces de blé de riz qui donnent une moisson de 5O% a 100% supérieure a celle des précédentes.

Habituellement c'est aux engrais chimiques que l'on a recours pour augmenter le rendement du terrain, engrais qui sont composes de phosphates et de potassium, eux aussi reperibles en quantité limitée.

Le perfectionnement des procèdes techniques utilises dans la production industrielle se base sur l'exploitation des caractéristiques de plusieurs I minéraux, dont on a mesure la quantité des réserves connues et calcule La durée dans diverses hypothèses de consommation annuelle. (Table I)

La pollution

La limitation ie ces matériaux, dont l'utilisation était règlee jadis essentiellement par l' avantage économique des prix du marche, est aggravee par le fait que toute opération industrielle comporte des lavages qui emportent en solution ou en suspension un % appréciable des substances en jeu, les déchets, qui constituent un gaspillage non négligeable et provoquent la pollution des eaux qui les entraînent dans les fleuves jusqu a la mer.

De l'eau la pollution se répand dans l'atmosphère, d'ou elle redescend sur la terre avec les précipitations. Le schéma de cette dinamique peut être représente par la figure a page suivante.

Les effluents provenants des industries galvaniques, du traitement dos surfaces métalliques ou des métiers plastique, contiennent des éléments toxiques, accumulables dans les organismes vivants. C’est le cas du chrome, du cuivre, du nikel, du zinc et du cadmium dans les bains.

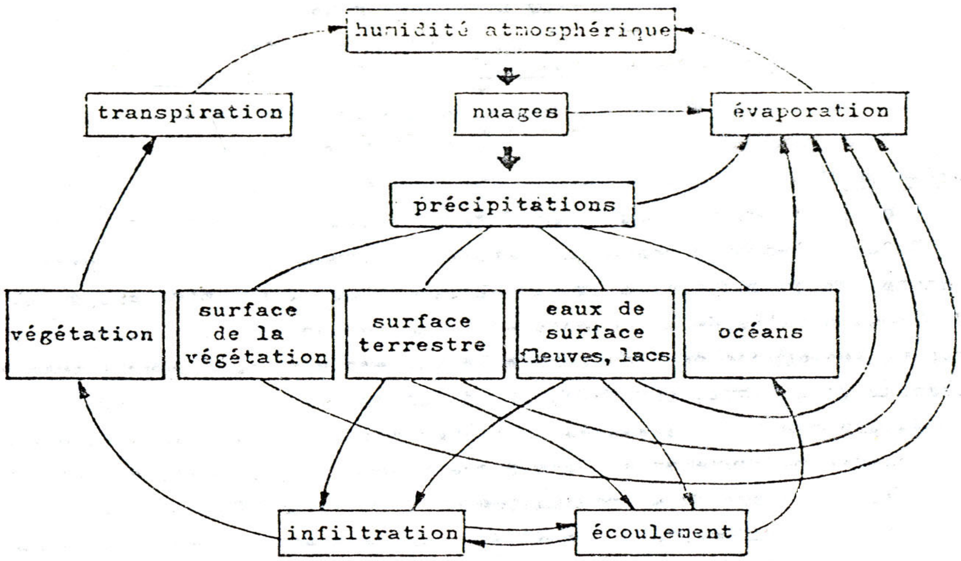

Fig.1 Procès de transfert des polluants à travers le cycle de l'eau (3)

de décapage et galvaniques; de l'argent dans les bains de développement photographique; du plomb pour la fabrication des accumulateurs; du cobalte et au vanadium utilisés dans la fabrication des catalyseurs; de l'étain use pour l'étamage et encore du titanium, chrome, zinc, cuivre plomb et cobalt uses pour le fabrication de pigments, encres et vernis.

La toxicité de ces métaux dépend du fait qu'ils ne sont pas biodégradables et qu'ils se diffusent dans le milieux a travers la chaîne biologique, devenant accessibles a la végétation et aux animaux.

Un discours a part serait nécessaire pour la pollution due a la radioactivité artificielle d'origine nucléaire, mais il nous porterait trop loin.

Quant à la production d'énergie thermoélectrique, 1a pollution qui en dérive se répand dans l'air à la sortie des résidus et des sousproduits de la combustion du mazout et dans l'eau sous forme de chaleur résidue dans l'eau de refroidissement, qui influence la solubilité de l'oxygène et accélère le procès d'oxydation biochimique qui intéresse la flore et la faune des cours d'eau.

Pour les moteurs des véhicules et les chaudières de chaudières de chauffage c'est l'incomplète combustion des hydrocarbures qui est la première cause de la pollution de l'air, outre que la production des gan le combustion qui empoisonnent l'air que nous respirons.

'Réduire gaspillage

Puisque les ressources sont limitées, il faut les utiliser au mieux, éliminant tout gaspillage. C'est le premier impératif, valable pour toute industrie, Comme pour l'agriculture et les consommations individuelles.

Les bureaux d'etu1es et de recherche& se sont engages a ce but, non seulement pour l'avantage économique. Dans bien des cas, comme celui de la production d'énergie et des transports, pour trouver des systèmes et des moyens alternatifs de production et d'~utre8 sources de combustibles aptes a résoudre a la fois les problèmes économiques, dérives par la hausse des prix du brut, et ceux de la pollution (par ex.. par In production d'hydrogène).

La combustion même des dérives du pétrole parait être un irrimediable gaspillage du potentiel chimique de l'or noir, dont on pourrait tirer bien d'autres sousproduits de grande valeur.

Les occasions de combattre le gaspillage ne rnanquent donc pas.

Dans l'industrie du papier, par ex., à peu près la moitie du bois des arbres abattus pour être broyés et cuits se perd dans les eaux de lavage des différentes opérations de fabrication. La pâte de cellulose a 1a fin utilisable pour faire le papier n'equivant qu'a la moitie de la matière première arrachee des bois, ces bois qui ont:la précieuse fonction de fournir l'oxygène a I' air, ce même oxygène indispensable a notre vie que les moteurs a combustion interne détruisent en grande quantité (pour brûler 1 litre de carburant il faut 8 litres d'air, Boit 1.6 litre d'oxygène) pour ne nous donner que I'illusion de la vitesse, toujours relative et parfois très dangereuse.

Si l'on ajoute qu'une grande partie du papier n'est imprimée que de un seul cote et qu'une autre partie on la jette dans la corbeille; aussitôt qu' on l' a dans les mains, on peut se demander s'il est admissible de continuer su cette voie.

Mais le gaspillage 'le plus grand, le plus coûteux, le plus absurde dan un monde qui réalise les limites de ses ressources, est sans doute celui de la fabrication des armements, qui épuisent d'énormes richesses et qui pourraient bien mieux servir a résoudre les problèmes de l'alimentation et du bien-être sur le chemin d'un laborieux et pacifique progrès.

Rien ne se détruit

Voila l'autre grande limite de notre univers: rien ne se détruit.

Ce dont on croit se débarrasser 1e jetant dans les eaux de lavage, va polluer les cours d'eau et s'accumuler dans la mer. Les engins casses et inutilisables s'empilent au bord des routes et l'humidité change le métal en rouille. Le mercure englouti par les poisson empoisonne les pêcheurs. La destruction des déchets est une illusion de courte vue.

Le déchets, soient-ils organiques, dérivés ou sousproduits des procès technologiques de transformation, des matières premières, restent avec nous sur le globe, en occupent une partie toujours croissante, et, ce qui est pis, concourent à la pollution du milieu, de façon à mettre en péril parfois, plus que notre liberté, notre vie même.

Tout se transforme

Les déchets, tôt ou tard, vont finir dans I ' eau. La quantité toujours croissante de l 'eau nécessaire aux besoins soit domestiques, que agri – coles ed industriels, impose la récupération des eaux d' égout comme des effluents industriels, dépuration préalable par aération en pression, par sédimentation, par traitements biologiques et par traitements chimiques.

Le traitement biologique se doit à l'**action** naturelle de microrganismes (bactères, champignons, protozoaires, etc.) qui convertissent les sub-stances organiques biodégradables en composés d'oxydation totale, quels anhydride carbonique, eau, nitrates, sulfites et phosphates, dans 1e cas d'oxydation aérobique, et en méthane, ammoniaque, hydrogène sulfuré, acides organiques, etc., dans le cas d'oxydation anaérobique.

Dans les deux cas le procès se fait en présence d'un accepteur de l'hydrogène: oxygène pour les microrganismes aérobiques; sulfates, nitrates, anydride carbonique, ou matières organiques pour les microrganismes anaérobiques. :

La biodégradabilité des effluents est exprimée par le rapport BOD 5/COD (domande biochimique d'oxygène après 5 jour / demande chimique d'oxygène) et s'effectue sans problèmes quand la valeur de ce rapport est supérieure à 0,6 ; elle nécessite de microrganismes selectionnés quand la valeur du rapport est comprise entre 0,2 et 0,6 ; elle est nulle, c'est à dire que les effluents ne sont pas biodégradables, quand la valeur du rapport est inférieure à 0.2.

L'action des microrganismes a trouvé de nouvelles applications dans l'industrie pour la production des antibiotiques, de hormones stéroïdes et de acides citrique, glutamique, etc.

L'autoépuration par microrganismes est exploitée au moyen de différents systèmes desquels on obtient de l'eau à différents degrés de pureté et des boues utilisables comme fertilisants en agriculture (compost) à condition de ne pas contenir des éléments toxiques.

Les boues dérivées des effluents industriels nécessitent d'abord l'élimination des substances toxiques et polluantes ; elles peuvent parfois être réutilisées dans les opérations do fabrication, mais, si l'on ne peut pas séparer les éléments nuisibles, elles doivent être déchargées

gées sous contrôle dans des mines abandonnées.

Les traitements chimiques sont nécessaires pour l'élimination des substances toxiques et de bactéries et virus pathogènes. Le plus diffus, utilisé le chlore sous forme de eau, d'hypochlorite et de bioxyde de chlore. Dans toutes les villes on boit désormais l'eau au chlore

L'eau pure est neutre quand la concentration des ions hydrogène est égale a celle des ions oxydrile; cette condition s'exprime par convention avec le cologaritme de la concentration des ions hydrogène, indiqué par pH. La valeur acceptable de pH, pour ne pas endommager les formes de vie, est comprise dans l'intervalle de 6,5 à 9,5. En dehors de cette intervalle l'eau doit être neutralisée par addition d'un acide si le pH est supérieur à 9,5, ou par addition d'une base si le pH est inférieur à 6,5. Il en dérive la formation de sels, dont certains sont solubles dans l'eau et d'autres précipitent en boues, qu'il faut éliminer de l'eau. Les ions mètalliques on les fait précipiter sous forme de composés peu solubles.

Les industries employent de très grandes quantités d'eau, soit pour refroidissement (90%), que pour la diluition des réactifs, l'abattage de gaz et, de fumées, le lavage de réservoirs et de réacteurs, la régénération des résines, etc. Ces effluents emportent en général de grandes quantités de substances polluantes.

Pour réduire au minimum possible la quantité d'eau, il faut une étude préliminaire du procès considérant toutes les possibilités de recyclage de l'eau et décupération des matières contenues.

Dans la sidérurgie, par ex., il faut 250 me d'eau pour produire une tonne d'acier, mais cette eau peut être réutilisée jusqu' au 96%.

La décharge des affluents industriels dans les fleuves peut être très dangereuse pour la végétation et pour les animaux. C'est pourquoi il faut établir des limites à l'acceptabilité de ces effluents pour sauvegarder

SERATRADI

En France la Société d'Etudes pour le Ramassage et le Traitement de tous les Déchets Industriels, depuis sa fondation en 1972, a orienté son activité autour de trois thèmes :

- enquêtes techniques et travaux d'analyse des déchets,
- engineering et construction de centres collectifs de traitement,
- exploitation de ces centres.

Des ses premières années d'activité, SERATRADI a étudie la législation et les réglementations mises au point dans les principaux pays industriels et en a fait l'objet d'une exposition comparée très intéressante de laquelle il ressort la nécessite que la réglementation puisse faire l'objet d'un contrôle effectif et que le principe "pollueur – payeur" suit suivi hum corollaire en vertu duquel celui qui élimine lent Muets dait être aide avec des subventions et d' autres ingitations.

De cette intéressant étude ne manque que la citation des lois promulguées en Italie, Nº 319 du 10 Mai 1976 ot Nº 690 du 8 Octobre 1976 et successives dispositions pour leur application.

Les déchet valent de l'or

Chaque année dans la CE on produit 1,7 milliards de tonnes de déchet le 75 à 90% desquels on les jatte, comme des ordures. Pour lutter contre cet énorme gaspillage, la CE a réuni les représentant a des "bourses de déchets afin de promouvoir leur activité. Cee bourses sont des organisations de "clearing" entre demandes et offres de résidus réutilisables. Elles fournissent aussi leur avis aux entreprises, pour stimuler les échanges et la réutilisation des déchets. Leur activité, circonscrite au début aux industries chimiques, ne couvre que le 5% des déchets, mais peut être avantageusement étendue à d'autres secteurs industriels.

Le traitement des effluents des industries vise à la récupération des sous produits ou des substances réutilisables dans la production, en même temps qu'a réduire na pollution.

Dans certaines industries il est déjà possible de récupérer avec profit les matières contenues dans les effluents; dans la fabrication des produits dérivés du lait, en 1968 aux USA la récupération des souspro – duits était supérieure au 90%, exception faite pour le sérum, qui était cupéré au 53%.

Les déchets des industries alimentaires, bière, huile, levure, sucre, et des abattages peuvent être récupérés et utilisés pour l'alimentation du bétail. Les déchets non récupérables et les boues provenant des industries de transformation de minéraux, souvent toxiques, doivent être éliminés par incinération après dessiccation, ou par décharge en carrières souterraines, contrôles à dessin.

Récupération; des déchets ménagers

Un chapitre a part est celui des déchets ménagers: à peu près 1 tonne par an et par famille. Leur composition peut être indiquée approximativement avec les chiffres suivants: papier 45%, matières organiques 25%, verre 17%, métaux 5%, plastique 5%, autres 5%.

La récupération de ces déchets a fait l'objet d'une étude approfondi de Jean Jacques Sauer, économiste et sociologue de l'EPFL, qui a voulu examiner si, dans 1 'état. actuel, comme dans un avenir ou l' économie reviendrait à des normes plus raisonnables, l'idée de cesser de gaspiller les produits " pop récupérer la matière première et al réintroduire dans un cycle de production, n'est pas seulement soutenable techniquement, mais surtout avantageuse pour les finances des Communes, des cantons et de la Confédération".

Les débets ménagers constituent pour la Suisse la source la plus importante et la moins exploitée. Les Communes qui organisent déjà le ramassage du vieux papier en Suisse, devraient mettre en place un système durable de récupération avec la coopération des citoyens, pour construire une alternative à la destruction et augmenter l'utilisation des ressources. La vente du papier collecté donnerait un appréciable bénéfice, alors que l'incinération, qui coûte (1975) 70 fr/tonne, ne rapporte au mieux que 10 fr/tonne, pour la chaleur récupérée lors de l'in cinération. La collecte du verre non consigné serait a l'avantage de l'industries réútilisatrice *et* soulèverait les finances publiques des frais de collecte. La récupération du métal constituant la seule source de matière première en Suisse, celle-ci est déjà très développe, mais peut être perfectionnée. Toutes espèces de plastiques donnent, par malaxage à chaud un matériel propre à des usages durable. Quant 'aux matières organiqucs, elles pourraient représenter une importante économie d'engrais si elles étaient transformées en compost dans de nombreuses petites unités situées en proximité des centres habités, on liaison avec l'agricu1ture.

Conclusions

La récupération des déchets n'est qu'une phase de la lutte contre la pollution. La question est de savoir de quelle manière *et* dans quelle mesure il faut modifier les procèdes de production et imposer des limites à l'exploitation des ressources naturelles, sans èòranler dans cet effort les ressources financières de l'industrie.

Les termes économiques de 1a récupération des matières premières sont encore généralement inconnus, tandis que la lutte contre le gaspillage devrait être soutenue par la législation.

La lutte centre le gaspil1age et l*e* recyclage des déchets et des résidus demandent *une* révision substantie1le de notre mentalité *et* de notre manière de vivre, de produire et de consumer. La science et la technique doivent être dirigées vers une remplaçable utilisation des ressources, pour satisfaire aux exigences d'un véritable progrès.

Un groupe d'économistes de Cardiff a affirmé que tous les déchets doivent désormais être considéré comme ressources. C'est un nouveau point de départ vers la possibilité d'un développement industriel sans pollution et sans déchets, qui mérite toute notre capacité d'imagination et de coopération, dans l'effort de contribuer à réaliser une société plus juste et libre.

Table 1.Disponibilité et durée des reserves les principaux minéraux

minéraux	Quantité des reserves connues	durée années à consomm. statique	taux % d'accroiss. de consomm.	durée années
aluminium	$1,17 \times 10^{9}$ t	100	3,4	31
chrome	$7,75 \times 10^{8}$ t	420	2,6	95
charbon	5×10^{12} t	2300	4,1	111
cobalt	$2,2 \times 10^{6}$ t	110	1,5	60
cuivre	308×10^{6} t	36	4,6	21
or	11×10^{6} kg	41	9	29
fer	1×10^{11} t	240	1,8	93
plomb	91×10^{6} t	26	2,6	21
manganèse	8×10^{8} t	97	2,9	46
mercure	$3,34 \times 10^{6}$ bonbonnes	13	2,6	13
molybdène	$4,9 \times 10^{6}$ t	79	4,5	34
gaz naturel	$32,3 \times 10^{12}$ mc	38	4,7	22
nickel	$66,5 \times 10^{6}$ t	150	3,4	53
pétrole	455×10^{9} bariles	31	3,9	20
groupe platine	$13,3 \times 10^{6}$ kg	130	3,8	47
argent	170×10^{6} kg	16	2,7	13
étain	$4,36 \times 10^{5}$ t	17	1,1	15
tungstène	$1,32 \times 10^{6}$ t	40	2,5	28
zinc	123×10^{6} t	23	2,9	18

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Massachusetts
Aileen Cavanagh

Commission I

THE COMPETITIVE ELEMENTS OF A DYNAMIC EQUILIBRIUM BETWEEN ADVANCING TECHNOLOGIES AND THE WORLD DEMAND FOR INDIVIDUAL FREEDOMS

(ABSTRACT)

Individuals commonly define freedom as the liberty to possess, use, and dispose of time, life energies, and material resources as one chooses. This definition is the one used in this paper.

Historically, technological advances from all fields seem to have been sought and implemented in order to expand the range of collective long term human choice about:

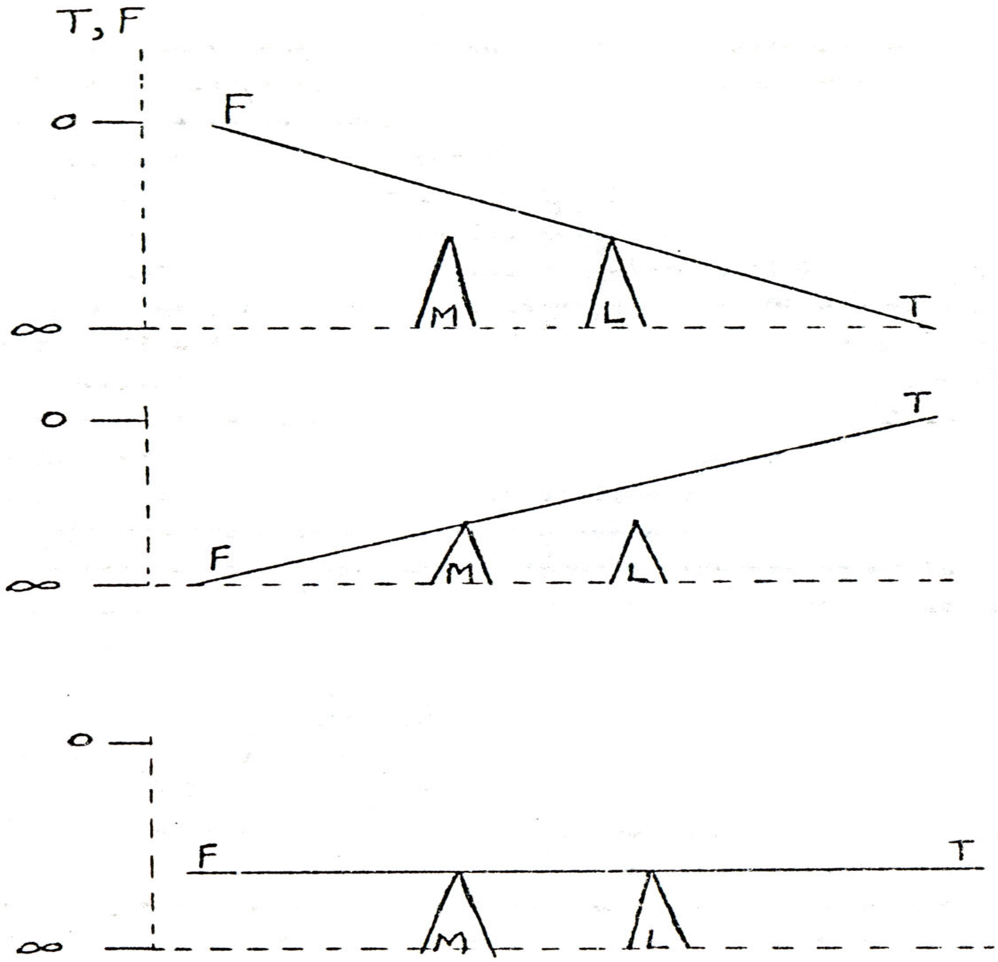
1.) What to do with our time, life energies, and material resources, and
2.) How, when, and where to accomplish what we choose to do.

Yet many technological advances which have successfully expanded collective choice seem to have lead over time to restrictions in the range of choice open to individuals. It appears that while each technological Innovation opens a new choice to collective view, the resultant institutional and collective decisions often remove one or more of the previous options from individual choice. Thus it appears that as the practical range of collective choice grows through worldwide technological advances in all fields, the practical or perceived range of individual choice narrows to those options which remain available within the society within which the individual lives. In this paradox we see competitive interaction among; the elements of individual and institutional demand as expressed, sought, and realized through Interdependent market, managerial, ethical, and political systems. Rather than achieving a dynamic equilibrium in which gains in technology are accompanied by compensating gains in freedom, we live now in a system in which technology frequently advances at the expense of freedom.

To achieve a system in which technology and freedom are to come to a peaceful dynamic equilibrium, and in which advances in technology are followed by advances in freedom, we need first to identify the extreme's between which technological innovations must fall if freedom as we now define it is to advance. This paper identifies these boundary conditions as:

1.) human NEED, expressed through market demand and political programming, and
2.) LIMITATIONS on human tolerance, expressed through market acceptance or rejection and political controls.

The paper decomposes innovation management systems into process components, including market and political elements, and it outlines over time the dynamics of interaction between the political management process and the technological discovery/invention or in applied research and development responding to identified needs. Both roots are discussed and analyzed in the paper.



F = FREEDOM

T = TECHNOLOGY

M = MORALITY

L = LAW

FREEDOM

- A SOCIAL CONCEPT
- THE EXERCISE OF VOLITION (FREE WILL)
- LIBERTY TO

POSSESS USE DISPOSE	TIME LIFE ENERGIES MASTERIAL RESOURCES	BY CHOICE

- CHOICE OF TASKS, AND OF

HOW WHEN WHERE	ACCOMPLISHED

- AN END WHICH IS SOUGHT
- NOT MORALLY NEUTRAL AS A STATE – OF – AFFAIRS
- IN A ONE PERSON WORLD: All rights and duties are to self and to environment, with no duties to others.
- IN A TWO PERSON WORLD: Rights and duties are exchanged, with a reciprocal right for each duty and vice versa.
- IN A MULTI – PERSON WORLD: Rights and duties are divided and shared, often with a high degree of specialization.

TECHNOLOGY

- AN ECONOMIC CONCEPI'

- PROCESS OF APPLYING KNOWLEDGE REPEATEDLY TO HEET IDEITIFIED OBJECTIVES

- COMBINES SCIENTIFIC KNOWLEDGE WITH ECONOMIC ACTIVITY

- A MENS TO AN END

- MORALLY NEUTRAL IN ITSELF, BUT THE DECISION TO APPLY OR USE A TECHHOLOGY CONTAINS VOLITION, ACTION, AND CONSEQUENCES WHICH ARE NOT MORALLY NEUTRAL

MORALITY

- PHILOSOPHERS SOMETIMES DEFINE MORALITY AS A RELATIVE SOCIAL CONCEPT AND SOMETIMES AS AN ABSOLUTE ONE.
  When relative, what is moral changes from one culture to another, and within a culture over time.
  When absolute, what is moral is invariant over time and place.

- DETERMINANT OF WHAT OUGHT TO BE DONE TO MEET AN OBJECTIVE THAT WHAT OUGHT TO BB DONE IS THAT WHICH IS "GOOD" OR "RIGHT"

- APPLIES TO BOTH MEANS AND ENDS

- NEEDS A BASIC PARADIGM
  Note that religious paradigms differ in locus of priority and authority, and on issue of freewill.

- GENERALLY HELD AS PRIOR TO THE LAW BY MORAL PHILOSOPHERS

- GENERALLY HELD AS SUBORDINATE TO COMMUNITY LAW BY LEGALISTS

- PREVAILING TRADITION IS CASUISTRY, IN WHICH MORAL CODES ARE SPECIFIED IN TERMS OF WHAT OUGHT NOT TO BE DONE RATHER THAN GIVEN IN TERMS OF WHAT OUGHT TO BE DONE

NOTE: There is clearly no present body of community law which is congruent with community moral standards. The closest cases are probably seen in the religious nation states in which the religious rules are adopted as community law. However, these rules are only applicable to internal affairs, and these nation states are finding they cannot live as dynamic members of the world community and rely solely on their religious tradition to guide them in international affairs.

LAW

- WRITTEN AND PROMULGATED RULES FOR INDIVIDUAL BEHAVIOR IN THE COMMUNITY TO WHICH THEY APPLY

- LIMITED IN JURISDICTION TO A POLITICAL BOUNDARY

- LAWFUL BEHAVIOR IS DEFINED RELATIVE TO THE LAW AND NOT TO COMMUNITY STANDARDS

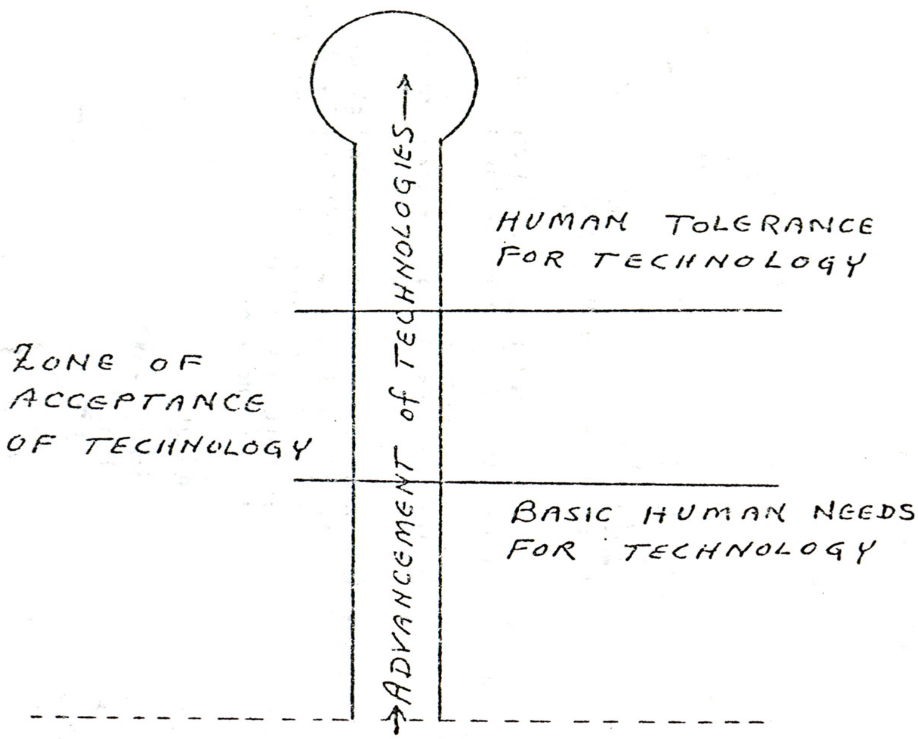
- THE RULES OF THE GAME

- SOMETIMES HELD AS PRIOR TO COMMUNITY MORALITY AS A TOOL OF COMMUNITY GOVERNANCE

- SOURCE OF LEGAL AUTHORITY CAN VARY. IN THE UNITED STATES A LEGISLATIVE BODY WRITES, DECLARES, AND PROMULGATES THE LAW WHILE AN EXECUTIVE BODY CARRIES IT OUT AND A JUDICIAL BODY ADJUDICATES DISPUTES AND RULES ON THE CONSTITUTIONALITY. IN THE UNITED STATES THE HIGHEST AUTHORITY IS THE CONSTITUTION. WHERE THE CONSTITUTION IS SILENT A JUDGE RELIES ON A CONSERVATIVE INTERPRETATION OF COMMUNITY MORAL STANDARDS, OFTEN CONSULTING WITH THEOLOGIANS AND MORAL PHILOSOPHERS"

- LAWS ARE CHANGED OVER TIHE, BUT LEGAL DISTINCTIONS ARE MADE RELATIVE TO THE LAW THAT APPLIES AT THE TIME OF THE EVENT THAT IS BEING ADJUDICATED

FIGURE 1



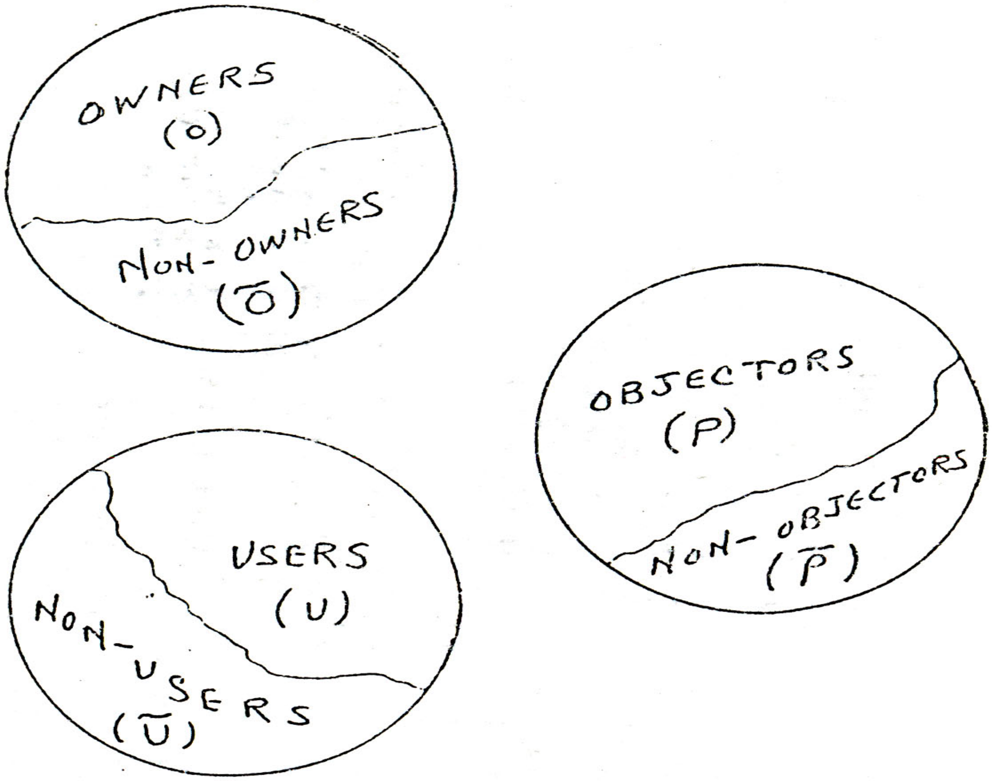
COMMENTS:

1. The level of "need" perhaps rises as technological capability to meet that need advances; this creates new market demands and new pressures on political institutions by their populations.

2. Will tolerance for control, a restraint on freedom, also rise as technologies advance, or will the zone of acceptance merely narrow?

3. It seems probable that unchecked technologies can be advanced much further than they ought to be advanced according to human morality, given the long term obligation to consider the consequences on the adaptability and survival of the human species,

FIGURE 2



Each human being may be classified in one of the following groups.

$U\ O\ P$

$\bar{U}\ O\ P$

$\bar{U}\ \bar{O}\ P$

$\bar{U}\ \bar{O}\ \bar{P}$

$\bar{U}\ O\ \bar{P}$

$U\ \bar{O}\ P$

$U\ \bar{O}\ \bar{P}$

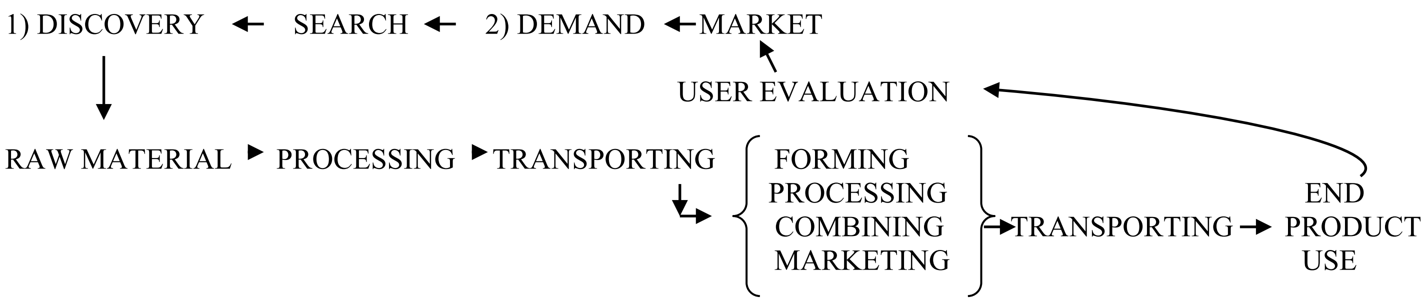
$U\ O\ \bar{P}$

HIGH ORDER HUMAN NEEDS		FIRST ORDER TECHNOLOGICAL DIRECTIVES
AIR - OXYGEN WATER DAYLIGHT FOOD - caloric fuel, Protein, Nutritional Elements	PHYSICAL NEEDS OF HEALTHY ORGANISM	CLEAN AIR CLEAN WATER AGRICULTURAL LAND FOOD (properly preserved) NUTRITIONAL SUPPORT "WORK" AND "PLAY" HEAT CLOTHING SHELTER WASTE REMOVAL AND PROCESSING – CONTROL OF BACTERIA AND OTHER HARMFUL,ORGANISMS RODENT AND INSECT CONTROL
ACTIVITY WARMTH SLEEP SANITATION ABSENCE OF BACTEIRA & TOXINS	CONTROLS TO PREVENT DISEASES	
SECURITY KNOWLEDGE HEALTH PROTECTION	SOCIAL NEEDS	CIVIL LAWS, CUSTOMS, MORAL CODES ---MUTUALLY AGREED UPON RULES OF BEHAVIOR EDUCATION - INFORMATION STORAGE AND RETRIEVAL, INFORMATION TRANSFER, INNOVATION HEALTH SERVICES - PREVENTIVE, TREATMENT AND CONTROL, EPIDEMILOGY
TRANSFER MECHANISM FOR ALLOCATION OF RESOURCES - MONEY TRANSFER METHOD FOR DISTRIBUTION OF RESOURCES -	ECONOMIC NEEDS	MARKET PLACES TRANSPORTATION CURRENCY
COMPANIONSHIP COMMUNICATION	PSYCHOLOGICAL NEEDS	SOCIAL ORGANIZATION LANGUAGES COMMUNICATION SYSTEMS

FIGURE 4

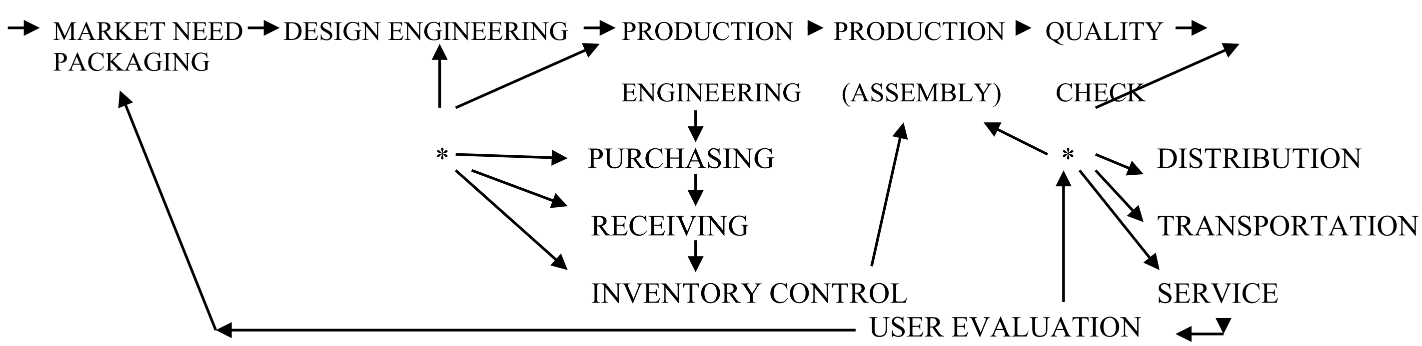
WAYS OF LOOKING AT THE OVERALL BUSINESS PROCESS

A. Value Adding stages:



1. Process (1) starts with DISCOVERY, then moves forward through marketing and demand creation to product markets, which may modify the product or confirm or alter the ongoing demand.
2. Process (2) starts, with a demand in the marketplace, which generates a search for a product to satisfy the demand, which leads in turn to discovery, then to motion into the product market along the path of Process (1).
3. Because there is a known market demand that stimulates Process (2), it proceeds with less uncertainty about the prospect of clearing the market than does Process (1). However, until costs are identified, the risk of market valuation under cost exists in both processes. Deep cuts in costs may be possible only through drastic changes in product quality and composition, which amounts to value subtraction rather than value addition in the search function.

B. Engineering Functions Executed in Bringing a Product to Market:



*= QUALITY ASSURANCE/CONTROL AMD PRODUCT TESTING

FIGURE 5

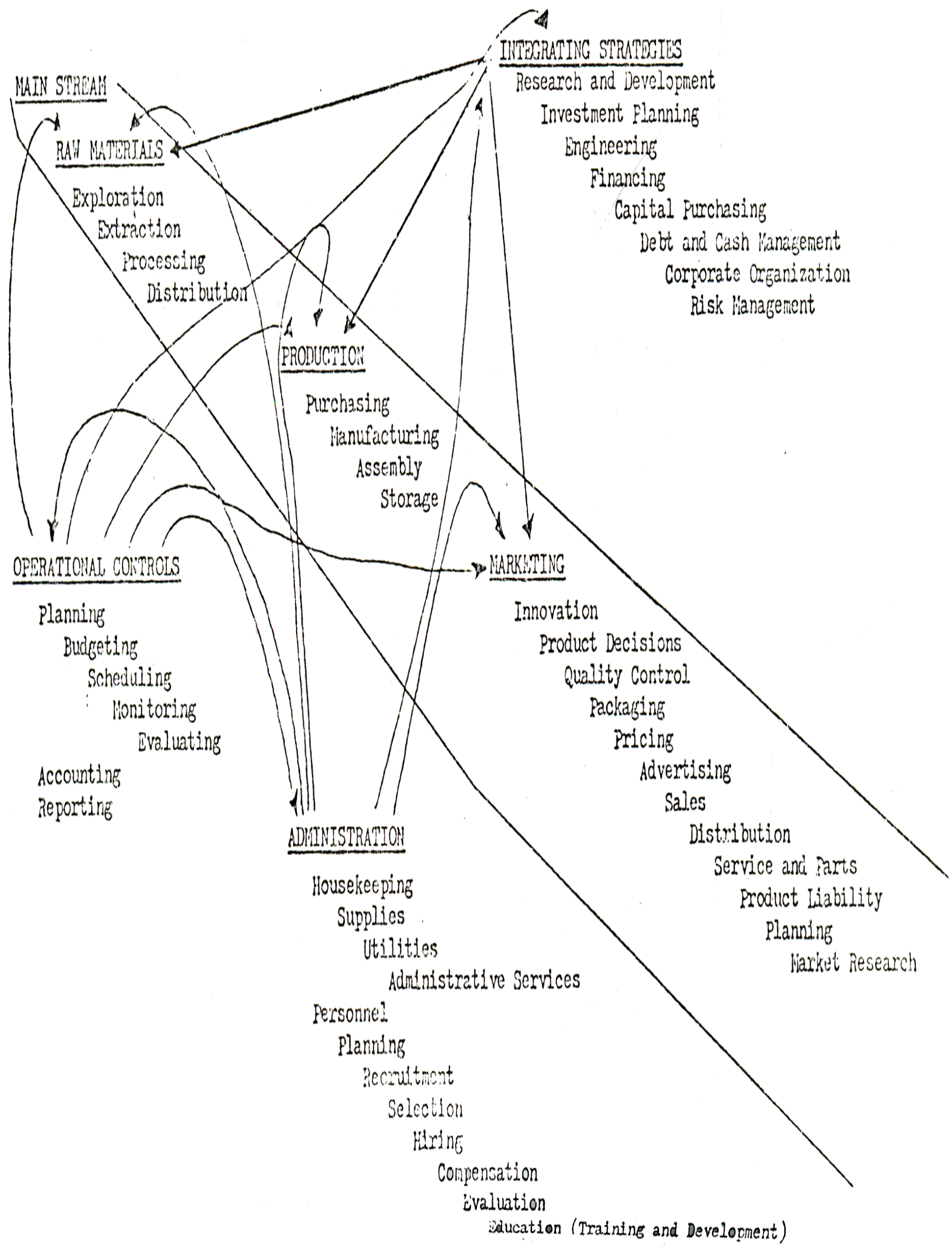
DECOMPOSITION OF PROCESS OF INSTALLING A TECHNOLOGY INTO USE

INPUT *	TRANSFORMING ACTIVITY	OUTPUT
A -> OBJECTIVE B -> MONEY C -> KNOWLEDGE -> TIME -> Equipment & MATERIALS	-> RESEARCH AND DEVELOPMENT ->	TECHNOLOGY -> C
TECHNOLOGY <- B -> MONEY -> MARKET DEMAND -> TIME	-> ASSESSMENT AND PLANNING ->	PRODUCT DESIGN AND DECISIONS ON INVESTMENTS IN CAPITAL PLANT AND IN MARKETING -> C
DECISIONS <- B -> MONEY C -> ENGINEERING -> TIME	-> PROCUREMENT AND DESIGN ->	INDUSTRIAL PURCHASES OF CAPITAL PLANT AND MATERIA[LS] -> C
PURCHASE ORDERS <- -> MATERIALS -> CAPITAL & MONEY -> LABOR C -> TECHNOLOGY -> TIME	-> CONSTRUCTION AND DESIGN ->	CONSTRUCTED PLANT AND OPERATIONS DESIGN -> C
CAPITAL PLANT <- C -> OPERATING TECHNOLOGY B -> MONEY -> PEOPLE (LABOR & KNOWLEDGE) -> TIME -> MATERIALS -> PRODUCT DESIGNS	-> OPERATIONS ->	OPERATING PLANT -> C
OPERATING PLANT <- -> DISTRIBUTION SYSTEM -> MARKETING SYSTEM -> CONSUMERS/BUYERS	-> PRODUCTION, AND MARKETING AND CONSUMER EVALUATION ->	PRODUCT WASTE JOBS CASH -> B etc. SYMPTOMS OF PROBLEMS -> (
D -> SYMPTOMS OF PROBLEMS <- A,C -> KNOWLEDGE -> EXPERIENCE -> TIME	-> ANALYSIS AND EVALUATION ->	PROBLEM DEFINITION -> A,C
DEFINED PROBLEMS <- A,C -> KNOWLEDGE -> EXPERIENCE -> TIME	-> CONTROL ->	PROBLEM RESOLUTION -> C GOVERNMENTAL REGULATION -

* Inputs and Transforming Activities are additive over all stages.

FIGURE 6

OVERVIEW OF OPERATIONAL SPECIALIZATIONS IN THE BUSINESS ENVIRONMENT



ABSTRACT

Kathleen F. Harer

Why Safety and Health are Important to Production

Prior to the Industrial Revolution, most production both in the United States and elsewhere in the world was of the "cottage-industry" type. Most work was agricultural in nature, with a few small business to support the farming family with those services and goods that could not be produced on the farm.

The Industrial Revolution radically changed society. One change was the employee exposure to occupational hazards that had never before been experienced in the number, variety, or severity that was introduced with the increased production capability of the times. With cheap labor and no accountability for injuries and illnesses by employers, accidents were simply written off as minor inconveniences. The passage of compulsory workmen's compensation laws led to employers being faced with financial responsibility for the safety and health of their employees.

Accidents cost companies in many ways, with compensation premiums being the most apparent direct and observable cost. But there are other costs involved--interruptions in production because of the accidents, lost services of injured or ill employees, time required to train new employees, property damage, etc. In today's world of high labor costs and resource Shortages, a company cannot simply ignore safety and health. They are an integral part of production. And the key *to* attaining acceptable injury and illness levels depends upon both management’s support of safety and health programs, and labor’s acceptance of their part in those programs.

Commission 1

Paper offered by **Veronica Milligan** - President, Women's Engineering Society and Member, Gwent Area Health Authority. Member National water council. Partner – Civle Advisory Industrial Development Services

Theme: Transfer or adaptation of technologies.

Paper. The problems and benefits for the health service derived from the transfer or adaptation of technologies.

Summary

1. Background and Introduction.

Industrial developments in the nineteenth century had a significant effect on the health of the people in Great Britain. Smoke and obnoxious gases polluted the atmosphere in large cities and towns. Scientists developed the technology to overcome the problem, but industrialists were reluctant to spend money on non-productive adaptations. Great Britain had the foresight to set up a powerful Alkali Inspectorate which has had a strong influence on improvements at industrial plants. Although the emphasis is on advising, such pressure is brought to bear that industrialists are anxious to comply with their requirements. The result is a for more satisfactory progress than has been achieved in other countries where the legislature is at present overwhelmed with unheard cases.

2. Present day situation related to previous technology.

Technological advances such as those encouraged by the Alkali Inspectorate, particularly since 1900, hove resulted in direct and indirect changes occurring in the demands on the health service. The advent of the internal combustion engine as applied to the motor car has increased the accident rate in the general population. Improved safety measures (and in particular Health and Safety legislation) in mines, quarries and general industry hove reduced serous industrial accidents. The character of admissions to hospital has changed. Great sociological advances, such as mains water connections have also had side effects for the health service, (affects of lead in drinking water).

Engineers need to consider the long term effects of their technology. What are the long term health consequences of such results of industrialization of waste dumping?

Con we as technologists consider improved usage of byproducts of production, (Consider the development of building materials from cool tips and cultivation of slag heaps) to minimise health risks.

There are also implications for our health service from the fall in birthrate and increase in life expectancy, both of which are at least partially as the result of improved technology.

3. The application of technological development within the health service.

Since the war, there has been a substantial impetus in the developments of major hospital units largely as the result of the transfer and adaptation of improved technology, both in the scientific and building field. There are benefits and problems associated with the modern trend. (Emphasis on high service content buildings with sophisticated operating theatres and central sterileunits.) Will energy shortages change this concept for the future?

4. **The latest developments** in transfer and adaptation of technologies to benefit the health service include such items as gas identification, special bed innovations, plastic surgery developments, bio engineering. A special technological transfer development for the future with regard to the treatment of cervical cancer is of special benefit to women.

NOTE: This paper should be followed by
Mrs. Maria Watkins' paper on Medical Electronics, as this subject has been purposely excluded
The two papers form a combined Women's Engineering Society contribution.

Mrs. Maria WATKIN'S **Commission 1**

Enhanced freedom for the disabled through high technology electronics

The spin-off of modern high-technology electronics has greatly increased the range and usefulness of numerous aids for the disabled Thus it has given these unfortunate people greater ability to cope with everyday necessities and hence has enhanced the quality of life for then. It is something we can justly be proud of.

This paper is a review of present day electronic aids for the disabled and also discusses some research in progress. Diagnostic and treatment aparatus as well as various protheses enable people with disabilities to be more independent or mobile, sometimes they lessen pain and help to overcome loneliness or boredom. Various learning aids and leisure activities are specially geared to the needs of the def, blind, spastic and mentally handicapped.

An attempt is made to evaluate techniques and equipment in terms of the enhanced freedom which they give to the disabled. Colour slides are available.

In particular, the paper describes usage and limitations of the newest heart-pace maker, pulsers for disseminate sclerosis sufferers. Various bio-feedback apparatus for the control of migrane, hyperactivity and hypertension. Portable heart and pulse rate meters for monitoring active subjects are discussed as well as equipment used for measuring small muscle movements in broken or paralysed limbs. Treatment of dislexis by monitoring eye movement through improved photography and oculugrams in one of the recent approaches to the prevention of disablement which is described in detail.

COMMISSION 1

ANALYSIS AND TESTING OF THAI SHALE OIL

By

Phulporn Anna Sangbangpla

1. INTRODUCTION

Oil shale is a type of marlstone; it consists of large molecules of organic compounds called lerogen, which is insoluble in solvents undernormal conditions. It is flammable and gives smoke and bitumen odor when burning. Oil shale does not contain free oil like petroleum. It must be heated in one way or another to about 500^0C – this operation may be called extraction. Kerosen will crack and become crude shale oil, and when this oil is distilled, gas, gasoline kerozine dissel oil, lubrication oil paraffin wax and coke will result. Oil shale has been known for many years, its oil is used to light lanterns before petroleum was discovered. Distillation and petrochemical products from oil shale has been well established in the

United States, United Kingdom and Europe in the middle of 18^{th} century. However, the discovery of petroleum wade the shale oil industries suffer in the economic way.

Owing to the energy crisis in $1^0$04, countries throughout the world started searching for other forms of energy source, and shale oil is the energy which can replace petroleum immediately. In Thailand, there is a large source of shale red in Tall provide. The amount of shale oil yield is in the range of 2.5 to 25 weight percent. The Department of National Resources estimated that 2790 mton of shale roe will give up to 2500 mbbl

In Thailand, 85% of the energy consumed comes from petroleum and owing to the energy crisis, the Faculty of Engineering, Chulalongkorn University has set up a research and development group for the analysis of Thai shale road. The research project is divided into three programmes as follow:

1.1 Direct use of oil shale
1.2 Utilization of shale oil
1.3 Utilization of spent shale

This paper is a report of the research on the Utilization of shale oil.

2. INSTRUMENT AND EXPERMENTAL PROCEDURE

Before undertaking this research, oil shale from different sources in the Mae Sod District were tested and analysed to determine the highest yield suitable for this research. This was done by determining the calorific value and oil yield present, including a test to compare the calorific values and quautity of shale oil yielded by different colored oil shale.

Oil shale that gives yield more than 10% was extracted in the apparatus shown in fig 1. The extractor is made of iron and is connected to condensing unit used water as a circulating liquid for heat removed. The data obtained from this batch process, 100 gm/batch, were used to design a continuous fed extractor (as seen in fig. 2) having extracting capacity of 300 kg shale rock/day. The horizontal retort is cylindrical in shape and the crushed shale rock is screw fed at one end, the heat is supplied at the middle of the retort where there is a vapor chamber. At the other end of the retort there is a receiving tank to receive the spent shale, which is then weighed.

This type of extraction is known as "semi -cocking", that is the production of carbon at low temperature, in this way crude oil yield is high. Mass analysis showed:

Crude oil	30-35%
Oil	10-15%
Water	8-10%
Residue	40-50%
Escaped gases	the rest

Crude shale oil obtained from the extracter is similar to crude petroleum oil, so it can be distilled in the same manner. However, in order to set up large scale shale oil refinery plant, production capacity must exceed 1,000 barrels/day and other information must be know, especially its physical and chemical properties. For the purpose of this study a batch type bench scale distillation unit was designed (as shown in Fig- 3) and set up to achieve primary separation known as "dressing" Crude shale oil distilled per batch is 1500 cc. Suitable separating conditions were determined by comparing the distillation temperature of this study with fractions obtained crude petroleum oil. By observing and comparing separation properties of the oil it was deduced that shale oil separates into 4 fractions (gee table 1) as follows:

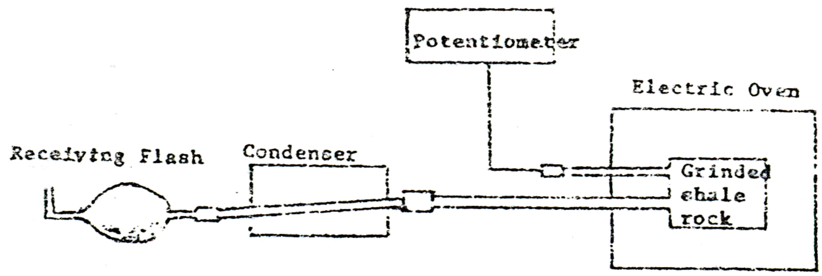


Fig. 1 Closed Retort

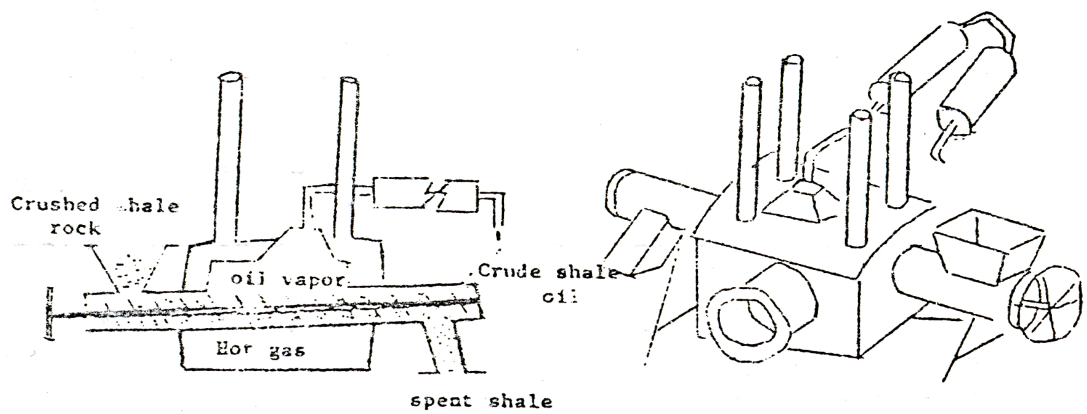


Fig.2 Screw Fed Extractor

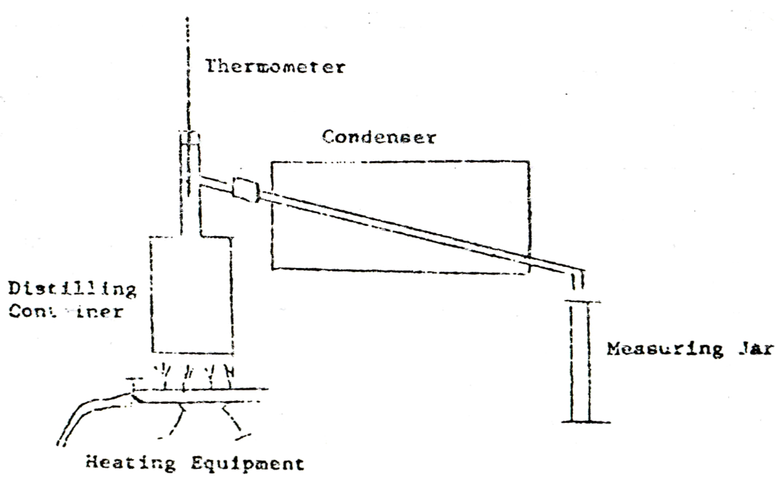


Fig 3 Distillation Unit

2.1 First fraction has a temperature of evaporation similar to that of gasoline, i.e in the range of 62-250^0 C the amount obtained is small.

2.2 Second fraction can be compared to automotive oil having temperature of evaporation in the range of 150-225^0 C the amount obtained is small.

2.3 Third fraction can be compared to diesel oil having temperature of evaporation in the range of 225-305^0 C the amount obtained is approximately 50%

2.4 Fourth fraction is the residue having temperature of evaporation in the range of 305-375^0 C This residue can be separated further to lubrication oil and paraffin wax which is present in large quantity as this residue solidifies at room temperature.

For this type of distillation where heat comes from an external source, electricity, gas or other fuel may be used.

After separating the crude shale oil into 4 fractions, physical properties of fraction 1.2 and 3 were determined according to the standards, and then compared with similar fractions obtained on distillating crude petroleum oil. The result are reported in table 3. The fractions were then tested in engines, using fraction 1 in gasoline engine and fraction 2 and 3 in dicsel engine. Performance curves are shown in fig. 4 and 5

3. PLSULTS AND DISCUSSION

Primary tests of shale rock samples taken from different sources in the Mac Sod District showing that samples taken from Huay kalok give the highest percentage of shale oil (see table 2). However, in the study shale rock from Huay Pha-lard was chosen because of accessibility, transportation and available as the shale rook is at the surface In addition, its calorific value and quantity of shale oil produced is relatively high. Therefore, the data and other details reported in this study is based on surface oil shale from other sources or oil shale which is buried under ground are total used further tests have to be performed.

Table 1 Shale Oil Fraction In formations

	Fraction				Remark
	1	2	3	4	
Temp range C	62-150	150-225	225-305	305-375	by average
%	10	15	50	25	
Heating Value	9812	10156	10384	10203	

Table 2 Yield of Different Shale Rock Samples

Source	Kind	Yield %	Oil C.C	Water C.C	Spent Shale %	Heating Value Kcal/K.g.		Remark
Huay Ka-lok	Black-brown	30.75	17.76	8.70	69.25	2456.85	10021.15	Sample 100 gm
	Light-brown	27.90	12.30	8.83	72.10	2428.78	9046.06	
Average		29.33	15.00	8.77	70.70	2442.82	9533.58	
Mae Ku-Laung	black	27.30	16.80	4.67	72.70	1090.11	8934.59	
	Red-brown	23.70	12.30	6.17	76.30	2199.95	7113.26	
Average		25.50	14.55	5.42	74.50	1645.03	8023.93	
Huay Pha-Lard	White	23.80	3.50	5.40	76.20	350.25	9426.10	
	Grey	27.40	6.50	5.33	72.60	1148.21	9052.93	
	Black	33.33	15.30	8.33	66.67	2739.23	8644.97	
Average		28.18	8.43	6.35	71.32	1412.58	9041.33	

Table 3 Comparison of Physical with Shale Oil Fraction and Petroleum Products Properties

Descriptions	Methods	Comparison					
		Regular Casoline	Fraction 1	Automotive Gas Oil	Fraction 2	Diesel Oil	Fraction 3
So. Gr. 15 C	AST D 1298	0.70	0.7998	0.840	0.8475	.0.865	0.8648
Distillation	D 8						
I.B.P. C		40	94	170	160	170	180
10% recovery at C		55	124	200	188	220	218
20%		60	131	225	201	240	236
30%		65	139	245	211	260	248
40%		70	147	265	224	280	259
50%		75	154	280	236	200	269
60%		85	160	295	248	-	281
70%		95	170	310	262	-	294
80%		110	179	330	279	-	310
90%		135	196	360	307	-	334
I.B.P; C		170	221	380	331	-	348
Induction Period min.	D 525	More than 480	140	-	-	-	-
Acid o. mg kog/grm.	I.P.270	-	1.48	0.04	13.05	0.04	5.47
Sulphur Contents %wt.	D 1551	0.001	0.07	1.0	0.63	1.5	0.6
Flas Pt. F	I.P. 170	Room Temp.	Rm. Temp.	160	110	165	108
Viscosity Kin. Cs	D 445	-	0.8409	4.0	-	-	-
RV I 100 F sec.	I.P. 70	-	-	-	31	40	35
F.1 O.M.	D 2699	-	62	-	-	-	-
“ + 3.17 gmPh/AG	D 2699	83.0	76	-	-	-	-
Cetame Index		-	-	50	41	52	44
Four point F			-		10		35
Eation Value cal/gm		11,200	19812.05	10.835	10156.80		

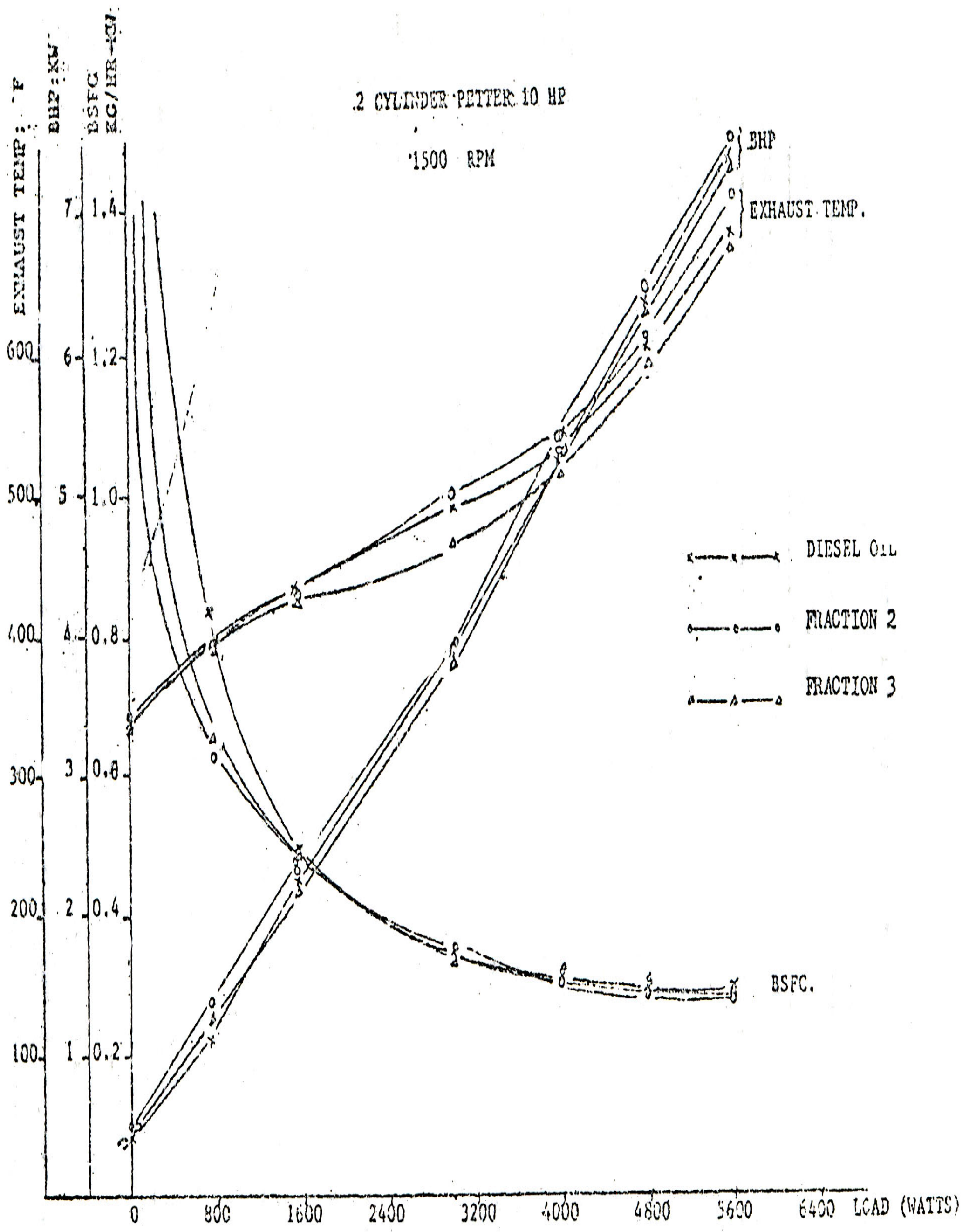
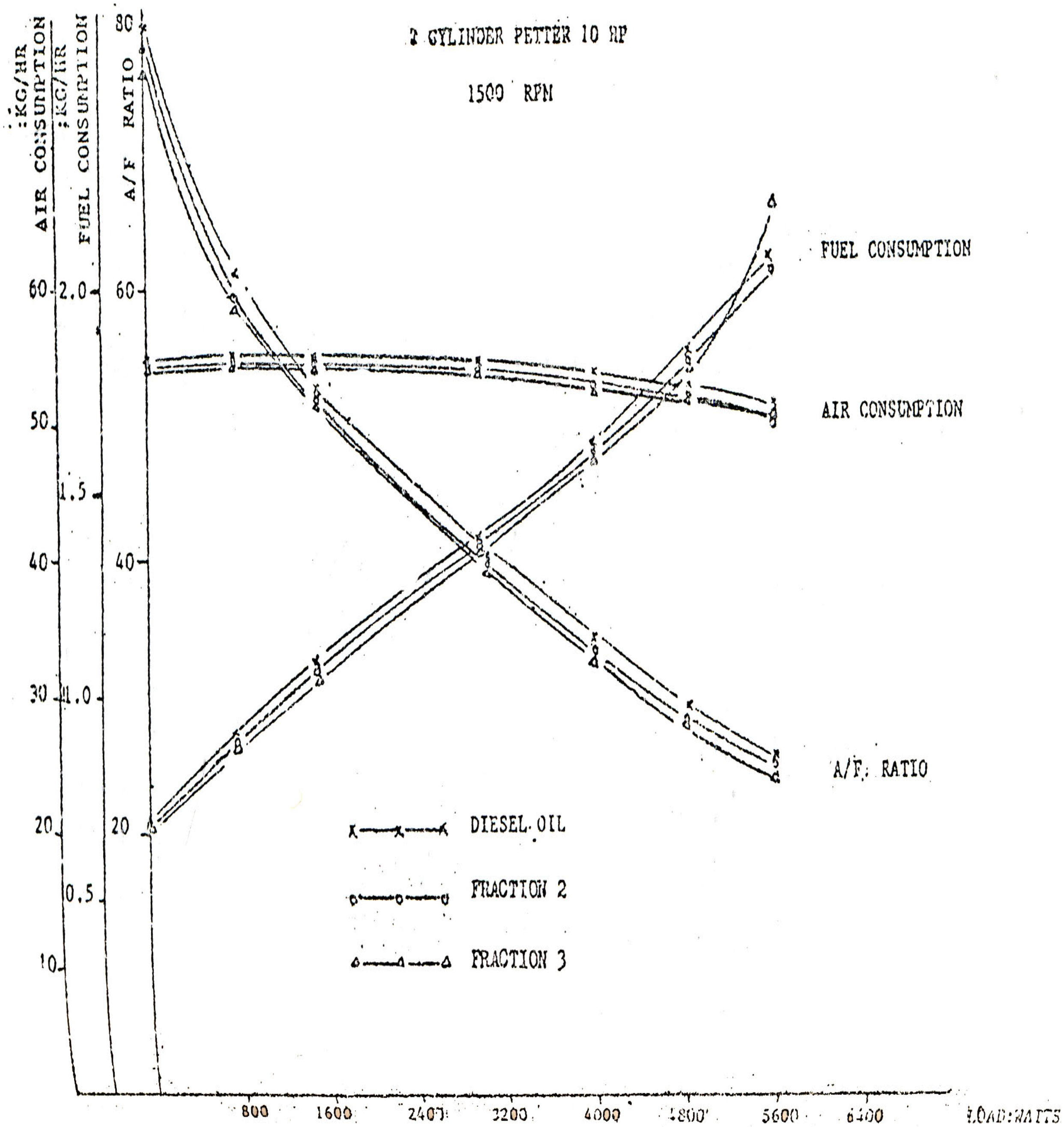


Fig. 4 Comparison of CI engine performance using shale oil and petroleum products



2 CYLINDER PETTER 10 HP
1500 RPM
AIR CONSUMPTION :KG/HR
FUEL CONSUMPTION ;KG/HR
A/F RATIO
80
60
2.0
60
50
1.5
40
40
30
1.0
20
20
0.5
10
FUEL CONSUMPTION
AIR CONSUMPTION
A/F RATIO
DIESEL OIL
FRACTION 2
FRACTION 3
800
1600
2400
3200
4000
4800
5600
6400
LOAD:WATTS

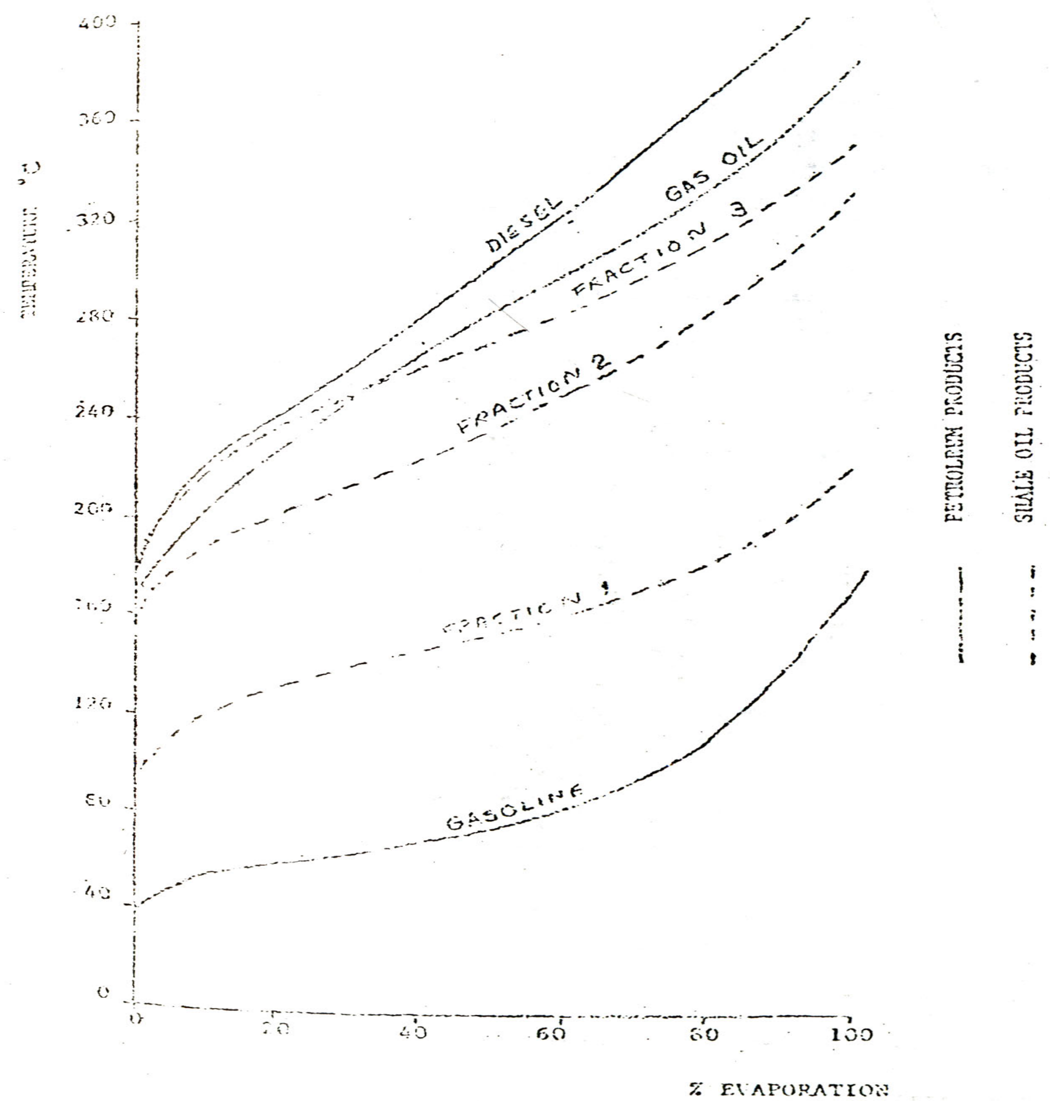


Fig. 6 Volatility curve

+ Table 4 Yield Shale Oil Fraction Analysis

	** Ultimate Analysis %				*** Alkane Fraction %		
	C	H	N	C/H	Alkane	Aromatic	Residue
Crude Shale Oil	78.73	13.78	1.32	5.71	48.1	10.5	40.4
Fraction 1	*33.34	6.01	0.18	5.55	46.5	31.7	21.8
Fraction 2	74.84	12.02	0.51	5.84	65.0	5.3	29.7
Fraction 3	83.64	14.27	0.64	5.86	60.5	11.7	27.8
Residue	58.10	9.33	0.86	6.21	36.7	11.5	51.8

* Very volatile, sampling problem – figure much too low
** By thin layer chromatography
*** By gas liquid chromatography and infraved

+ Table 5 Shall Rock Analysis

	Total Carbon	Organic Carbon	Hydrogen	Nitrogen
1	1.32	0.565	0.60	0.00
2	0.22	0.215	0.24	0.47
3	2.66	0.408	0.45	0.09
4	21.38	19.34	3.57	0.72
5	2.70	0.38	0.54	0.50

+ The analysis in Table 4 and 5 were done by Dr. Robert Kinghorn, Head of the Petroleum Technology Department, Imperial College, U.K.

In our analysis the different fraction obtained thin layer chromatography was used to different the percentage recovered, gas chromatography and infrared spectopbotomer were used to determine the percentage of alkenes present in each fraction. By examining table 4 it is seen that there is a high percentage of alkenes of which mostly are branched chain compounds.

Fraction 2 has a narrow spectrum of cyclic compounds while fraction 3 contains mostly straight chain compounds, which show that it is a mixture of gasoline, kerosene, gas oil and petrochemicals.

Analysis of physical properties of fraction 1 indicated that the properties are not quite the same as these of gasoline especially its volatility (see fig. 6) and octane number (see table.3), therefore it is not suitable for use in a gasoline engine. However testing in a gasoline engine was performed and banking resulted to such an extent that the test had to be stopped

Physical properties of fraction 2 and 3 are similar to that of gas oil and diesel oil (sec table 3), and on testing in a diesel engine, the performance were very satisfactory.

In this study further analysis of fraction 4 has not yet been performed, however it is strongly believed that it contains a large quantity of paraffinic compounds. If these compounds were to be separated they can be converted to wax, lubricating oil and the residue used as bunker oil.

During distillation, it was found that the amount of the different fractions were uncertain, especially the first fraction which is rather height in weight. Apart from that, some other properties had been changed, e.g. the color of the oil fractions, and the more pungent smell of the shale oil. This might be caused by the oxidation action, so further suggeation would be to develop a better distillating process. Some recommending methods are: hydrogenation, polymerization, isemsrization, reforming, addition of antiaxidante and inhititors etc. which are the processor use in petroleum refinery plant today. It is believed that by doing this the amount of the first fraction will be larger and also some properties will be improved, in addition, the pungent small will be reduced. Furthermore, it may also reduce the gum which normally; adheres to the instruments used during the distillating process.

4. CONCLUSION

The result of his study were very satisfactory and the data obtained showed that oil shale from Nae Sod District, Take province could be used as a type of fuel to replace energy from petroleum. If the excavation for the raw material and analysis are performed thoroughly, poor quality oil shale can be used in program 1 i.e. direct use of oil shale and better quality oil shale can be used in program 2 i.e. utilization of shale oil. There should be an attempt to design and construct a pilot plant so that the data obtained would be valuable for scale up. The production cost must be estimated in order to design an economic refinery plant.

The research carried out at the Faculty of Engineering, Chulalongkorn University is only a fundamental study. To appreciate the full extent of the usefulness of the oil shale, co-operation must come from every sector. Apart from the engineers and scientists, the industries and the government should have a policy to sponsor this project.

ACKNOWLEDGEMENTS

The successful completion of this research was made possible by the splendid co-operation of many individuals. To all those who in any names aided in the work I wish to express my sincere thanks. The research fund is sponsored by the Faculty of Engineering, Chulalongkorn University.

I am especially grateful to Professor Suwan Sangpetch who initiated this program. I am indebted to Mr. Semjet Wattanasin of Sirivivat Company, to Professor N.P.W. More and to Dr. Robert kinghrom of Imperial College, U.K. for their kind co-operation. Special acknowledgement is made to the lecturers and personnels of the Department of Mechanical Engineering who help in the designing and the construction of various equipments, and like wise to the engineering students who help in digging and transporting the oil shale samples. Finally, I would like to express my sincere thanks to Dr. Sasithorm Boon-Long for her contribution to the discussion concerning the relevant chemical topics and also mdae the written part of the report possible.

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Commission 1

Decentralisation of Power Production by Utiliation of Alternative Energy Sources – a key to the Energy Self – Sufficiency of Developing Countries

K.P.SULEEBKA, B.E., M.Sc., Ph.D. (Engg.)

SUMMARY

In all the methods of present day centralised power generation, chemical or nuclear energy is converted into electricity and transmitted and distributed over to the place of energy consumption. The fuels are burt……. at a rate much greater than the rate at which they are being renovated by the natural forces. Becides, most of the processes adopted in power stations have an energy convertion efficiency of less than 30 % and further wastage of energy takes place in transmission and distribution of electrical power. A good amount of other resourses also are wasted in some types of power production, e.g. arable land could be lost to provide for a reservoire for hydro-electric power stations. Some other types of power stations. have a potential hazard, e.g. nuclear power stations. It is therefore necessary to look at power production from the point of view of 1. long term availability, 2. efficiency of energy conversion and 3. potential hazard in addition to simple economics of the present day prices and availability.

The balance of power production & consumption is tilted towards the western industrialized soceities of the world. The developing countries where the world's 2/3 population lives, would like to achieve the same level of technological advancement as the western societies. But to copy the energy production & consumption pattern of the industrialized west would be to invite bankruptcy of the world energy resources. To avoid this, the developing countries have to 100k to a different philosophy of power production & consumption, t-he one which shifts away from converting fuels into electricity in a centralised power station but relies upon the conversion of natural energy like solar and wind into a useful form of energy at the place of consumption.

A particular example of a thermoelectric module to obtain electricity for lighting, radio and television is discussed with some economic implications.

Eliza 1. Wojtaszek <u>Commission 1</u>

"PROTECTION OF AIRCRAFT AGAINST LIGHTNING AN EXAMPLE OF USEFUL APPLICATION OF EMP TECHNOLOGY"

ABSTRACT

SUBMITTED TO THE V IWES CONFERENCE OF HOMEN ENGINEERS AND SCIENTISTS

ROUEN, FRANCE, SEPTEMBER 4-8, 1970

Every technological and scientific advancement carries the potential for misuse. A look at the history of technology and science reveals the existence of the dilemma: How should an individual engineer/scientist ensure that the technologies and discoveries are being used to the benefit of humankind? We are all familiar with numerous examples of the scientists/engineers face-d with the delemma: Nobel and his discovery of dynamite, Oppenheimer and the atom bomb.

While the public should be aware of the possible misuses of the technologies and discoveries, they should be equally aware of the benefits this technology carries. It is the responsibility of every engineer and scientist to present to the public the full scope of consequences and benefits the technology which he/she is developing.

For the past several years, I've been involved in the analysis of the electromagnetic pulse (EMP) coupling into communication facilities. The source for this high energy is a nuclear blast. The technologies and methods developed on these projects have recently found a very useful and new application in protecting aircraft from lightning.

The introduction of advanced composite materials in the construction of aircraft requires analysis of electrical effects on the aircraft to ensure passenger safety.

EMP technology, which was originally used to analyze the effects of a nuclear blast, can now be used to protect airline passengers from lightning danger.

Commission 2 (C2)

DU TRANSFERT DE TECHNOLOGIE A LA COOPÈRATION INDUSTRIELLE

Responsables: Monique BRYLINSKI et Geneviéve CHARLET

pour qu'une coopération réelle puisse s'instaurer, il est indispensable que les pays dotes d'une industrie à technologie modeste soient aptes à maîtriser la technologie de pointe. importée des pays fortement industrialisés. Le choix des secteurs à développer doit tenir compte du pays «receveur», des expériences déjà réalisées dans le monde, des coûts énergétiques et financiers.

C2 – 1 Comment répondre à l 'attente du pays receveur.

C2 - 2 La technologie au service de l'eau, en particulier de l'eau potable, élément primordial d'une alimentation correcte.

C2 - 3 La technologie au service de la conservation des denrées alimentaires. indispensable pour assurer un approvisionnement régulier, notamment en protéines animales et végétales: techniques de conservation, lutte contre les prédateurs, etc...

C2 -4 La technologie au service des conditions de vie. Comment aliéger les travaux quotidiens, protéger la santé, améliorer le cadre de vie: habitat, équipements domestiques, artisanaux, etc...

C2 -5 Assimilation de connaissances et conception de technologies originales. Expériences de création d'entreprises et de structures d'ingéniérie.

Commission 2 (C2)

FROM THE TRANSFER OF TECHNOLOGY TO INDUSTRIAL COOPERATION

Conveners: Monique BRYLINSKI and Geneviéve CHARLET

For the establishment of realistic cooperation, it is essential that countries having only industries based on simple technology should be capable of mastering the advanced technology imported from the highly industrialised countries. The choice of areas to be developed must take into account the receiving country, previous world experiences and the costs of energy and finances.

C2-1 How to meet the expectations of the receiving country.

C2-2 Technology in the service of water, in particular of drinking water, fundamental component of a correct diet.

C2-3 Technology in the service of the preservation of foodstuffs, essential for ensuring regular supplies of food, especially animal and vegetable proteins. Preservation techniques, fight against predators, etc...

C2-4 Technology in the service of living-conditions.
How to ease the daily tasks, to protect health, to improve the quality of life: housing, domestic equipment, handicrafts, etc...

C2-5 Assimilation of knowledge and invention of original technologies.
Experiences in the creation of projects and of engineering systems.

COMMISSION 2 – C 2

DU TRANSFERT DE TECHNOLOGIE A LA COOPERATION INDUSTRIELLE

Responsables : Monique BRYLINSKI et Geneviève CHARLET

PROGRAMME DE TRAVAIL

Pour qu'une coopération réelle puisse s'instaurer, il est indispensable que les pays dotés d'une industrie à technologie modeste soient aptes à maátriser la technologie de pointe importée des pays fortement industrialisés. Le choix des secteurs à développer doit tenir compte du pays "receveur", des expériences déjà réalisées dans le monde, des coûts énergétiques et financiers.

C2-1 Comment répondre à l'attente du pays receveur.

C2-2 La technologie au service de 1'eau, en particulier de l'eau potable, élément primordial d'une alimentation correcte.

C2-3 La technologie au service de la conservation des denrées alimentaires, indispensable pour assurer un approvisionnement régulier, notamment en protéines animales et végétales : techniques de conservation, lutte contre les prédateurs, etc...

C2-4 La technologie au service des conditions de vie. Comment alléger les travaux quotidiens, protéger la santé, améliorer le cadre de vie: habitat, équipements domestiques, artisanaux, etc...

C2-5 Assimilation de connaissances et conception de technologies originales. Expériences de creation d' entreprises et de structures d' ingéniérie.

SYNTHESE DES TRAVAUX

La présence dans cette Commission d'ingénieurs de pays développés, ayant l'expérience de transferts, et de représentantes éclairées de pays receveurs, a permis un dialogue trés ouvert et une remarquable continuité dans la discussion.

L'accent a été mis sur plusieurs conditions qu'il est indispensable de satisfaire si l 'on veut réussir une opération de transfert de technologie.

. Il faut prendre le temps de préparer patiemment l'opération par une connaissance mutuelle des parties intéressées - le donneur et le receveur -, connaissance approfondic portant sur la technologie certes, et l' environnement, mais aussi sur le vocabulaire utilisé par l' un et par l' autre "se comprendre", sur les habitudes sociales, diverses selon les régions, sur le personnel qu'il sera possible de recruter et de former (importance de l'éducation).

. Il faut "partir du bon pied", en établissant d’emblée des relations de partenaires, qui excluent les rapports de force. "se préoccuper non seulement des choses mais des hommes".

. Il faut définir de façon rigoureuse et précise les conditions du contrat, la responsabilité des parties pendant l'opération et aussi longtemps que le fonctionnement n'est pas parfaitement assuré.

Les congressistes des pays en voie de développement ent insisté sur la nécessité d'agir avec prudence et réalisme en s'efforçant d'envisager toutes les conséquences des transferts envisagés. Mais la lucidité oblige à reconnaitre qu'il faut un certain temps de fonctionnement pour apprécier réellement ces dernières et que les conséquences négatives des techniques avancées (pollution, emprise des villes et routes sur les terrains cultivables) sont largement connues.

Un danger a été longtemps ignoré ou sous-estimé : celui de provoquer un changement brutal des modes de vie par l'utilisation soudaine des technologies avancées. Or, les coutumes, les habitudes alimentaires, font partie de la culture d'un pays et de son identité, "les aliments interdits". Oter brusquement à la femme son travail traditionnel engendre le besoin d'une autre activité, peut provoquer l'exode rural, engendrer le chômage. Modifier les régimes alimentaires et les augmenter quantitativement, supprime la malnutrition de carence, mais peut provoquer des déséquilibres alimentaire.

Pour limiter les risques d'erreur, il faudrait que les pays en voie de développement puissent déterminer les technologies qui leur sont nécessaires et, dans un second temps, créer cux-mĕmes des technologies adaptées à leurs besoins et à leurs possibilités. Cette situation se rencontre dés maintenant ; mais trop souvent encore, le receveur n'est pas en mesure d'exercer un choix réel, ni de mettre au point ses propres inventions car il manque de structures, de techniciens, de capitaux.

A des technologies lourdes, chéres, difficiles à entretenir, il y a souvent lieu de préférer des technologies simples, qui parfois existent dans d'autres pays depuis des millénaires (éoliennes) ou que l'on vient de mettre au point dans d'autres pays (irrigation par goutte à goutte) Il faut procéder progressivement en utilisant autant que possible ce qui existe sur place: étude de matériaux locaux, production locale d'électricité (vent, eau, gaz de fumier)...

Dans les pays en voie de développement, une des priorités est de libérer l'individu de travaux pénibles, qui prennent beaucoup de temps. Ces travaux sont principalement accomplis par les femmes, à la maison et dans les champs. C'est par elles que passe le progrés dans les cultures, la récolte et la conservation des produits agricoles, l'amélioration des modes de cuisson (four solaire qui évite la corvée de bois et par conséquent le déboisement) les progrès dans l'hygiène (filtre à eau par groupe d'immeubles) afin de satisfaire les besoins vitaux locaux. Il faut satisfaire la demande intérieure de produits de consommation,durables ou non. Les technologies appropriées qui satisfont cette demande, en tenant compte des conditions du pays ou elle est exprimée, ne doivent pas étre considérées comme des demi-mesures temporaires. Elles sont la solution pour de nombreuses années.

Les solutions trouvées doivent ëtre transmises. La radio, les communautés villageoises lorsqu'elles existent, jouent un rôle important.

Commission 2

LISTE DES COMMUNICATIONS

Marie-Thérèse BASSE - Sénégal

Comment répondre à l' attente du pays receveur.
La technologie au service de la conservation des denrées alimentaires.

Amélia A. HLEDE - U.S.A.
The dairy industry adapts to modern technology.

Marian OWEN - U.S.A.
Professional Ethics, as applied to Foreign Engineers working in developping countries.

Lydia I. PICKUP - U.S.A.
Configuration management during technology transfer.

Mahin RAHMANI - Iran
Choix et adaptation des technologies industrielles appropriées dans les pays en voie de développement.

Monique ROLIAND - France
Approche pour une recherche en technologie appropriée du manioc au Congo.

Clara P. STEINBERG – Brésil
et Riva BAUZER
Recreation for all without leaving home.

Yvette E. STEVENS - Sierra Leone
Appropriate technology in developping countries.

Dabisi O. UGBEBOR - Nigéria
How to meet the expectations of the receiving country.

SENEGAL
Docteur Marie-Thérèse BASSE
Institut de Technologie Alimentaire

Commission 2 C 2_1

COMMENT REPONDRE A L'ATTENTE DU PAYS RECEVEUR

La coopération industrielle est devenue une nécessité impérieuse si l'on veut combler les inégalités entre pays riches industrialisés et pays pauvres en développement. La conférence de l'ONUDI à LIMA en 1975 a essayé de définir la charte pour un nouvel ordre economique international où les échanges devront se faire entre partenaires égaux. Entre autre, la conférence a recommandé un redéploiement industriel vers les pays du Tiers Monde.

Nais précisément que désire en l'occurrence le Tiers Monde en Général ? L'on ne retiendra que les besoins communs aux pays en développement laissant sciemment les spécificités propres à chacun.

Les besoins essentiels immédiats sont :

- l 'exploitation rationnelle de ses ressources naturelles
- l 'autosuffisance alimentaire
- le bien-être social des populations surtout rurales.

Deux sortes d'actions sont à mener pour leur satisfaction: l 'une appartient au pays lui-même, elle est donc nationale, l 'autre relève de la coopération bilatérale ou multilatérale selon l 'ampleur du problème.

ACTIONS NATIONALES

C'est avant tout l 'identification de la situation: la connaissance des atouts dont dispose le pays, ses ressources s'il en a, son potentiel économique:

sol - sous-sol
énergie, ressouroes en eau etc.......

Ses moyens financiers: les marchés, la trésorcrie, la capacité d 'endettement

Ses moyens humains: la population, la main-d'oeuvre les cadres

Ses moyens materiels: les infrastructures sociales (hôpitaux, écoles) ou économiques (routes - transport etc….)

Une fois cet inventaire fait, le dialogue devrait s'instaurer avec les partenaires qui disposent chez eux de ce dont manque l 'autre et qui pourraient trouver un intérêt dans un commerce avec ce dernier.

ACTIONS DE COOPERATION

Les accords à passer entre assisté et assistant devraient pour être garantis de succès être basés sur le respect mutuel de la souveraineté des Etats, sur la sauvegarde des intérêts des parties, sur une volonté affirmèe d 'entraide excluant l 'exploitation de l 'ure par l 'autre ou sa dépendance totale.

Ce préalable satisfait, comment répondre à l 'attente du Tiers Monde? Il s'agit pour un pays dit développé: d 'être à son écoute, d 'évaluer avec lui les besoins qu 'il exprime et s ‘assurer que l 'on dispose réellement des moyens de les solutionner, -de discuter avec franchise des modalités de l 'assistance afin que chacun sache à quoi il s'engage vis-à-vis de l 'autre.

Le transfert de technologie peut-être une arme redoutable en ce sens qu'il peut créer une subordination telle qu 'il tue toute initiative locale? La technique seule ne représente pas un danger, l 'intellectuel peut l 'assimiler. C’ est le contexte dans lequel elle baigne qui est à "épurer".

Cette technique voit le jour dans un pays étranger, dont la culture est différente, dont les besoins pour humains qu 'ils puissent être ne sont pas forcément vitaux: ils peuvent être de prestige comme en connaît la société actuelle de consommation alors quc ceux' de la population du Tiers Monde sont encore moyenâgeux, de survie. Ces besoins sont liés à toute une structure sociologique qui ne demande qu'à évoluer harmonieusement sous l 'action fécondante de l 'assistance extérieure, sans bouleversement spectaculaire. Celui-ci désagrégerait irrémédiablement sa nature. C' est alors la dépersonnalisation du pays assisté pouvant aller jusqu'à, son acculturation ce qui est plus grave. Faut-il pour un pays perdre son originalité pour accéder la société industriel1e ? Est-ce l 'évolution dans cette direction qui doit lui conférer le titre de pays développé ou celui de grande puissance?

Non, cette voje offre chaque jour l 'amertumc de ses fruits qui a nom: contraintes multiples de l 'homme, perte de son goût de vivre dans cette course effrénée vers la rentabilité économique. Celle-ci lui est présentée comme devant aboutir à l 'excellence de la qualité de la vie. Y parvient -il réellement et quand bien même ce serait, a-t-il seulement le temps de savourer paisiblement cette vie tant les sollicitations sont nombreuses et coûteuses, le bonneur se paie cher: il faut toujours de l 'argent. L 'on consume la vie, comme une chandelle, par les deux bouts.

Pour le Tiers Monde le transfert des techniques doit passer par un choix judicieux correspondant à ses options de société. Ce dernier doit se faire à travers des cadres nationaux avertis d'où:

- la première action d 'assistance doit être la formation des cadres pour le transfert du savoir-faire.

- la deuxième appartient au pays assisté: c 'est l 'adaptation de la technologie au contexte local pour obtenir l 'adhésion du milieu qui doit bénéficier pleinement du transfert.

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- la troisième requiert l 'action coopérative et conjointe des partenaires pour l 'intégration de la technique: apport financier et technique, des uns, support humain et materiel des autres.

Des exemples relativement fréquents illustrent par leur échec la non observance par les partenaires de cette règle du jeu: la domination sous des déguisements variés idéologiques ou financiers veut régner en maître. Ce sont des projets industriels grandioses d 'usines clé en mains ou encore des projets multinationaux de développement appuyés par une aide alimentaire, elle finit par bloquer les efforts de production agricole locale.

Aussi la philosophie que nous croyons devoir tirer de ces quelques reflexions sur l 'attente d 'un pays assisté pour un transfert de technologie est que le coeur et la raison des partenaires doivent être présents à tous les stades du transfert depuis les négociations jusqu' à la réalisation sur le terrain. Ainsi la technique sauvegarde effectivement la liberté.

SENEGAL
Docteur marie-chérèse BASSE
Institut de Technologie Alimentaire

Commission 2 C 2_3

LA TECHNOLOGIE AU SERVICE DE LA CONSERVATION DES DENREES ALIMENTAIRES

La technique dans ce secteur a fait d'énormes progrès simplifiant le travail de la femme à qui était socialement dévolue cette tâche. Elle demeure une des solutions clés de l 'accroissement des disponibi1ités alimentaires dans le monde et de l 'amélioration du niveau de nutrition.

Malheureusement la diffusion du savoir faire est géographiquement limitée à certains continents et les échanges entre pays très restreints.

La technologie alimentaire est diverse: il existe des formules dictées par l 'instinct parfaitement justifiées que l' on trouve chez des peuplades peu familiarisées pour ne pas dire totalement ignorantes de la Science. D'autres arrivent des pays avancés, recettes rationnalles, équilibrées, calculées pour couvrir les besoins alimentaires.

Dans les deux cas le dénominateur commun doit être la recherche et son corollaire l 'industrialisation pour atteindre l' objectif de la FAO: "du pain pour tous:'

En matière de coopération industrielle alimentaire, il serait erroné de ne considérer qu'un transfert vertical des technologies, celui de haut en bas c' està-dire des pays riches vers les pauvres. Il serait même dangereux de faire fi des habitudes alimentaires, reflet de la Personnaîité d'un peuple liées à saculture on ne mange France comme aux Btats-Unis d 'Amérique, en Chine comme dans les pays Scandinaves. Sur ce plan, chacun a son patrimoine dont les plus farouches défenseurs sont les masses populaires.

L'on admet aisément un transfert horizontal entre pays de même niveau de développement dane 1e respect mutuel des économies de chaque partenaire. the ere nouvelle se dessine très timidement où l' on voit se profiler un debut de transfert technologique des pays pauvres vers les pays riches. C’ est paut-être la grande chance de la coopération alimentaire. Le Tiers Monde veut industrialiser ses techniques villageoises avec la collaboration des pays avancés où l 'ingénierie est en pointe: c' est l' outil qui s' adapterait dorénavant à la matière. c' est un carrefour d' où personne ne repart perdant, chacun a quelque chose à apporter et en retour à emporter. L'exemple du couscous industriel de mil au sénégal illustre cette coopération, le pays assisté définit les caractéristiques du produit et l' assistant construit l' équipement ad hoc. Chaque partie se sent concernée et complémentaire de l' autre, c' est le vrai sens du mot co-opération.

Les activités de l' Institut de Technologie Alimentaire (I.T.A.)au sénégal conferment, si besoin en était, les heureux résultats obtenus dans la conservation des denées alimentaires grâce aux techniques mises en oeuvre.

La conservation de la farine de mil antisanale qui pouvait durer une semaine environ après séchage au soleil s'est vue être de 4 - 5 mois pour la farine obtenua mécaniquement.

L'hygiène dans sa préparation et une déshydratation plus poussée dans le séchage au soleil de même que l'amélioration des conditions de stockage et d' emballage ont permis d' obtenir des poissons sees de trés bonne qualité. Ce progrés ne manquera pas d' avoir des répercussions satisfaisantes sur la commercialisation de ces produits.

../..

L'action du froid permet aux populations habitant l 'intérieur du pays de recevoir sur leur marché du poisson frais jusque là consommé en l' etat seulement dans les zones côtières.

La constitution des stocks céréaliers et leur traitement approprié fait naître l 'espoir de voir recular au Sahel le spectre de la famine consécutive aux longues années de sécheresse.

Les courtes périodes d' abondantes récoltes fruitières ne sont plus des éléments hostiles à l 'approvisionnement en matières premières, du moment que la congélation permet de les stocker longtemps sans altération.

L' on pourrait citer la longue file des avantages de la technologie pour mettre les denrées alimentaires à la disposition des consommateurs. Il importe toutefois que la technologie sauvegarde la valeur nutritive des aliments pour leur faire jouer leur rôle d' assurer la santé.

Un facteur économique de poids qui ne doit pas ner. plus être perdu de vue c' est le coût de la technique, Il peut ëtre un frein à l' utilisation des denrées parce que leur prix sera sans commune mesure avec le pouvoir d' achat de leurs consomnateurs.

U.S.A. Commission 2 C2

Amelia A. HLEDE

THE DAIRY INDUSTRY ADAPTS TO MODERN TECHNOLOGY

The subject of my paper "The Dairy Industry Adapts To Modern Technology" will be presented with emphasis on the industry as it evolved in the Pacific Northwest, particularly in the State of Washington and developments elsewhere as they affected us. As a starting point we must look back and see what has already happened. Our progress has in many phones surpassed all others in the industry. With these points in mind I will try to highlight our industry as it is today, and also look to the future. My focal point will be the milking process.

Cows came to the Northwest (Washington- Oregon Territory) in the early 1800's. Dr. John NcLaughlin first brought Spanish cattle in from California. Other breeds were shipped in via the Hawaiian Islands, but by far the greatest number came with the pioneer families as they moved westward. Without the cow providing the milk that sustained them (as well as providing draft-power to pull their wagons) starvation en route would have been their fate. And it, was for the most part the pioneer women who cared for and milked this faithful animal. The cows they brought along were the high butter fat types, (Jersey, Gruensey, and Durhram).

As the lumber and coal mining boom began and towns sprang up, more dairy products (especially butter and cream) were needed. With the perfection of the cream separator, many family type dairies answered that demand. By 1800 the first local creamery processing plant appeared, dozens soon followed. This was our first step

Toward automization. The family farm dairy operation, however, was left mostly to the women and children while the men worked in the fields, the lumber camps, or in the coal mines.

With the ideal conditions for dairying, here, more milk was soon produced than could be utilized locally. Keeping in mind that there was no refrigeration for long distance shipping and even ten miles by wagon or a slow tempermental gas-buggy was too far. The condensary seemed to be the answer. Milk could be put in a can, kept a longer period of time, and even shipped to the east coast.

Starting as a condensary the Carnation Company founded by E. A. Stuart In the late1800's is today known the world over. It was Mr. Stuart who in order to meet a 1906 government milk- cream standard introduced the Holstein-Friesian cattle to our state. His evaporated product was too low in B. F. (butter fat) to qualify as cream and too high to quality as milk. The Holstein breed having a low B.F. was the ideal cow milk from which the evaporated product could be produced and qualify as evaporated milk. The Holstein-Friesian breed was readily, accepted. Our own herd of 150 cows was started in 1928 and has Carnation blood in it.

Another company Consolidated (which is associated with dairy cooperatives) had its beginning in the 1920- 30 era. The label "Dari-gold" was also to become known world wide. Today it has plants located at favorable receiving-distributing locations in the state to handle the various products-fluid milk, ice cream, butter, cheese, and powdered milk. For example, at Consolidated's ultra-modern cheese plant at Chehalis, Washington (built in 1975-76) a maximum of 560, 000 pounds of milk can be processed daily. The newest powdered milk plant now under construction at Lynden will have a capacity or processing 9,000 pounds of milk per hour for a twenty hour operation time.

Progress was definitely in store for the processing plants but what about the farmer? If he increased, he had to hire more and more hand milking machine was slow in coming. Interestingly enough the first suction-type milking machine was patented by an American women, Ann Baldwin. By 1895 came pulsation, now we had the essential components. Early models remained crude and inefficient; and a quarter of a century later (by 1923 statistics) only about five per cent of the dairies were using machines.

If we look at the situation more critically, we can justify the slow development. Those engineering minded individuals were now working in a new field, today known as Bio – engineering. It look thousands of tests and improvements to develop a satisfactory working model to work in conjuction with a living system. The dairy cow is so sensitive to the machine that she will respond differently even to minute changes, such as shell design or liner material.

Actually AS the milking machine was being developed to be fully ut1ized the entire dairy farming system needed "over hauling". It was in this respect that the close relationship between the farmer and the County Extension Dairy Agent (a representative of the Washington State Agricultural Extension Service) paid off. This was particularly true on the west coast, and is probably one of the significant factors to our being in the fore front today. The dairy farmer of today realizes that constant "over hauling" is a must. It even happens that by the time an installation is made, a new once is already on the market or on the drawing board to replace it.

A good example of this is the herring – bone type milking parlor. For some operators this is the ideal type, for others the solution was the newer rotary herring – bone system. No improvements on the milking unit alone could enable two men (or women) to milk one hun-

Dred cows per hour. In the milking parlor principle the cow comes to the machine as opposed to the stanchen type barn where the milker must transport the milking unit to the cow.

Another basic step (especially as the herd size increases) is computerized information. Diagrams I and II show dairy ration computerization and DHA individual cow records. This and related information enables the farmer to increase his profits and to improve his herd. In 1977 Washington State Placed first in the nation in milk production per cow with an average of 14.517 pounds.

Even with all the automation that milking systems now afford, slightly over 50% of the time required to operate a dairy farm is spent in milking. The automatic attach – detach mechanism with an electrode type flow sensor and digitized information is indeed a sophisticated mechanism. Lets see what it is designed to do and how it operates with a computer.

It is designed to supply proper vacuum in relationship to the milk flow. Congruence of vacuum and pulsation rate is paralleled to the lower rate per minute at the beginning and end of the let down cycle with the maximum being reached somewhere in between. Depending on the type of sensing device some models have a built in setting while in others the operator has the option of setting the flow rate for vacuum shut-off. Realizing that cows can not or will not always react favorably to any systems, the risk of any damage to the animal is elimated by giving the operator complete manual control.

In the automatic milking mode the pressing of the attach/detach control switch will cause the milk valve to open, the milking unit will be lowered and pushed into proper position under the cow.

There is built in delay of ½ to 2 minutes to give the operator ample time to attach the unit and get the cows cooperation to let her milk down. If flow doesint being in the specified time, the unit automatically detaches and a "non milk" indicator light flashes to indicate that the cow was not milked. The same indicator flashes if during the milking cycle for any reason the unit disconnects before the cow is completely milked. In the normal milking cycle, however, the unit disconnects only when the cow is producing milk at a rate less than a specified poundage (in the neighborhood of ½ pound) per minute for a specified pre-set time.

Another important feature is digital display of the total number of pounds produced up to any given time during the process. This gives the operator the option to feed the cow the proper amount of grain in so far as that is determined by her output of milk. Since grain is always fed at milking time, the feeding operation could be advantageously computerized.

For most of us the computer is an old stand-by; but, for the dairy industry its interaction (in relation to the milk-meter and attach/detach mechanisms) into the milking process brings in a new innovative dimension. The on-line digitalization (usually in tenths of a pound) as milking progresses and transfer of total pounds produced by the cow per milking and related data to a mini-computer for future reference is revolutionary in scope. The mini – computer itself is normally located in a more protected area than the milking parlor proper; only the display panel is needed by the milker at milking time.

In addition to the attach/detach switch and signal lights, there is an input key – board and an output digital display on the

Front panel. The operator simply punches the cows identification number on the key – board and the proper code in order to receive on the display panel the information he needs. Normally the first code indicates if the cow is to be milked, if her milk is to be held and not to be put in the bulk storage tank, or if she dry and is not to be milked; the second code, shows how much milk she produced the previous day; the third code, indicates her rate of flow and total pounds produced as milking progresses; other codes are also available, pending on how the mini-computer is programmed. The information displayed on the panel enables the milker to take proper action. For example, if a cow numbered (xyz) is a hard milker the operator may increase the End of Milk Delay to make certain that she will be milked out completely.

What information is available to the manager or owner and what information he chooses to convey to the milker at milking time obviously depends on how the mini – computer is programmed. Limited, but pertinent information is now available on the mini – computer on a daily basis – this leads to better management which leads to a higher production.

What does the future in store? Certainly we can expect greater computerization. Of course, the farmer has reliable computerized data (D.H.I.A. and other services) available. However, in this too there is room for improvement. Data availability (time-wise) and transmittal (including forms) are due for changes. Direct access to both computer input and output is advantageous both from a greater reliability standpoint and time wise. Printed data is fine, but as more and more information becomes available the instant television type display is a better answer. As progress is made in this direction, higher caliber and more skillful operators will be needed.

How are we preparing to meet this challenge? Two farm oriented organizations which are letting the young people maker their own decisions early are the Future Farmers of America and the cattle clubs known as 4-H clubs. The acceptance of women into the dairy agricultural field is shown by the increasing number of girls in the FFA and in the dairy – type 4-H clubs. This on the job experience and independent effort on the individuals part coupled with college should give us the trained people the dairy industry will need in the future.

We have looked at dairying from the technical point of view with respect to the milking process. True, this is the nucleolus of the entire operation – as far as the farmer is concerned it is his harvest. Being the most difficult of all operations to mechanize it is perhaps the most challenging, time-wise it requires most of the farmers time. However, cattle nutrition, waste disposal and soil management, housing, milk refrigeration equipment, genetics and veterinary core, machinery purchases and upkeep, finance and business records are all equally important And are undergoing changes. To be successful the farmer must have common sense knowledge of his entire operation. And to continue to be successful the dairy industry must continue to produce a pure, wholesome, unadulterated, chemical free product MILK nature's most perfect gift to mankind.

Advanced as we are today, this only the beginning. Agricultural engineering is the key to our continuing our "Adaption to Modern Technology". In closing, I would like to emphasize that more and more agriculturally inclined engineers, both men and women, will be needed on our team.

SOLUTION OPTIMUM
WASHINGTON COOPERATIVE EXT. SERVICE
WASHINGTON STATE UNIVERSITY
042578
INCOME MAXIMIZING DAIRY RATION FOR HLEDE FARMS
BUCKLEY, WASHINGTON

SPECIFICATIONS
AVERAGE COW WEIGHT 1500 LB.
AVERAGE MILK FAT PERCENTAGE 3.7 %
MILK BLEND PRICE S10.00 PER CWT (FOR FARM)
MAXIMUM PRODUCTION CURVE 80 L.B.

FEEDS USED IN RATION	**LB/DAY**	**% ROUGH.**	**PRICE PER CWT**	**RANGE LOWER**	**RANGE UPPER**
AI.FA. CUBES	20.60	77.64	3.80	0.53	3.92
AI.FA. HAY 22% MCF	6.00	22.36	4.20	*******	******
TOTAL, ROUGHAGE -	26.54	(90%DM)			
		% CONC.			
DAIRY 14% HIGH E	34.65	99.84	5.91	*******	6.03
DICALCIUM PHOS	0.06	0.16	12.30	-2.17	76.73
TOTAL CONCENTRATE -	34.70*				

* PROVIDE TRACE MINERAL SALT AND AT 0.5% OF CONCENTRATE.
TOTAL FEED COST IS $ 3.09 PER COW PER DAY

OPTIMUM DAILY MILK PRODUCTION PER COW UNDER PRESENT CONDITIONS

AMOUNT	**PRICE**	**INCOME**
70.7 LB.	AT S10.00 PER CWT	= $ 7.07

MILK INCOME – **FEED COST** = **INCOME ABOVE FEED COST/COW**
$ 7.07 - $ 3.09 = $ 3.98

ESTIMATED RATION ANALYSIS (90% DM BASIS)

	TOTAL RATION	ROUGHAGE	CONCENTRATE
ESTIMATED NET ENERGY….	581.58 KCAL/LB	389.02 KCAL/ LB	728.82 KCAL/ LB
DIGESTABLE PROTEIN…	10.95 %	11.55 %	10.48 %
CRUDE PROTEIN…………..	14.86 %	16.01 %	13.98 %
CRUDE FAT…………………	2.16 %	1.58 %	2.60 %
CRUDE FIBRE………………	17.00 %	28.13 %	8.49 %
ASH…………………………	6.55 %	8.42 %	5.12 %
CALCIUM………………….	0.75 %	1.19 %	0.41 %
PHOSPHROUS……………..	0.40 %	0.21 %	0.55 %
NON-PROTEIN NITROGEN.	0.0 %	0.0 %	0.0 %

	PRICE PER CWT	
FEEDS NOT USED IN RATION	**AT FORMULATION**	**OPPORTUNITY PRICE**
DIARY 16% high e	6.12	5.93
COTNSEDMEAL48S	9.00	6.97
LIMESTONE . GROUND	1.50	-2.70
CORN SIL.23% DM	1.00	0.98

? LOGOUT CLR
0.47 SECONDS CPU TIME
EST. MUS CHARGE = $0.57
ELAPSED TIME = 00:28:25
08:32:42 END-SESSION JETCP

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Eckert, Wesley	Consolidated Sales Co. Seattle, Washington
Dairy Supply Service Inc.	Puyallup, Washington
Northwest Dairyman's Association	Seattle, Washington
Washington State Dairy Products Commission	Seattle, Washington
Western Farmers Association	Seattle, Washington

U.S.A

Commission 2 - C 2 1

Marian OWEN

American Bell Int. Inc.
in IRAN

PROFESSIONAL ETHICS, AS APPLIED TO FOREIGN ENGINEERS WORIUNG IN DEVELOPING COUNTRIES

Summary

The foreign engineer in a -developing country needs mare than technical expertise. He / she must understand the developmental goals of, the country, and be aware of special cultural, environmental or technical education problems that will affect the success of the projects at hand.

Failure to recognize these factors and proceed accordingly constitutes a breach of professional ethics.

U.S.A.
Lydia PICKUP
Past President,
Society of Women Engineers

CONFIGURATION MANAGEMENT DURING TECHNOLOGY TRANSFER

Configuration Management is the discipline which applies technical and administrative direction and surveillance to (1) identify, (2) control changes to, and (3) record and report change processing to and implementation status of the total configuration of the product. The "product" can be anything from homes to ship hulls, from chairs to computer programs, from machinery to medicines, or from nails to nuclear power stations. If someone needs to know what the product is, after *"one"* has been made, configuration management is needed while its requirements are being defined, while it is being developed, and while it is being produced and tested. In the usual terminology in the U.S., this is spoken of as Configuration Identification, Configuration Control, and Configuration Accounting (not to be confused with "accounting" in the financial sense).

Configuration Management, as a separate discipline and widely recognized by that name, is found primarily in the aerospace industry and more particularly on military projects. However, all industry practices configuration management to some degree, no matter what name it is given. For example, suppose the manufacturer of the cans used for foods decides that it is more economical to build these cans with a larger diameter -- if he fails to also increase the diameter of the lids correspondingly, the user is going to have trouble when he processes his foodstuff, fills the cans, and drops the lids down to seal them in place, only to discover that the lids fall through *the* top of the can into the food -- the lids are too small. Suppose the user's machinery which carries the cans through each processing step will not accon1l11odate the larger diameter can. Or, suppose the pricing and sales of the canned food is by case of 24 cans, but with the larger diameter can, only 23 will fit in the case, and the user has just purchased a six-month supply of pre-printed cases! "Configuration Management" would have forced recognition of the total impact of the change to the diameter of the can, and the decision to make or not to make that change could have been based on all the facts, not just part of them.

When it comes to the transfer of technology, we have several added factors to consider. First and foremost is the barrier to complete understanding that the translation from one language to another imposes. In a friendly conversation, simple, non-colloquial words and phrases can be selected by both sides to ensure a better understanding in the translations. But this is not always possible with technical terminology, and one word may have a totally different meaning to the originator and to the translator. In fact, even when using the same language, meanings may vary from one industry to another. The second major barrier comes from different methods of doing business. For example in the U.S. it is extremely rare for a manufacturer to design and make his own screws, bolts, or nuts. We go to a manufacturer whose primary business is this kind of item, and if at all possible, we select one of his standard items which is suitable for our needs rather than having him build a special item which would be more costly. It is my understanding that many European manufacturers routinely have their own shops build such items. This example shows that European documentation will have more drawings than a U.S. manufacturer needs, and U.S. documentation will have fewer than needed in Europe.

Thus, you can see that, when technology is transferred from one country to another, there will be a number of problems arising which cause confusion and delay the project, even though each of .these problems taken alone may be very minor. It becomes important, then, to learn each other's way of doing business at the very beginning of a technology transfer project, to assess the differences for their impact on each other, and to work out the simplest methods possible to offset the impacts.

Within the configuration management discipline, one of the greatest stumbling blocks is the method of controlling changes. In any large system, there will be several manufacturers involved, each building a piece of the system, and with all pieces expected to come together at the end and function as a system. Fairly obviously, I think, we cannot afford to let anyone of these manufacturers work in isolation, making whatever design and whatever changes he wishes without regard for the impact on the rest of the system. At the beginning, the design requirements for the system must be specified. Next, these requirements must be divided up and assigned to the various major segments of the system, and the interrelationships (interfaces) between these segments must be defined. This process will continue down as far as needed so that each manufacturer knows exactly what the design requirements and the interfaces are for each of his pieces of the total system.

When a change is needed or desired for any design requirement or interface, the configuration management discipline ensures that the change is not permitted until it is assessed for its impact on all parts of the system, each impact fully defined, the possible schedule for incorporation determined, the cost evaluated, and authorization to proceed issued. As you can imagine, when a number of manufacturers are involved in a system, the time required from the original definition of a proposed change to the authorization to proceed can be appreciable. Of even greater importance, however, is a complete definition of the impact of the proposed change, with a listing of the drawings and documents which will have to be revised. Then it becomes important to identify the number assigned to the change in the revision description of each drawing and document so that the "users" can determine when that chance has been in corporated into each item of documentation and when all required documentation revisions have been made so that they can proceed with the fabrication and testing of each piece of the system, knowing that a fully coordinated change is ready for implementation.

In the transfer of technology from Europe to the U.S., we discovered that when we received a package of revised documentation and the change notice which listed the drawings and documents the chances were excellent that these revisions were parts of a number of unrelated changes -- that the change notice was simply a listing of whatever drawings and documents happened to have any change incorporated at that time. This meant that for each drawing revision we had no easy way to determine whether that change affected that drawing only or whether there were many drawings affected, all of which were needed in order to build a total working system. This is not an insurmountable problem, but it did cause additional engineers' time to define when all revised drawings for each change had been received, rather than permitting easy configuration accountability by lesser trained personnel based on a change notice which listed all required revisions for one change. It also caused additional time and money to be spent on communications between countries both by mail and by telephone in order to sort out some of the confusion. Do *not* misunderstand - not all U.S. companies follow the same procedures that I am accustomed to, but, obviously, I think they should

Now, let me identify some of the specific areas where there can be problems and recommend ways to avoid such problems, regardless of the countries and the languages involved.

In defining the methods used in each country, in identifying the differences, and in determining the solution to problems caused by these differences. It is important to recognize that literal translations may cause more problems than the actual methods do. For example, after several meetings among representatives of two U.S. companies and three European companies, there seemed to be no better common understanding of configuration management methods that there was before *any* of the meetings were held. In preparation for yet an meeting, i was asked to prepare viewfoil charts showing how we controlled changes, how the other U.S. company controlled changes, and how the European companies controlled changes to see lf perhaps a review of all three might provide a common understanding. The two U.S. companies charts, although little different, were no problem, and I was to use a European chart from translated document -- and there was the key to the whole thing! That chart happened to have been prepared originally in French and showed both the French and the literal English translation for each item on it, and the literal translation of the French words bore no relationship to the comparable U.S. terminology for the same activities. Now, as many of you know, my knowledge of is very limited, but even that limited knowledge, coupled with my thorough understanding of configuration management, let me prepare a chart of the European methods showing our configuration management terminology along with the French words from the original chart, and all at once we had the begin of a common understanding which let us all move on to identifying the differences and determining solutions acceptable to all parties. The "secret" success in communicating lies in applying knowledge of the field and recognizing when a literal translation is not the answer. It is well worth the time and effort to teach at least the rudiments of the field to the translators to have them work closely with those most knowledgeable in the field so as come up with the best translation possible. We must all use our imagination, and ingenuity to determine what is meant by the words used.

It is important to provide strict accountability for each drawing and each drawing revision as it is received, untranslated, and for whether or not ea change will be incorporated into the system you are building to someone else’s design. In working with the untrans1ated documentation, it is very easy, with the help of a translator, to teach someone good at that kind of work where look on the foreign drawings for the information needed and the few key words in the other language which will provide the kinds of identification needed for this accountability. After translation, when the responsible engineers have assessed the actual changes being made, a method of feedback must be, provided so that each revision received can be identified as to whether its in corporation into your drawings is required, when it is scheduled to be accomplished, and when it is actually accomplished. It should be noted that even when building to someone else's design, not all changes to that design need to be incorporated. For example, some changes are made to facilitate fabrication due to the manufacturing techniques used in your plant or in your subcontractors' plants, and the same is true in the other country. Often this kind of change will not be beneficial in both countries and therefore would not be incorporated in both sets of drawings. When such a change is not incorporated, care must be exercised on all subsequent changes to the same drawing to ensure that omission of that one change remains both desireable and feasible or that it is later incorporated and accounted for.

When interchangeability is required between the systems being built in different countries, the level to which interchangeability will be maintained must be carefully defined in order to be cost effective. For example, in a weapon system which is to be built and used by several countries, the decision must be made as to whether every item on its missile must be interchangeable no matter in which country it is built, whether only major segments must be interchangeable, or whether the only requirement is that the total missile may be used interchangeably in each country's system. Of course, the same type of decision must be made for each of the elements of that system, and while the example is a weapon system, the decision process is equally applicable to any kind of a system involving technology transfer.

Thus there are several main steps to be followed in order to provide Configuration Management during technology transfer:

1. Ensure that each understands the other's existing methods; identify any problems which the other's methods will cause; and find mutually acceptable solutions to those problems.
2. Ensure a complete exchange of drawings and documents and of all changes thereto, and provide strict accountability of all such items received or sent.
3. Provide a complete definition of each change, including a listing of all affected drawings and documents and a schedule of when each revision will be complete; assess each other's changes to determine whether or not they must be incorporated; and provide a feedback of this decision into the "received" accountability records.
4. Ensure that the applicable change number is identified in each drawing and document revision description and in the accountability records. With the records reflecting actual incorporation, as well as scheduled.
5. If interchangeability is required, a careful determination of the level of interchangeability must be made and controls imposed to ensure adherence to that decision.

The primary key to each of these steps lies in the translation from the language of one country to that of the other, with the "language" of the field superimposed on the literal translation. Main words and phrases can be taught to non-bilingual personnel who need to provide accountability prior to translation, and translators can be taught the rudiments of the field and given ready access to experienced personnel to ensure proper translation. This sounds fairly simple – and it really is, provided those working the problem are capable of exercising and willing to exercise imagination and ingenuity in finding solutions which will be acceptable to all parties.

Remember that Configuration Management is a discipline and requires a disciplined approach to identification, control, and accountability for whatever technology is being transferred from one country to another.

IRAN
Mahin RAHMANI
Université de Téhéran

Commission 2 C 2_2

CHOIX ET ADAPTATION DES TECHNOLOGIES INDUSTRIELLES DANS LES PAYS EN VOIE DE DEVELOPPEMENT

Les problémes liés à l' incorporation de technologies avancées dans les processus de production des pays en voie de développement et le choix approprié de ces technologies se situentau centre du débat en cours pour la réalisation d'un nouvel équilibre mondial.

Les distorsions de structure et les liens de dépendance qu' entraine l' introduction en milieu en voie de développement de technologies conçues et produites en réponse aux besoins des économies industrialisées ont été longuement anal ysées au cours de ces dernières annèes. Par contre, la question de la recherche d'eventuelles solutions de rechange a jusqu 'ici fort peu préoccupé les théoriciens. A ce l' egard, la question de l' existance -au niveau opérationnel- de technologies plus "appropriées" et mieux "adaptées" à la constellation des ressources des économies moins développées mérite d'être posée.

L' importance de ce probléme et ses implications Quant à la politique économique poursuivie par les pays du Tiers Monde m'ont amenés à une discussion sur le "choix économique de technologies industrielles appropriées et adaptées pour les pays en voie de développement".

L' accélération continue du rythme des changements technologiques qui caractérise notre époque est à l'origine de mutations qualitatives et quantitatives décisives. Les fondements mémes de notre civi lisation connaissent un processus de profondes transformations susceptibles d' ouvrir de nouvelles perspectives de développement, en rupture totale avec ce que nous avons précédemment connu et connaissons encore aujourd' hui.

Il ne fait aucun doute que l' évolution technologique dont nous sommes témoins, qu'il s' agisse du développement de l' informatique et de ses applications, de l' utilisation industrielle de l' energie nucléaire ou de la généralisation de nouvelles méthodes de gestion, pose des problémes politiques et sociaux nouveaux et influe sur la vie de chacun de nous. "Technologies de civilisation" tout en modifiant l' environnement géo-économique, elles conditionnent de façon durable notre mode d' existence et propagent par là-même de nouveaux modèles de société.

Toutefois, cela ne saurait suffire. Le développement des sociétés dépend, à notre époque, et toujours davantage, de la recherche scientifique fondamentale et de ses prolongements technologiques. Il est done nécessaire de mettre en place des mécanismes politiques pour le contrôle des initiatives, privées ou publiques qui visent à l' introduction et à l' implantation et l' adaptation de nouvelles technologies.

La planification et la maitrise du développement technique, ainsi que l' évolution des options opérées, la comptabilisation rigoureuse de leurs coûts financiers et sociaux, de leurs retombées directes et des incidences secondaires éventuelles constitueront dans les prochaines décennies les problémes prioritaires de l' ensemble des démocraties.

Etant donné que la Firme Multi-Nationale se orésente comme le canal privilégié du transfert technologique dans les pays en voie de développement, une lourde responsabilité lui incombe à ce titre en ce qui concerne l' assimilation et l 'adaptation de la technologie transférée dans les pays d' accueil et, pat là, la valorisation du potentiel scientifique, technique et industriel de ces pays.

Les critiques adressées aux F.M.N. pour le peu d' effort qu' elles déploient pour adapter leur technologie (et non pas leurs produits) aux conditions des pays d' accueil, pour procéder a une véritable décentralisation de la R-D et, en plus, pour respecter les priorités du développement national des pays d' accueil ne font que mettre en cause les finalités de leur stratégie "world wide", en d' autres termes, leur optique mondiale.

Du côté des pays en voie de développement, on peut faire un double constat: la politique suivie jusqu' à maintenant en matiére de transfert technologique et de politique de science et technologie était individualiste et parfois même isolationniste. En effet, il n'y a que très peu de concertation efficace et encore moins de véritable coopération horizontale entre eux.

De l 'autre côté, la plupart des tentatives d' intégration régionale n'ont que trés peu atteint leurs objectifs et une grande partie d' entre elles ont lamentablement échoué. une des raisons essentielles de ces échecs est le fait que la technologie a été presque toujours considérée soit comme une variable exogène à l' intégration soitce qui est pire- comme une donnée contraignante sur laquelle on ne peut pas agir; dans les deux cas, on se contentait de mesurer
la rentabilité ex-post, sous forme résiduelle, induite du processus d' industrialisation.

Les modalités actuelles du transfert technologique s' effectue essentiellement à travers:

a) l' lnvestissement direct, national et international ainsi que l' importation de biens d' équipement auxquels la technologie se trouve incorporée;

b) les déplacements d' individus entre les pays, l' emploi d' experts étrangers, les accords de consultations ainsi que les échanges d' information et de personnel dans le cadre de programmes internationaux de coopération technique;

c) les contrats de licence sur les brevets et le savoir-faire;

Le premier aspect négatif du transfert technologique dans les pays en voie de développement est son coût excessif pour les pays receveurs.

L' existence de ces coûts à étè largement dénoncé aussi bien par les chercheurs isolés que par les Institutions de recherche et Organisations internationales tandis qu' à partir d' une controverse sur le bien-fondé de ces accusations, la discussion reste ouverte pour la determination d' un "juste prix" pour le transfert technologique.

Donc, la première conséquence néfaste pour les pays en voie de développement découlant directement des pratiques actuelles du transfert technologique est la lourde charge financière-- en devises-- qu' ils subissent et qui réprésente une hypothéque sur les options de l' avenir du fait de l' alourdissement excessif de leur dettes. D' ailleurs, une recherche du coût de ces opérations peut nous fournir certains éléments d'un premier constat de déstructuration des économies des pays acquéreurs de technologies.

Malgré le bruit et la publicité autour du concept de la "technologie. intermédiaire" son application n' a pas encore dépassé le cadre de quelques expériences isolées. La technologie transférée reste la plupart du temps celle qui a été conçue pour les pays développés et cela en dehors de toute considération sur son état.

L' inadaptation de la technologie importée aux structures socioéconomiques des pays en voie de développement tient, pour simplifier, à deux raisons essentielles. D' une part, ces processus de production sont "produits" en réponse aux besoins des économies industrielles qui connaissent une abondance du capital et du travail qualifié, c' est-à-dire une situation inverse à celle de la plupart des pays en voie de développement. D' autre part, la très forte concentration des activités de recherche et développement dans les pays industrialisés donne une orientation spécifique auxininovations technologiques consistant à épargner le travail sans qualification pour y sustituer des biens d' equipement et des processus productifs de plus en plus sophistiqués.

L' implantation de technologies avancées dans des structures productives pour lesquelles elles n' ont pas été conçues entraine des conséquences bien connues. En particulier, l' adaptation de processus de production à intensités capitalistiques élevées détermine une accentuation du déséquilibre des facteurs dans les économies sous-développées. La réduction de la quantité de main-d' oeuvre par unité produite étant en effet la fonction principale du progrés technique, l' utilisation de nouvelles technologies tend à limiter les possibilités d'emploinotamment dans le secteur industriel. La diminution de la part du facteur travail dans les fonctions de production entraine a son tour une concentration accrue de revenus au détriment des salariés ce qui tend a réduire la dimension du marché intérieur et induit un modéle spécifique de développement industriel.

Dans ces conditions, on propose généralement aux pays en voie de développement d’ adopter des technologies plus "appropriées" et mieux "adaptées" à leur dotation en facteurs. Il est généralement admis que ces technologies ne doivent pas étre fondées sur 1' utilisation de méthodes de production obsoletes et économiquement dépassées, basées sur du travail simple, sans qualification mais qu' elles doivent être, par contre, conformes aux besoins de ces pays et utilisatrices d'une quantité normale de capital par unité de travail.

L' étude approfondie de la révolution technologique s' impose done mais pas seulement pour la maitrise de l' évolution de la civilisation. Les applications technologigues de la science s' avérent étre, en effet, désormais des parmétres décisifs de la croissance économique.

L'analyse 'des facteurs de la croissance économique dans les pays en voie de dévaloppement montre que, au-delà d' un certain seuil de développement cela tend à dépendre de moins en moins de l'accroissement purement quantitative des moyens de production et il est toujours plus largement fondé sur les applications de la science aux activités de production, de gestion industrielle et commerciale.

pour eur ort, certains de ces pays en voie de développement ont atteint ce seail. par exemple, en IRAN nous avons en effet achevé le stade initial de notre développement qui a consisté essentiellement à établir une infrastructure de base et à créer un tissue industries qui s'est rapidement diversifié et s’ étend accuellement aussi bien aux industries légéres de biens de consummation qu’ aux industries Lourdes telle que la pétrochimie, la sidérurgie, etc...

mais il existe d'autre niveaux, celui des transports, de l 'habitat, de la technologie agricole, etc... ml il seralt possible d'explorer des voies nouvelles, originales, mieux adaptées à nos conditions socio-économiques spécifiques et à nos disponibilités en facteurs.

Dans ces domaines, l 'adoption de technologies dites "intermédiaires" ou "appropriées" quelles que soient par ailleurs les critiques dont ces concepts font l 'objet et leur annotation idéologiques serait à méme de mieu assurer l 'adéquation de la technologie utilisée aux conditions propres a ces pays.

Enfin, dans aucun autre domaine, l'écart entre pays industriels et pays en voie de développement ne s 'avére aussi marqué que dans celui des dépenses de la recherche scientifique et technlque concentrées à plus de 98 % dans les pays avancés. cette disparité limite singuliérement le pouvoir de décision des nations en voie de développement et compromet leur indépendance en matiére de choix de technologies.

Au cours des derniéres années, le rôle stratégique de la variable technoloqique dans le processus du développement des pays du Tiers Monde à été démontré d'une façon déterminante.

Pour ces pays, qui dit "technologie" entend avant tout importation de technologies ou, en termes plus courants, "transfert technologique". A long terme, la technologie transférée en elle-même ne présente de valeur pour les pays receveurs que s'ils sont capables d 'intégrer les éléments épars en un ensemble national coordonné par une politique de la science et de le technologie et s 'ils disposent d ‘une capacité industrielle permettant sa mise en oeuvre.

Le probléme est néanmoins de savoir s 'il existe en cette matière une possibilité effective de choix et si les technologies intermédiaires sont disponibles sur le marche mondial ou en tout cas, opérationnelles. car, d' une part, le transfert technologique au niveau international est réalisé principalement à travers le réseau interne des firmes multina tionales qui tend à imposer les technologies dominantes dans les différentes liqnes de production. D'autre part, la gamme des procédés techniques produits en série et disponibles sur le marché est en fait trés réduite, surtout dans la phase supérieure de l' industrialisation et, par conséquent, les pays en voie de développement ne disposent pas, en fait, de technologies "alternatives". Enfin, les options technologiques sont conditionnées par le fonctionnement même du sysétme économique et de son mode spécifique du développement. En particulier, le fonctionnement à l ’échelle mondiale, de l 'effet de demonstration, se traduit par une homogénéisation des techni... ques de production indépendament des dotations en facteurs.

Finalement, la conclusion est que dans les pays en voie de développement, l 'industrialisation doit poursuivre deux objectifs bien di stincts. Le premier objectif consiste à satisfaire la demande intérieure de produits de consummation durable et non-durable. Etant donné les caractéristiques fondamentales de cette demande -modéle de consommation importée- les produits localement fabriqués doivent nécessairement obéir aux spécifications du modéle d'origine et la technologie à utiliser doit, par conséquent, étre rigoureusement identique à ceile du Pays fournisseur. Autrement dit, la transplantation dans l'économie iranienne de modéles de consommation importés va déterminer en grande partie le choix de la combinaison des facueurs de production. Dans ce schéma de développement, l'activité industrielle se réduit pratiquement à de simples opérations de montage et d'assemblage de piéces importées de l'extérieur ce qui exclue toute adaptation majeure des produits et des techniques de production ou caractéristiques du marché local.

En ce qui concerne le deuxiéme processus d'industrialisation fondé sur une stratégie d'exportation l'éventail dcs possibilités de choix de technologies alternatives se réduit encore davantage et l'adaptation devient même incompatible en égard aux objectifs poursuivis.

En effet, la mise en place de capacités de production qui excédent les possibilités d' absorption locale sont principalement orientées vers les marchés extérieurs obligant les secteurs concernés à se plier aux normes de production en vigueur au niveau international. Cette stratégie exclue done d'emblée toute adaptation à la dotation en facteurs du pays.

<u>NOT E S</u>

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FRANCE
Monique ROLLAND
E. N. S. I. A. MASSY

Commission 2 C 2 3

APPROCHE POUR UNE RECHERCHE EN TECHNOLOGIE APPROPRIEE DU MANIOC AU CONGO

Dans le cadre de ma 3éme Année à l'E.N.S.I.A. (Ecole Nationale Supérieure de Industries Agricoles et Alimentaires), j'ai eu l' occasion d' étudier un sujet concernant la cooperation industrielle et les transferts de technoloride dans les pays en voie de développement.

En effet, l'ENSIA a créé, en relation avec le G.R.E.T. (1) une cellule thématique sur les techniques appropriécs aux problémes posés dans ces pays.

Le sujet que j'ai traité, la Transformation du manioc au CONGO, m'a montré combien était nécessaire, non seulement une bonne connaissanca des problémes technologiques et bio.chimques mais aussi de toutes les conditions Socio-.économiques propres au pays. Pour cela, une coopération avec les autochtones est indispensable

Le théme du manioe en technologie appliquée était intéressant pour trios raisons:

* l 'importance dumanioc dans l' alimentation des zones tropicales (80% de la ration calorique)
* l 'augmentation des villes et l'éloignement des zones de production,
* la préparation trés pénible : femmes courbées 6 heures par jour et développant un effort physique considerable.

L'étude a comporté deux partics :

I – LE CADRE SPECIFIQUE

Lors d'un voyaga (trop court) on République Populaire du congo, je me suis attachée à y connaître "l 'environnement du manioc" :

- les conditions propres au pays

géographie physique et humaine, structures sociales, politique générale du pays, contumes alimentaires, besoins exprimés par les femmes.

- les conditions propres à la plante

Qu' est-ce que le manioc; comment ast-il cultivé; quelles sont sea propriétés nutrition nolles; quelle est son histoire dans le pays ...?

(1) G.R.E.T. Groupement de recherche et d'études sur les techniques rurales.

-- la transformation du rauioc au CCNGO

Quelles sout lea préparations traditionnelles, les habitudes alidoniaires; comment est fait la commercialisation; existe-t-il une evolution dans ces preparations, des technique récemment implantées; quell est le revenue des paysans …..?

On aboutit à une série de contraintes et d'ateuts dont il faudra tenir compte lors de la synthésa et des propositions

II - LA TRANSFORMATION DU MANIOC

La recherche précédente permettra d'éliminer un certain nembre de transformations usitées aillcurs (cf tableau joint)

- Cependant une premiére étape consiste à rechercher toutes les maniéres de transformer le manioc existant dans le monda; fabrication de farine, de gari (1), de tapioca (2), d'alcool, etc.,

On essaie de connaître les processus biochimiques (élimination de l'achide cyenhydrique des variétés améres), les problémes que pose la transformation et comment ils ont été résolus dans les différents pays oû la preparation considérée existe.

On obtient déjà ainsi une gamme de matériels trés divers, du Moulin à farine à la féculerie industrielle, dont il serait intéressant d'étudier les avantages et les inconvénients en fonction des conditions de l' environnement, étudiées au premier paragraphé.

- Une deuxiéme étape consisterait à faire une recherche spécifique à partir des opérations unitaires de base de la transformation, et à chercher pour chaque élément à faire des transferts de techniques (d 'industrie alimentaire ou non). Par exemple, la fabrication de chicouangue (3), que j'ai étudiée, consiste en un rouissage, un défribraga, une déshydratation des laminages et des cuissons: on peut chercher des analogies avec la fabrication du pain ou des pâtes, le rouissage du lin, la cuisson du couscous etc.,

L'objectif que nous voulons atteindre est de faire une infomation sur les alternatives technologiques avec les coûts, le fonctionnement, les avantages et les inconvénients (en fonction du pays).

(1) farine de manioc, fermentée et cuite (sorte de semoule)

(2) fécula de manioc ayant subi une gélétinisation

(3) chicouangue: grosse boule de manioc, fernenté, servant denouxriture de base aur congolais. C'est l'equivalent du pain de ménage des paysans français de l880.

Totalement <u>difféments</u> do celui des pays en voie de développement et les échees seront bans doute nombreux.

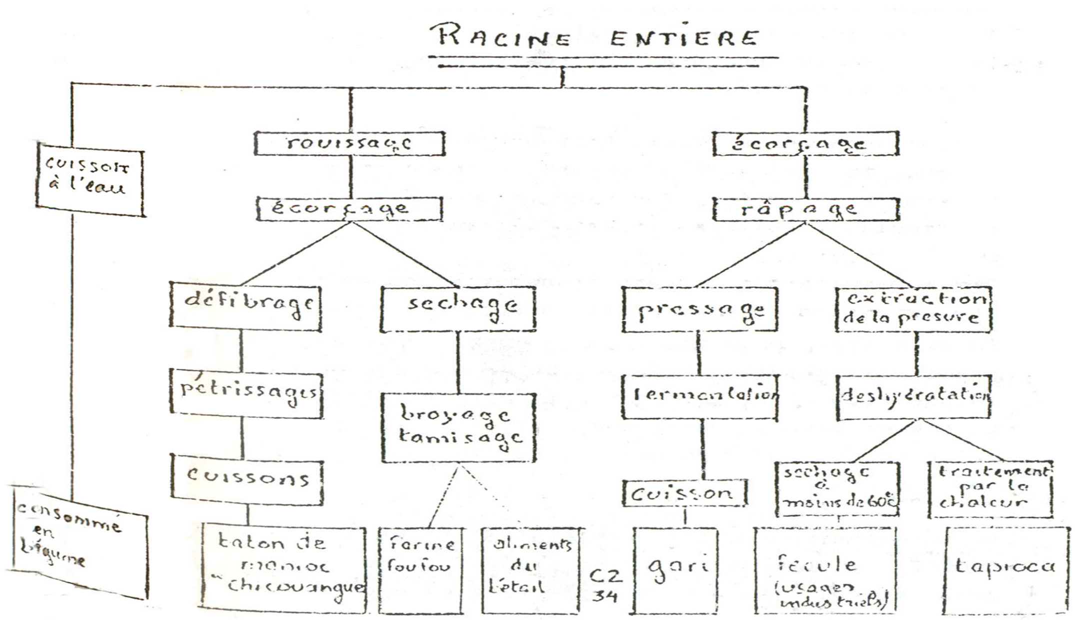
Mais est-ce une raison pour se décourager et ne rien faire ?.non. ceci ost une <u>étapr</u> avec ses défauts et ses qualitiés. A chacun d 'essayer de l 'améliorer.

Il ne faut pas se cacher cependant combien une <u>telle recherché est</u> <u>difficile et aléatoire:</u>

. d 'une part, peu de rensignements concernant ces techniques sont disponibles, l 'information circulant trés mal dans ce domaine . De plus, une telle recherche nécessite un <u>investissement</u> financier et surtout humain qu'il n'est pas toujours possible de faire.

. d 'autre part, ces etudes sont jusqu' à present faites par des "occidentaur" qui réagissent avec tout leur <u>centexte d' education</u> et de société,

<u>Annexes Transformations du manioc</u>



BRESIL
Clara P. STEINBERG
and Riva BAUZER

RECREATION FOR ALL WITHOUT LEAVING HOME

1. RECREATION AS A BASIC HUMAN NEED

We accept the thesis that recreational progress can, by and large, contribute towards the fulfillment of basic human needs.

Recreation activities occupy a special and privileged position in the educational process, since all of us, regardless of individual differences, either in aptitudes or abilities, need recreational pursuits. Even individual differences in need are, to a large extent, a matter of the kind and degree of learning possibilities, including built-in interests and motivations. Our ego and self-esteem are nurtured because we have become a more interesting person to others, with a more dependable image of ourselves.

Activity is the law of life. A playing spirit revitalizes the mood of anyone really indulging in the activity.

Playing activities teach us to look forward to the feelings of comradeship and *the* satisfactions of the experiences that await us when we participate wholeheartedly in group tasks. Life takes on new meanings: recognition, acceptance, self expression, self-fulfillment and collaboration. Challenging situations and adventure make our world limitless. Founded self-assurance replaces excessive reliance upon others or inadequate patterns of submissive blind obedience.

Group activities are the avenues through which social skills are mastered and friendships developed. And recreation provides individuals with opportunities to live through group situations.

2. THE GROWING CHILD IN AN URBAN SOCIETY

Perhaps, as never before in history, our society needs to question itself so very earnestly about the proper upbringing of children. More people are getting concerned about the adequate growing experiences of young children, distressed with the apparent later effects of early permissiveness in child-rearing and outraged by the crime and violence of those who have not been duly "socialized".

Recent studies show that a child beginning with a relatively simple system of reflex adaptations, moves on as an extremely active constructor of his own environment. Through stages of cognitive functions, he will achieve more mature notions of space, time, causality and morality. Individual characters are built and experiences are integrated under socializing pressures, modeling a singular life-style, which helps to develop a happier and more productive unique person.

It is generally acknowledged that school systems provide inadequately for great individual differences among children. For example: the usually bright child, with a rich background of intellectual activities may not be able to proceed at his own pace, but will often become bored, disenchanted. The child with a mild language deficiency may be overlooked in the classroom and may fall far behind in all other study areas just for being so neglected. Nevertheless, it is through enriching socialization via recreational activities, for instance, that a child selects and adopts the mores, and learns how to fulfill his aspirations through acceptable patterns of social behavior. This is why developmental psychologists are increasingly looking at the child as a learner and problem-solver in all situations. This seems to be the best route for generating a community life involving rather independent, inquiring, well-informed, physically and emotionally fit persons, with good capacity to interact with other people.

In an era of accelerated urbanization, fraught with anxiety and frustration, and of rapidly changing life-styles, the balanced and meaningful use of 1eisure time through constructive recreational learning activities may be particularly significant.

3. ACCELERATED URBANIZATION AND HOUSING PROJECT

The increasing urbanization growth observed allover the world seems to be a distinct feature of our complex society and a difficult one to cope with. Greater urbanization is a comparatively recent situation. According to existing data, the first cities appeared some 5500 years ago. Still, late as 1850, only two percent of the world population in cities with more than 100, 000 inhabitants. However at the end of the current century, forty percent of the world population may be living in such large cities.

At the beginning of the XX^{th} century, only about ten cities had populations of over one million inhabitants. Today can easily count more than one hundred of such cities. And perspectives are that by the end of this century, there will be more than a dozen cities with over twenty million inhabitants. In fact, some will have populations of about thirty million people.

Changes occur at such a fast pace that we do not even have the time to evaluate the situation; however, we should not be illuded by the idea that restraining the growth of cities is an easy matter.

Cities such as New York, Tokyo, London, Sao Paulo, Paris, Moscow, Rio de Janeiro, or Mexico have bigger populations than many countries, for example: Sweden, Belgium, Norway, Switzerland, Austria, Israel, Guatemala.

The modernization of mass transportation helped, initially the expansion of city areas, assuring conditions which favored the horizontal urban growth. However, the fast population growth linked to the economic problem relevant to the situation, have acted as main difficulting factors in the continuous development of city transportation, bringing on hard pressure towards the adoption of high-rise housing projects.

On the other hand, the accelerated rhythm of the increasing numbers of such construction projects, has hindered, to a great extent, the adequate planning of open and free spaces, So important to function as stimulating leisure-learning places, and play sites.

It should not be necessary to recall here how permanently congested roads and frightening dangerous traffic have made impossible the use of streets as play areas, as was done in the “good old days”.

Besides, even apparently calmer sidewalks, squares, and parks have been transformed into huge parking lots, thus cancelling the possibility of using previous walking, wandering, wondering, and adventuring sites. Not to mention the problems involved in simply trying to reach those places. We sadly recognize that each year, allover the world, many children are hit and killed in traffic accidents.

And the cities have lost one of their principal functions -- that of a special meeting and communication site. People have lost their sense of secure community life. It seems that we all feel, at the same time, the need to belong and the fear of participating in collective life. Family life is not the same: grandparents, parents and children do not live together anymore. In cities of millions we are reaching the isolation long ago depicted in Riesman's "The Lonely Crowd".

4. THE RECOVERY OF LOST FREE SPACE

The high-rise housing projects seem to be one economic way in the attempt to solve some of the problems of increasing urban demographic concentration. That is: the need to cope with more people, more cars, more parking lots, etc., in the same site.

The wise planning of leisure and recreational activities may contribute substantially to the recovery of lost free spaces, inf1uencing directly the improvement of conditions which would help the social development of neighborhood life in overcrowded cities.

The use of all possible places, including schoolyards, churchyards, clubhouses, squares, parks, communal gathering resorts, and others, can provide different opportunities for play.

The use of free spaces around and inside high-rise residential buildings (including open air, as well as covered, or semi covered multi-functional areas) represents a most convenient advantage for child-rearing practices, especially for little ones. They can profit from a great number of rich playing opportunities, close to their first habitat -- the home – protected from street violence, yet dealing with different playmates, under the guidance of a constant, and known, group.

In some Brazilian cities, such as Rio de Janeiro and Sao Paulo, the municipal legislation on the construction of residential apartment buildings, already calls for the inclusion of areas for specific use as play grounds, in side the building premises.

5. RECREATION FOR ALL WITHOUT LEAVING HOME

This is the name of our project, intended to mobilize mini-communities living in high-rise residential apartment buildings.

Having at hand free and versatile spaces, specially conceived with dwellers leisure needs in mind, we program recreational activities which include valuable lifetime pursuits, such as: arts, handicrafts, music, dance, theater, informal conversation groups, and the practice of sports, not only for children but for other interested groups of all ages, as well.

Sessions are conducted by specialized play leaders, who see the program as a laboratory where skills 1ean1ed at home, at school, or elsewhere, are uncovered sharpened, promoted.

Our main purpose is to help integrate people in solidary residential communities, exposing dwellers, from the very young up to adult and older ages, to various group interaction levels. This kind of experience may further general welfare and cooperation, allowing great freedom of opportunities to all participants, within a wholesome array of "give-and-take" situations of community life.

In the few words, our experience amounts to one more argument reinforcing the idea that it is possible to give all kinds of people opportunities for free, creative – constructive action, even in dense built up areas in vertical cities, if thought and imagination are brought together into the task of offering substitutes for the lost spaces, such as socializing sidewalks or backyard's adventurous spots. We know that when such gifts are dimmed by poor living conditions, the future careers and happiness of young people and may be endangered.

After all, we must keep in mind that cities were built to serve men's needs, and not the other way around.
Towns and cities will always be what men make up of them. As Martin Buber once wrote:

"Only in the Thou the I Become a real I"

SIERRA LEONE
Yvette E. STEVENS
University of Sierra Leone

APPROPRIATE TECHNOLOGY IN DEVELOPING COUNTRIES

THE ROLE OF WOMEN

1. INTRODUCTION

Before the advent of Western Civilization, the people of developing countries had their indigenous technologies which although usually characterized by low capital and labour productivities, provided them with their basic needs. These technologies, which still exist, however fail to generate the surplus needed for economic growth. Inclesale importation of technologies from the developed world, quite apart from the fact that they are out of the economics reach of nest rural communities, do not always find acceptance in these communities mainly because they are designed with a completely different society in mind.

Developing countries are now producing qualified personnel in every field, all the onus of providing alternative, low cost, and acceptable technologies must be laid squarely on their shoulders. They are in a position to use whatever training they have received to design and give advice on technologies ‘appropriate; to their societies and thus device ways of improving productivity, relieving labour, and reducing costs, with the local people in mind.

It should be stressed right from the beginning, that Appropriate Technology does not have to be a compromise between Indigenous and Western Technology, or some kind of second class technology. Indeed in some cases it could in sophistication compare with technology from the developed world. The emphasis here should be on the use of locally

Interest both within and outside developing countries. It is seen as a means of improving living conditions in the rural areas and thus narrowing the gap between the rich and poor families of developing countries.

Development will however be slow if the women who form over 50% of the population and up to 80% of the agricultural labour force are denied access to knowledge. It is indeed unfortunate that women have so far been ignored by workers on Appropriate Technology, mainly because these workers are foreign to these areas of developing countries play a very important role in all aspects of life. Development programme therefore, which ignore women are almost inevitably doomed to fail. If Appropriate technology is to create an impact, it has to be directed not only to the men, but equally, if not mainly, to the women.

Any innovation brought to rural societies is looked upon with suspicion, and schemes can ever fail because of this. Caution therefore has to be taken in the introductory stages. Women social workers could be used to advantage in this respect. These social workers have over the years won the confidence of the local people in their role as advisors on many issues. The local people are apt to consider favourably any idea coming from the 'family friend'.

The necessity to involve women in the design state cannot be overstressed. Since they would be the ultimate users of the devices, it would be of immense benefit if design is done according to their specifications. Pre-design surveys are to be made and interviews conducted to know exactly the requirements of the particular equipment. Only then can one guarantee that the device will be successful or acceptable.

Designs which have been made without considering the woman have been known to fail and money and time spent on them wasted Thus, for example, pedal operated grinders developed for the grinding of cereals have not found acceptance because in most African societies it is improper for women, who traditionally do the grinding, to sit astride. In this case some foreknowledge and interview both before and during design and development would have shown that hand operated grinding mills would have been more popular. Similarly naize shellers designed by men also failed because the women who have spent their lifetime shelling maise found they could do it faster by hand.

The mistake here is that men are always in mind when technologies for the rural areas are designed. While the fact that women perform most duties in the rural areas continues to be ignored, there will be wasted time, effort and capital in design and development of devices which could not main popularity in the rural areas.

2. THE ROLE OF WOMEN IN THE RURAL AREAS OF DEVELOPING COUNTRIES

Women of Africa,
Sweeper,
Smearing floors and walls
With cow dung and black soil,
Cook, ayah, the baby on your back,
Washer of dishes,
Planting, weeding, harvesting,
Sterekeeper, builder,
Runner of errands,
Cart, lorry, donkey…………
Woman of Africa
What are you not?

Ckot p' Bitek
Song of Ocol

The above verse summarises the role or women in the rural areas of meet developing countries. These women setup as early as 5 o'clock in the morning and go to bed as late as 10 o' clock at night, having spent most of the day cooking, fetching water, working on the famu and also in activities like soap-making to supplement the family income.

The main fuel used in cooking us firewool. The women have to fetch

To firewood from the forests, and since no massive replanting of trees is done, the forests get further and further away and the distances traveled to fetch the wood gets longer and longer. They have to carry the wood all the way home and chop them into smaller pieces for cooking. The stoves used are usually of stone or of scrap metal, the design of which could certainly be improved to reduce the cooking times of foods and the effort needed to keep them alight. (This is usually done by farming.)

Women also have to fetch water for use in the home. This, as fuel, might involve walking long distances several times a day. Fetching water and fuel are generally not considered as work but as part of the woman's daily chores. The fact that they have to travel increasingly greater distances is generally overlooked. Worsening drought conditions in some countries do not help the situation. Recent studies is Ethiopia showed that in 75% of all households under survey, the women spent three hours or more on a single journey to fetch waster.

Feeding the household is another of the women's tasks. To do this, they cultivate their own garden where vegetables are grown mainly for domestic consumption. Any surplus is sold to subsidise the family income. This is quite apart from the help they give the menfolk in the farms. During peal periods the women do most of the planting, seeding and harvesting, Handling and running of the farms is considered as the man's job since the element of money comes in. Most of the ardous tasks in the farms, however, are performed by the women.

Care of children and old people is also the responsibility of the women. Then there are other jobs like cleaning, wasting, and preservation of food for the family. They also have to help with storing and marketing of cash crops produced in the farms, and are still obliged

To find time during the day for soap-making, oil producing and other activities to provide extra income for the family. In seaside villages, women also fish for minoes, shrimps, cysters and crabs both fir consumption and for sale in the markets.

In recent times the mass exodus of men from the rural areas to the town and cities for the purpose of acquiring better paid jobs, have left the women more tasks to perform. They are having to build and repair houses, build roads and participate in all kinds of community projects.

3. APPROPRIATE TECHNOLOGY AND WOMEN OF DEVELOPING COUNTRIES

How can Appropriate Technology help the women of the rural areas of developing countries? There are basically three ways:

(a) Labour saving devices to cut down on time and effort spent on non-productive tasks such as carrying water and fuel.
(b) Equipment to assist women in income generating activities such as weaving, soap-making and food processing.
(c) Devices to help women make the home environment healthier and more comfortable.

Areas in which Appropriate Technology could make a significant difference to the lives of rural women include:

(i) Provision of water in rural areas.
(ii) Introduction or light transport facilities for the transportation of water, wood, farm produce and other leads.
(iii) Adoption of efficient agricultural tools.
(iv) Introduction of grinding mills and other crop processing equipment.

The explcitation of solar energy for use in cooking would relieve women of the burden of fetching fuel during these times of the year when it

Is dry and sunny. Fortunately most developing countries are endowed with sunshine for most months of the year. Design and development of solar cookers and ovens would therefore be of immense benefit to the people of these areas. Two types of solar cookers have been designed so far. One which reflects the heat of the sun to the bottom of the pot - the solar reflector cooker, and the other; the solar steam cooker which uses the heat of the sun to boil water and produce steam which is used for cooking. The former type has the disadvantage of having to provide a device to track the sun. Development of the existing designs of both types would lead to improved designs which would meet local requirements.

Another possible form of fuel for use in the home is biogas derived from animal and human wastes. Of course methods of storing the excess gas would have to be considered. There would be problems in getting them to use this method, and a lot of convincing would have to be done.

Design of stoves to burn firewood efficiently is another area in which design and development would be invaluable.

The collection of water and provision of water supply can be achieved by appropriate devices. Water catchments for collecting rain water in large quantities are in use in some countries. These are simple containers to collect water, but the restriction here is on costs. In Thailand, a thin-walled coment catchment which holds 3000 litres of water is available at a cost of about 10 US. Roof attachments can be designed to case the collection of rain water.

In some areas the villages are on the hilltop whilst the streams are in the valleys, back that the women have to travel through difficult tarrain. In cases like this hydraulic ram pumps could be designed using local materials. One such locally designed pump in Nairobi gives to flow of 5 litres per minute and can pump water up to a height

Of about 100 metres at 1 metre head. Its cost is just a fraction of the commercially made pump of the same capacity.

Chain and washer pumps can be used where the river close to the village has steep banks. Ashallow well dug close to the river and a pump of this type can provide water supply to some rural communities. Such a pump produced from local materials. Rubber washers, chain of strong rope raises water at the rate of 30 litres per minute and costs just $ 10 US. A whole range of water lifting devices which are hand operated or use 'free' forms of energy instead of expensive oil and other scarce fuels could be designed.

Agricultural tools for digging, planting, weeding, harvesting, threshing and winnowing would reduce time and energy spent on these jobs and improve productivity.

Experiment for preparation and processing of foodstuffs would relieve the women of this burden. Traditional methods of grinding cereals in Africa take about 1 to 2 hours to provide floor for the evening meal of a family. Appropriately designed grinding mills would take about 50 minutes to yield flour for a whole week.

Locally available energy resources should be explicated to provide power for operating machinery used in the rural areas. The possibility of generating electrical power by using small streams and rivers in areas where these are available or windmills where wind speeds permit must be explored.

Other areas in which Appropriate Technology can help the women of the rural areas is in crop and food production, animal husbandry, production of household utensils, home improvement and fishing methods. Surveys will yield areas of interest peculiar to particular countries, and it is the job

Identify these areas.

4. THE SIERRA LEONE EXPERIENCE

In Sierra Leone a few organisations are engaged in Appropriate Technology work. They are:

1. Advisory services for Technological Research and Development. (ASTRAD) Faculty of Engineering, Fourah Bay College.
2. Department of Agriculture, Kjala College.
3. Tikenke Agricultural Extension Centre, (TAEC)
4. Ministry of Agriculture and Natural Resources.
5. Ministry of Social Welfare and Rural Development.

A newly formed organisation drawn up from all organisations involved in Appropriate Technology work, has set itself the following tasks:

a. Promotion of work on Appropriate Technology;
b. Identification of areas in which Appropriate Technology work can be carried out.
c. Collation of work on Appropriate Technology
d. Solicitation of financial support for projects.
e. Setting up and maintenance of a library and information centre on Appropriate Technology.
f. Organisation of meetings involving both local and foreign workers for the purpose of exchange of ideas.

This is The National Association on Appropriate Technology.

UNICEF recently furted a survey of Rural Technology in Sierra Leone with a view identifying areas for possible improvement to provide available materials and resources to provide for the local needs, having in mind the social and cultural back round of the people for which the technology is designed – one reason for putting the responsibility of designing in the hands of trained specialists conversant with local conditions and attitudes.

The advent of the concept of Appropriate Technology has inspired job opportunities in the rural areas and increase the self sufficiency of the nation. The survey was conducted by Njala University College, AST AD, F.b.C. and the Ministry of Social Welfare and Rural Development. The role played by women in operation of rural technology, the descriptions of various operations, and equipment and materials involved in the technologies were identified. The technologies covered include palm oil processing, nutcil processing, coconut oil processing, gara processing, gari production, lubic production, laundry soap making, starch production, foofoo production, fish smoking, rice parboiling, local gin production, cassava, corn, and onion preservation, slipper making and charcoal processing. It is hoped that a more detailed study will be carried out to give recommendations on how these indigenous technologies could be improved.

Preliminary studies carried out by ASTRAD and the Ministry of Agriculture and Natural Resources in 1971 revealed that African women needed some help in respect of extracting oil from palm fruits. The traditional met ca is by hand or foot which is laborious, time-consuming and unhygienic. A hand operated screw press was designed by ASTRAD, which resulted in an increase of yield of 50 %. The traditional method extracts only 35%. The press is easy to use, robust, and relatively cheap. The operator should be able to cover the 180 cost of press and clarifying drew in two years of production and make a profit of about E10 a month, which will increase sharply once the initial loan is paid. The first prototype was tested in 1972 and by 1974, a better prototype had been produced.

In 1977, the Ministry of Social Welfare and Rural Development and the Women's centre ECA, gave specifications to ASTRAD to prelnce an improved design. This led to the production of a new prototype which is to be tested at village level. It is expected that this project will establish villages acceptance of the presses and eliminate any initial technical or socio-

Economic problems that might arise. If this venture is successful, the next step would be manufacturing of such presses for use in the rural areas of the country.

ASTRAD had designed and tested a variety of solar water heaters, solar cookers ovens and crop dryers. Research is being done on local building materials and small scale power generation using available hydro power from streams. It is thought that cheap power in the form of electricity could be used for driving locally designed machinery economically. There are plans in the Faculty to introduce a postgraduate programme in Rural Environmental Technology.

Self help prospects are becoming the order of the day in the country. These projects which are generally organised by the Member of Parliament in his constituency, provide means of using local labour and materials to provide these areas with basic essentials: schools, hospitals, assembly halls and roads. Men and women in these areas are proud to be able to participate actively in these programme. Materials and funds are usually provided by donations.

The TAEC has completed design of rice winnowers, well pullers, rand-fed jab planters, hand maize shellers and push-pull hoes. These items which are on sale are being used in the rural areas by both men and women. Now undergoing field trials are cassava raters, groundnut shellers, wheelbarrows, handcrafts, forge blowers and hacksar frames. Design id being done on single-row seeders, automatic jab planters, shallow and deep water lifts, bird carers and palm nut crackers. Development wok on existing designs continue.

The major satback encountered is finance. It is hoped that growing awareness of the benefits of Appropriate Technology would lend to positive support in the form of funding for research and development of projects from both local and external sources.

5. CONCLUSION

It is seen that that Appropriate Technology can help to ease the burden of women in developing countries and thus improve the living standards of these people.

Appropriate Technology should not be considered as a halfway measure, but rather as a means of using locally available resources, thus cutting down on costs, to mechanise processes which at present involve tremendous time and labour. This would leave the women of the rural areas time to devote to community development projects, to participate in adult education programmes and to take better care of their children.

Education of the men and women of the rural areas would be vital to the acceptance of these new equipment. These people would tend to stick to old traditions, whatever the odds, and unless proper programmes are drawn to educate these people thy might refuse to accept the change. Women Social Workers should be able to persuade these people in the initial stages. Once the begin to reap the benefits, there would not be any more problems.

When the devices have been accepted, training programmes for their use and maintenance must be run for the users. This is essential if they are not to be dismissed because of poor performance caused by inefficiency to use of perform simple maintenance on these devices.

The price of some of these commodities might not lie within the reach of most single families, but it is thought that at the initial stages some of these could be purchased by groups. This is nor a problem in the rural areas where the people live in small hemlets. Each such hemlet could purchase devices to be used in common by all the families. Income derived from there are could be utilized to purchase more such equipment until eventually everyone will be able to posses one.

Government and private concerns should provide credit facitives to and women in the rural areas to enable then to purchase there equipment. Even with the loan to be paid and the interest, the costs would soon be realized and the user would be sure to benefit.

With the rising cost of conventional fuels, the rural areas of developing countries would gain from employing locally available resources to drive their machines, cock their food, pump their water and perform other tasks now being performed by laborious, time-consuming methods. There possible, small scale electricity generation using small streams, wind power and solar energy should be invaluable in providing the power needed to drive pumps and other machinery.

Women are trained in various fields should be consulted when design of equipment for the women in the rural areas is being done and their expertise would then be a tremendous help in both design and development. It would seem logical that women should be male to test equipment decimal for use by women.

If appropriate technology is to succeed in improving the standard of living of the rural societies of developing countries, it is essential that women, the forgotten workers, be brought in mind in all stages of design and development.

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NIGERIA
Docteur OLADISI O. UGBEBOR
University of IBADAN

HOW TO MEET THE EXPECTATIONS OF THE RECEIVING COUNTRY

1. INTRODUC'I'ION.

The inclusion of the topic "From the transfer of technology to industrial cooperation" and the sub-topic "Ho" to meet the expectations of the receiving country" for discussion is for several reasons, most encouraging to a participant from a developing country. Some of these are:

(i) The term "transfer of technology" implies that the receiving country "understudies" the highly industrialised country. We know of course that a country or individual who continues to understudy another without doing any independent thinking or research will forever remain underdeveloped relative to the other. Lack of technology also means inadequate supply of electricity and clean drinking water resulting in ill-health and loss of man-hours. The realistic avenue open therefore to developing nations is for them to pursue intensive research in science and technology in order to solve their energy problems and pave the way for industrialisation. The relationship between the developing country and the highly industrialised nations will then be in the form of cooperation (as opposed to understudy).

(ii) The subtopic presupposes that:

(a) The highly industrialised countries have come to realise that the developing countries are beginning to evolve comprehensive energy policies and therefore have certain expectations.

(b) These energy policies are sufficiently well-formulated to be taken seriously.

(c) The highly industrialised countries should endeavour to meet these expectations.

Let me say straightaway that I will focus my attention on the country that I have grown to know so well that is of course my country NIGERIA. I shall cite a few examples from the experiences of other receiving (or developing) countries and it will not be surprising if several other such countries have expectations similar to those of Nigeria.

Let me also say that the Federal Republic of Nigeria has at present the most 'open' government that we have ever know, with the widest range ever of citizens participating in the debate and formulation of policies. As an enlightened citizen of my country, I occupy the privileged position of an indirect participant in policy-making as one who feels directly the effect of such policies.

2. TECHNOLOGY AND FREEDOM.

I feel it is pertinent to discuss briefly just boy important the acquisition of high-level technology has become to Nigerians. In fact we have come to realise that our economic and political freedom rest heavily on our technological advancement in the near future.

For instance, many developing countries because of lack of high-level technology, have to export unprocessed raw materials and as s result obtain below 25 percent (and in some cases only 10 percent) of the price at which the industrialised nations sell the products manufactured from these raw materials to the ultimate customer. The result is that the ultimate consumer in the developing countries can hardly afford the manufactured products! We realise that no nation can achieve self reliance and attain greatness so long as that nation remains an importer of basic needs and we hope that Nigeria will soon cease to be in the list of markets for dumping of goods from foreign countries, goods for which the raw materials originated from our country. And we are not folding our arms. Let me first of all mention a few *of* the inventions of our young scientists in our polytechnics and universities.

A female student of the University of Ife, Nigeria, has designed an automatic gate for railway level crossing. The device has built-in switches and remote control for opening and closing the gate as well as switching on and off the red warning light and the warning bell. The project was designed as part of the requirement for the award of the degree of Bachelor of Science in Electronic and Electrical Engineering of the University for the 1977/78 Session and was supervised by a Nigerian lecturer in the department. Also recently, three electronic engineering students in one of our polytechnics designed and built three electronic calculators. The calculators can perform such mathematical operations as addition, subtraction, multiplication, division, inverse, square root and trigonometric functions. Another young engineer has designed a machine capable of drawing water from wells and his aim in doing so was to mechanise the present energy-sapping and time-wasting methods of drawing water from wells in rural areas of the country. Last but by no means least, a secondary school leaver was present at his very own stand at an Electronics Exhibition to display a host of electronic gadgets he made on his own.

And the thirst for technological advancement is not limited to individuals. Nigeria is looking forward to a not-too-distant date when she can expert energy. Our government recognises that an essential step towards becoming an industrialied country is the establishment of the iron and steel industry. Such basic industry will help to increase the level of intermediate capital goods production as well as ensure that our domestic needs are as much as possible met from local production. A tentative allocation of #800 million (about US $1,250 million) has been made by the government towards the establishment of such an industry. Moreover plans are under way to establish direct reduction plants and rolling mills. We are also hoping to develop and export our abundant supply of natural gas. The National science and Technology Development Agency has embarked on scientific projects aimed at controlling environmental pollution. Other research projects include the development of low cost agricultural tools and appropriate technology for small-scale farmers and the development of methods for the converd on of urban wastes, animal manure and industrial by-products into suitalble fertiliser materials.And, talking of agriculture, the Nigerian Institute for Oil Palm Rescarch (NIFOR) has made major advances in the techniques of the cultivation of the oil palm. Oil palm occurs wild in Nigeria and in the past, only wild palms were being harvested.Now

Now improved palms produced by NIFOR are being planted in large plantations as well as by small farmers.Most of the questions about the oil palm which were asked at the inception of the Institute have been answered and methods growing palms have been perfected.Now research is underway on other palms of economic importance including the coconut palm.The institute has an engineering research unit which has produced,amoung other things ,an inexpensive and effective motorised horizontal digester to take care of the small-scale growers' Pounding problems.And there lire greater plans for the future.We hope to build a "Science Village" where top scientists would reside in isolation from the general community in an atmosphere conducive to high-powered research.we hope that this wiII eventually become Nigeria’s "Centre for Scientific Excellence".

3. HOW NOT TO MEET OUR EXPECTATIONS

I believe it is important to discuss this topic because lot of what is going on in developing countries at present would come under this title.Moreover the issues to be examined here do come under the next topic albeit in a negative sense.I must emphasize that Nigeria seeks industrial cooperation with friendly nations and please take note of the word friendly.My country approached friendly highly industril11ised Western natious to build (entirely at our expense) for what they considered the resonable price, our iron and steel complex.But What did we get? Negative answers.Not until a friendly nation from behind the "iron curtain" came to the rescue could we begin to build this very important industrial base.Now comes the irony of the matter.I will be specific in this instance and mention the automobile industry. Let me say that it is not out of prejudice that I have chosen to discuss the Peugeot

Automobile Industry in Nigeria. On the contrary, Peugeot Automobile of Nigeria (PAN) is rated No.1 outside France in order of importance (so says the Commercial Manager of Peugeot Automobile Nigeria, Mr. J. P. Huertas) and it is the first automotive plant in Africa. On a personal note, T also ride Peugeot 504 L A/C Saloon car because it is efficient on our roads. The Peugeot Car Assembly plant in Nigeria is doing well, having increased production at the Kaduna plant from 27,000 Cars in 1975 when the plant started operations to 160,000 Cars as at now with a view to further expansion. What I am saying is that FAN is making a lot of money in Nigeria. And yet the cost of assembled-in-Nigeria (I prefer this terminology to made-in-Nigeria) Peugeot Cars is no less than the cost of Peugeot Cars imported from France. The major reason for this is that most of the components are flown in from Lyons, France by UTA (a French airline) at prohibitive costs. Although it is true that some production components available within Nigeria are gradually being integrated at the plant, thereby cutting down the volume of import of manufactured components, such items are the less heavy components like tiles, glasses and batteries. Suppose for a moment that the several years' delay in the take-off of our iron and steel industry was absent and that we were already producing steel (we have abundant natural gas and heavy deposits of iron ore), then the setting up of a purchasing and local contents division by PAN to look for available local sources would have been most meaningful to a developing country like Nigeria .For one thing the heavy components could have been manufactured by PAN or purchased from Nigerian manufacturing companies. Then cars assembled in Nigeria would have cost far less than those imported from France, with the same profit-margin, as they now make.

Another area is the burden on the economies of developing countries in the form of export of profit and gains from loans. Also direct foreign investments constitute another factor of negative impact .As distinct from loans with repayment terms, profits on such investments are repatriated from the developing countries even when the investments have fully recouped themselves. For example, during the past three decades, it is reported that a Western-owned company has exported from Tanzania 30 times more capital than it originally

Invested there! The situation in which Western –owned companies export iron ore rather than pellets or metal from developing nations and cut and polish African diamonds only in Europe is unacceptable.

It has been postulated that international oil companies are getting prepared to change their roles from oil companies to oil service companies in the sence that they will be opting more for providing technology and services on a fee basis. The onus of developing Nigeria's oil industry further

Will now be on the state-owned Nigerian National Petroleum Corporation (NNPC) which is a. poor late starter in such a highly developed industry and whose task will be made even more arduous by the prohibitive costs of hiring necessary equipment from these companies .A specific example is an offshore
Offshore drilling rig hired by the NNPC at a staggering estimated cost of 2 million (approximately us $3.5 million) for only one year.

Hitherto highly industrialised nations have laid an unhealthy emphasis, in giving technological assistance, on the development of middle-level technical manpower at the expense of high-level scientific research. The emphasis has been on training technicians to "maintain the technology imported from the industrialised nation offering such assistance. The importance of technicians is appreciated but the point is that we need to go further than just maintain finished products, our aim, ultimately, is to make some of these products ourselves as well as maintain them.

It is sad to note the interest shown by some highly industrialised nations in the supply of military technology to some developing countries. Such military technology would usually be more sophisticated than that of a. hostile neighbour. This causes the neighbour to look to some other highly industrialized nation for similar assistance. This exercise wastes scarce resources of developing countries .It is feared that the collaboration of highly industrialized western nation with an oppressive government in Africa in the development of nuclear weapons could put an end to the hopes of an oppressed African population for liberty and self-determination. The development of these nuclear weapons could have far reaching evil effects on the African Continent as a whole.

4. HOW TO MEET OUR EXPECTATIONS

Having intimated you with our hopes and aspirations for energy development and the many ways in which our expectations are being frustrated, I will now deal with how our expectations can best be met.

What is needed to replace the eagerness of some industrialised nations to supply military technology to developing countries is greater application of the provisions of the United Nations (UN) Charter for peaceful settlement of disputes, collective security and peace-keeping forces (see Chapters VI, VII and VIII). Regional bodies like the Organisation of African Unity (OAU) should also be encouraged to settle disputes between member-countries.

In the place of nuclear weapons, we *want* nuclear energy for peaceful purposes. In an address to the United Nations on December 8, 1953; President Dwight D. Eisenhower (of the United States of America) proposed the "atoms of peace" programe. As a result of this programme the International AtomicEnergy Agency was formed in *1951.This* orgonisation has two *major* objectives:

(i) The use of nuclear energy as a key to industrial development, particularly in the underdeveloped countries of the world.

(ii) Safeguarding the peaceful uses of nuclear energy to prevent their being diverted to a military purpose.

A request for the "sale of nuclear technology" to developing countries for peaceful purposes only would then not be out of place. Moreover, agreements going along with such sales would provide for international inspection of nuclear-reactor facilities used for such peaceful purposes. If some highly industrialised nations are willing to "sell nuclear technology" for military purposes in defiance of UN Security resolutions, then surely developing nations are not asking for too much. Our energy needs in the near future far outstrip what we can hope to generate through conventional means. When it is recalled that uranium, the all-important nuclear fuel, was first discovered in its purest form (60 per cent purity as opposed to 0.1 percent purity of previous finds) in Zaire in Africa and that India (another developing country) possesses large reserves of thorium ore which can be converted into uranium 233 (a valuable reactor fuel) it becomes obvious that the yearning of one developing nations for nuclear technology (for peaceful purposes) is a legitimate one. Developing nations are interested also in conversion of solar energy to electricity. Large areas of Africa receive enormous solar energy and intensive research into practical and economical conversion of solar as well as geotherma1 energy into other forms especially electrical, is urgently needed. In this regard we need financial assistance for research. The emphasis here has to be on high-powered research as opposed to middle level technical training for maintenance purposes. Just as the United States of America makes space technology facilities available to European countries, the developing nations too would like the kind of technological and industrial cooperation that would give our research scientists and engineers access to such major research and development facilities which exist in places like the Oak Ridge National Laboratory in Oak Ridge, Tennessee, U.S.A. the Los Alamos Scientific Laboratory in Los Alamos, New Mexico, U.S.A., the Knolls Atomic Power Laboratory in Schenectady, New York, U.S.A. and the Fermi National Accelerator Laboratory at Batavia, near Chicago, Illinois, U.S.A., to mention a few. Most of the research scientists and engineers in developing countries work in isolation (because they are few in number) and in unfavourable conditions (economic and technological underdevelopment breed political instability and a host of other problems) .Inadequate facilities cause retardation. We need funds, the right atmosphere, the facilities, and we will make it. Nigeria in particular has men and women who are scientifically capable and who are highly respected in their fields all over the world. But we need grants. We need to interact more with our colleagues by way of regular visits to the highly industrialised nations. We in Nigeria need training in the development and exploitation of our vast energy resources which include petroleum, coal, uranium, wood and hydroelectric to produce the basic necessities of life as well as for export.

Sometimes research is best conducted in the receiving country in Which case all that is needed may be interaction with scientists in other countries

Who have been involved in similar projects. Developing nations are particularly interested in durable and simple inventions as well as those with minimum costs .I will cite a few examples. A new system of appropriate technology ancient water-power machines used in Ethiopia and Northern Sudan for more than 2,000 years has been devised by Mr. Gimbel. His models were en exhibition at Britain's Royal (Agricultural) show. The interesting thing about the models is that they can be taken apart and reassemble, l piece by piece to show their workings and how they can be constructed using local materials and labour, and the new system is expected to last up to 20 years without repairs. The second example is the production by scientists at Heridot-Watt University in Scotland of a solar cell which is expected to cost as little as one hundredth of the price of existing devices for tapping the sun's power. This latest, invention could help developing countries by offering benefits including irrigation and power supplies to rural areas. Finally, a process has been developed by a metallurgist working at the Indian Institute of Technology, Kanpur, whereby a rich black cement is produced from rice husk ash and lime. The interesting thing about this cement is that it is structurally as strong as a much more acid-resistant than the ones we import from developed countries. This rice husk cement is therefore very suitable for structures in the food and chemical industry where corrosion rates are high. This technology is extremely cheap (it cost about US $3, OOO to set up and produces about 250 tonnes of cement each year) and developing nations will benefit most from it

5. CONCLUSION

I have not by any means exhausted all that can be done to meet the expectations of the receiving Country .For instance ,the organizers of this conference have contributed towards the realisation of this goal, although I wish may more scientists from developing countries could have attended and presented papers. Nevertheless I hope that I have excited your minds and set you thinking along useful directions. I would like to express my deep gratitude for the opportunity given me to present this paper. I say to the organizers of the conference “merci beaucoup”.

Commission 3 (C3)

FORMATION ET INFORMATION DES FEMMES SUR LES CARRIÈRES SCIENTIFIQUES ET TECHNIQUES

Responsable: Gisèle HUGUES

La place des femmes dans le monde industriel et dans le monde scientifique est subordonnée à l' information et à la formation auxquelles elles ont accès ainsi qu'à l'attitude de la société à l'égard des femmes faisant carrière.

Les travaux de cette commission seront consacrés aux divers aspects de cette question et aux perspectives d'avenir qui s'ouvrent aux femmes dans les différents pays.

C3 - 1 Information objective et déroulement de carrière. (Discussion en français).

1°) Comment informer les jeunes filles de l'importance de la science dans le monde et, par conséquent, de l'intérét des carriéres scientifiques ?

2°) Comment les femmes ingénieurs et scientifiques peuvent-elles porter cette information au niveau des femmes en général?

3°) Les femmes sont-elles vraiment désireuses d'accéder à des postes de responsabilité majeure?

C3 - 2 Information objective et déroulement de carrière. (Discussion en anglais).

C3 - 3 Psychologie de la société à l'égard des femmes ingénieurs et scientifiques. (Discussion en français).

Les traditions religieuses, familiales, sociales et la carrière scientifique des femmes.

La société de votre pays et la considération qu'elle aceorde aux femmes ingénieurs et scientifiques.

C3 - 4 Psychologie de la société à l'égard des femmes ingénieurs et scientifiques. (Discussion en anglais).
C3 - 5 Perspectives d'avenir dans les différents pays.

Spécialités scientifiques et techniques les plus ouvertes aux femmes. Ouvertures prévisibles : industries nouvelles, organismes de recherche et de développement.

Modalités propres à faciliter la carrière des femmes (horaires souples, temps partiel, etc...).

Commission 3 (C3)

INFORMATION OF WOMEN ON SCIENTIFIC AND INDUSTRIAL CAREERS AND THEIR TRAINING IN THESE CAREERS

Convener: Giséle HUGUES

The position of women in the industrial world and in the scientific world is as much conditioned by the information to which they have access and to the training which they receive as it is by the attitude of society to career women.

The studies of this Commission will be devoted to several aspects of this topic and to the future prospects opening up to women in different countries.

C3 - 1 Presentation of information - goal and description of careers (discussion in French).

C3 - 2 Presentation of information - goal and description of careers (discussion in English).

1 °) How to tell girls about the importance of science in the world and, hence, of the interest to be found in a scientific career?

2°) How can women engineers and scientists convey this information at a level suitable for the general run of women?

3°) Do women really want access to posts of major responsibility?

C3 - 3 Psychological attitude of society to women engineers and scientists. (Discussion in French).

C3 – 4 Psychological attitude of society to women engineers and scientists. (Discussion in English).

Religious, family and social traditions and the scientific career for women.

The society of your country and the standing accorded to women engineers and scientists.

C3 – 5 Future prospects in different countries.

Types of scientific and technical work most open to women. Foreseeable openings: new industries, research and development.

Conditions of employment which can facilitate a woman's career (time-tables, flexitime, part-time, etc...).

SOMMAIRE

FORMATION ET INFORMATION DES FEMMES SUR LES CARRIERES SCIENTIFIQUES ET TECHNIQUES

Responsables: gisele HUUGUES. **Marguerite CORDIER**

PROGRAMME

La place des femmes dans le monde industrial et dans monde scientifiques est subordonnée à L' information et à la formation auxquelles elles ont accésainsi qu'à l' attitude de la société à l'égard des femmes faisant carriére

Les travaux de cette commission ont été consacrés aux divers aspects de cette question et aux perspectives d' avenir qui s' ouvrent aux femmes dans les different pays.

INFORMATION OBJECTIVE ET DEROULEMENT DE CARRIERE

1. Comment informer les jeunes de I' importance de la science dans le monde et, par consequent.de l' intérét des carriers scientifiques?

2. Comment les femmes ingèbnieurs et scientifiques peuvent-elles porter cette information au nivear des femmes en general?

3. Les femmes sont-elles vraiment dsireuses d'accéder à des postes de responsabilité majeure?

PSYCHOLOGIE DE LA SOCIETE A L'EGARD DES FEMMES INGENIEURS ET SCIENTIFIQUES

- Les traditions religieuses, familiales, socials et la carriére scientifiques des femmes.
- La société de votre pays la consideration qu'elle accorde aux femmes ingèbnieurs et scientifiques.

PERSPECTIVES D' AVENIR DANS DIFFERENTS PAYS

Specialties scientifiques les plus ouvertes aux femmes. Ouvertures prévisibles: industries nouvelles, organisms de recherché at de dévoloppement.

Modalités propres à faciliter la carriére des femmes(horaires souples,temps partiel,etc…).

ORGANISATION DES JOURNEES

Les différentes sessions ont été presides

- Le lurid 4 septembre (après-midi) par DORMER ELLIS-CANADA

- Le Mardi 5 septembre (matin) par MARIAN OWEN-IRAN

- Le Mardi 5 Septembre (après-midi) par CLARA STEINBERG-BRESIl

- Le Jeudi 7 septembre (matin) par GHOSE-INDE

- Le Jeudi 7semtembre(après-midi) par SUSAN TURI –HONGRIE

LISTE DES PARTICIPANTES

- M.BELL	ROYAUME-UNI
- H.BLANC	FRANCE
- R.BULADNE	PHILIPPINES
- R.BRAND	PRESIL
- M.CORDIER	FRANCE
- D.DI FRANCESCO	U.S.A.
- D.ELLIS	CANADA
- M.ESTEVES-VELASQUEZ	U.S.A.
- L.GODIN	FRANCE
- GHOSE ILA	INDE
- L.GRAHAM	U.S.A.
- A.HARNESS	U.S.A.
- S.HOPILLIARD	FRANCE
- E.HOWARD	POYAUME-UNI
- G.HUGUES	FRANCE
- E.LAVERICK	ROYAUME-UNI
- C.LAISSUS	FRANCE
- G.LEBON	FRANCE
- M.LEVY	FRANCE
- P.LORING	U.S.A.
- A.MOUTON	AFRIQUE DU SUD

- J.OVARLEZ	FRANCE
- M.OWEN	IRAN
- A.MAYER-JACK	FRANCE
- R.PICART	U.S.A.
- B.PREECE	U.S.A
- A.PRESSMAN	U.S.A.
- I.RISCHOWSKI	U.S.A.
- P.SAENGBANGPLA	THAILAND
- Z.SAIDIN	MALAISIE
- P.SALONGA	PHILIPPINES
- M.SCHEELE	PHILIPPINES
- M.STEEL	U.S.A.
- C.STEINBERG	BRESIL
- G.TESSIER	FRANCE
- S.TURI	HONGRIE
- M.VUILLEMIN	FRANCE
- I.VEBER	FRANCE
- C.WISNIEWSKI	U.S.A.

Avec Nos Excuses Pour Toutes celles don’t les noms n’ont pas été mentionnés sur cete liste et qui ont participé la COMMISSION N^{0}3

SYNTHESE DES TRAVAUX

FORMATION ET INFORMATION DES FEMMES SUR LES CARRIERS SCIENTIFIQUES ET TECHNIQUES

I INFORMATION OBJECTIVE ET DEPOULEMENT DE CARRIERE

Parmi les congressistes, nombreuses, inscrites á cette commission l' avis dominant a été que méme dans les pays développés,les jeunesfilles discarnent mal l'intérét des carriers scientifiques, car elles restent insuffisamment conscientes de l' importance de la science dans le maonde. La mixité dans les Ecoles ne semble méme pas étre un element favorable,car les etudes sont parfots différentes pour les filles et les garcons.de plus,la mixitésemble impensable aux indes par example.cependant,toutes les congressistes ont insisté pour que les etudes des filles et des garcons soient rigoureusement les mémes.

Conscientes des problems d' information, aux etats-unis,en grande bretagne et au brésil, les associations de femmes d' ingénieurs ont fait des efforts trés importants pour donner le gout des etudes scientifiques aux jeunes gens et aux jeunes filles.

Plusieurs communications ont eu trait á la carriére des femmes ingénieurs.dans l'ensemble des pays,il semble qu'il n'y ait pas ou qu'il subsiste peu de discriminations dans les organisms publics et dans l' enseignement. Toutes les congressistes reconnaissent l' intérét de rénumération,intérét encore plus ressenti dans les pays en voie de développement,ou bien souvenc il écarte toute consideration conventionnelle qui pourrait entraver la carriére de la femmes ingénieur.

Le dilemne maternité-carriére est ressenti par toutes. Certaines méme, refusent l' enfant pour faire carriére.(refus qui n'est pas acceptépar la société).

En examinant la politique á poursurivre pour soutenir les femmes dans leur carriére scientifiques,il est indéniable qu'il faut citer l'action stimulante par l'association brésilienne(cf rapport clara sternberg).

II PSYCHOLOGIE DE LA SOCIETE A L'EGENIEURS ET SCIENTIFIQUES.

Une premiére conclusion qui s' impose et qui semble surpreante: la jeune fille qui vient d' avoir son diplome d' ingénieur, quelque soit son pays est un sujet de fierté,pour son pére,ses fréres ou son finace. Par contre,seule la mere regretted qu'elle n'ait pas suivi une voie plus traditionnelle.

Certes, les milieux évolaés socialement donnent des femmes ingénieurs en plus grand nombre,mais dans les pays en voie de développement ou l' on recherché des cerveaux,des femmes ingénieurs peuvent étre formées par un systéme de selection rigoureux á partir de milieu trés modeste. Il y a encore quelques pays ou la carriére de al femme est coupée net.

Par le marriage (la femme ne devant pas travailler); mais cela semble relativement rare.Par contre,bien souvent les instituteurs et les professeurs sont trés souvent ignorants des carriers scientifiques s' ouvant aux femmes et quelques associations de femmes ingénieurs s' efforcent d' organizer des seminaries scientifiques débattant de questions actuelles comme l' énergie, la pollution ou de problémes tells que l'emploi ou la formation professionnelle.

III PERSPECTIVES D' AVENIR

Il est trés difficile de cerner des perspectives d'avenir internationals . en effet,par example en France, la chimie est une branche saturce.alors qu'en grande bretagne,la chimie offer de nombreux debouches. La specialization recommandée souvent en France apparait trés mauvaise aux U.S.A.

Quant aux modalités propres á faciliter la carriére des femmes,tous les pays ont été d'accord pour l' aménagement du temps de travail pour l pratique d'horaire souple, á la seule condition que ces facilités soient accordées aussi bien aux hommes qu'aux femmes.

Par contre,toutes les congressistes ont insisté sur la nécessité d'une formation permanents,surtout pour les femmes s' arrétan de travailler momentanément pour élever leurs enfants.

Enfin,les problems de mobilité sont plutot des fecteurs positives. En effet,le Canada a éu idée de former des femmes ingénieurs en acceillant des émigrés ingenieurs.

CONCULATION

On observe depuis quelques années un certain accroissement des effectifs féminins,dans les formation scientifiques et techniques,et ce développement autorise des espoirs sur la carriére que ces femmes feront dans l'avenir.

Cependant,il faut reconnaitre que seule une detite minorité de femmes ingénieurs et scientifiques accede á des postes de responsabilite élevee ferme pour certaines,par le manqué de mobilitéou par le nivear de formation et par la résistance des homes ,pour d'autres,par leur propreréticence,par les conflits poses par leur via privée et professionnelle, et par le manqué de solidarité entr'elles.Toutes les etudes faites par la commission nous ont conduit á émettre une série de voeux:

Les raisons invoauées pour pour expliquer cette situation ont conduit la commission á émettre une série de voeux:

- Que les etudes soient rigoureusement les mémes pour les garcons et les filles,dons tous les pays, et.que si possible, l’ enseignement soit mixte
- Que les femmes ingénieurs et scientifiques s’ efforcent de developer l’ information sur les sciences.
- Que les professeurs de mathématiques et de physique soient bien infotmés sur carriers scientifioues et techniques ouvertes aux femmes.
- Que l’initiation aux sciences et aux travaux de l’ inqénieur intervienne dans les programmes assez tôt ppur éclairer les choix d’ orientation des éléves
- Que les femmes aient la volanté de fairs carriére
- Que les femmes en cours de carriére pratiquent entre elles une solidarité active.
- Que les femmes refusent le benefice de mesure discriminatoire : les formulas d’ aménagement du travail doivent être prises dans l’ intérét des hommes aussi bien que des femmes.
- Que les femmes ingénieurs interrompant leyr travail pour raisons familiales veillent á entretenir par tous les moyens existants,leur savoir technique et une culture personnelle.

GRANDE BRETAGNE COMMISSION N^0 3

EDUCATION OF THE YOUNG ENGINEER

Mrs. **G.A HOWARD** member of engineering faculty
Of Cambridge university

First of all, something about who I am and how it is that I am entitled to speak

For some years I have worked with the women's engineering society-advising girls how to become engineers – I have talked at school conference and debates, chaired university careers conferences and spoken at international conferences for the council of international contact (at these conferences, 500 young people who have gained university entrance and are in this vocation gather together in London every August –250 from overseas and the remainder from the U.K)

I am now working for Cambridge University advising engineering undergraduates on their careers, and because it is my job at Cambridge I shell inevitably emphasise the problems of training and experience as it affects the types of people who come to Cambridge to read Engineering and metallurgy. These are bright young people with good track records –88% in our first year had better than 2 'A's and 'B' at 'A' level –this is a high standard.

In 1902 the University of Cambridge started its careers advisory service, the Appointments Board, similar to the idea began by Oxford University in 1892, the setting up of these bodies was the result of the changing

The original universities and their colleges were founded by monarchs and the church to provide them with staff for their administrations. Later colleges were founded by others seeking immortality, and the future was more or less predestined when students graduated- into the church, the law, or back to their father's estates, which all occupied their time so exclusively that any use of their learning become little more than a hobby.

Men who did not go to University usually followed their father's crafts, joining guilds after apprenticeships of some 5 years of major, so here again the pattern of a predestined output appeared, plus some migration upwards-if that is the word-towards more learned occupations.

The idea of learning for it's own sake" was a product of the later 19th century and produced men and women who were less willing to accept a predetermined future; an attitude which is now to be found all over the world due, in great part, to the influence of the British Empire.

Since the first world war there have been increases in opportunities for education; a rapid change in the skill a demanded by industry and society- and a consequent need for much closer guidance of young people, there is a shortage of engineers, therefore a need to catch them young, so that from an early age children are steered in the right direction, Engineering is not a subject which can be picked up late in one's education; it required a sound grounding beyond the there R's of writing, reading and arithmetic.

This does not mean that they need know nothing else; a good engineer is a rounded person having many interests and a wide understanding, yet it is amazing how poorly schools advise boys and girls –poorly, and often too late – although there are in England at least two charitable societies who endeavour to improve the knowledge and image of engineering in schools.

I am sure you know the Oscar Wilde play “The importance of being Ernest” –in this play, when lady bracknell first meets the hero she is deeply interested in his background and parentage, and in the same way, to discover the fundamental pedigree of a good engineer we must know what sort of person he/she i.e. how and in what he/she has been trained and, very important, what is going to be his or her work place.

In a conference of this kind all of us attending have some experience of the sharp end of the engineering business. True, the older we get the less we remember what that first day of walking into a factory was like, yet we do retain some sort of recollection – but boys or girls at school probably have never even done a holiday job when they are asked to decide what ‘O’ level or metric subjects to choose (this in the English system is the first major examination taken between the ages of 15-17). With the choice of sixth – form subjects the die is east, yet these last two years before entering a university or starting profession and technical training are crucial.

But in general in the U.K., knowledge of the engineering industry in schools is poor. Engineering at all levels is now demanding higher standards of technical achievement with a correspondingly lower demand for skill of hand.so we find, on the one hand, the traditional craftsman with his sons following him is a dying tradition, and on the other hand an increasing demand from industry for greater technical achievement in its new entrants, a demand which has not been met by the schools, whose offerings of Greek dancing and nature trails are unlikely to produce skills fundamental to the budding engineer. There are various schemas in hand to improve the knowledge of industry in the outside world; films, TV programmes, schools visits, courses for career advisers and government encouragement. in Cambridge, we have a member of the women’s Engineering society, a civil engineer who is supported by the city guild of clothmakers , to talk to the schools, particularly girl’s school, about job opportunities in engineering.

Why is there this lack of knowledge, a problem of to day and not of yesterday? I suggest that at least in part it is due to the following:

Firstly, unemployment. It is difficult enough to find work, let alone holiday jobs. Unemployment also leaves a shortage of apprentice training places and the trades unions are not falling over themselves to allow school children and undergraduates to gain work experience in the vacations.

Secondly, the work place is changing – automation, computer-aided design, new Acts on safety and employment all help to change the old pattera.

Thirdly, the personnel are changing. The workman who took a train or coach to the nearest seaside for a two-week holiday, now hops on his character flight and relaxes in the sun by a swimming pool in a manner which only filmstars did 40 year ago. Even the older trade union leaders have been heard to remark, sadly, that they are no longer pressing for a living wage but for the second TV set, while the newer trade union leaders have their butlers and chauffeurs, although even this picture has change recently with unemployment, and a more realistic attitude has taken over.it will be

Interesting, to see how the change in attitude develops when those new out of work go back, as unemployment reduces. To increase the number of engineers, and particularly women engineers it is important that an up to date and accurate image gets to the young people at school

Let us now take another look at training, and consider how we, as older engineers, can help. At junior schools or up to the age of 13/14, we can talk to Parent Teacher Associations through school governors, professional bodies and local Education Authorities. This to help to ensure that teachers know what industry is about. it the moment the image of the engineer is in a "Grey" area.

Some British firms have? - Or 3-day courses for careers advisers from

All types of educational establishments. During a management exercise on one such course, a rather interesting incident occurred. For two members of the syndicate the exercise was what they had expected, but a third a teacher, commented that 'This is ridiculous, no nobody works at this pace." She was told one of the facts of life – "You have obviously never been a Staff Officer in the army. Equally well we could say, "you have not been an engineer in a production line job.

On n TV programme concerning engineers it was reported that a teacher had 'encouraged' her child to visit an engineering exhibition with the remark, 'Now you will see what sort of job you'll get if you do not pass your exams.'

Teachers are not, of course, all like these examples, but almost all of them do have one thing in common - they have never worked at anything; other than teaching and so they have rarely been in competition with their own age group in an industrial situation and have not worked the long hours and had the short holidays of the normal engineer. It is because of this background that engineering guidance is most needed in schools. It would be desirable if a regular exchange of teachers and staff in industry could be arranged,. To be realistic, this would be almost impossible in this time of unemployment, but I am happy to report that the Institution of Mechanical Engineers and the institution of Electrical Engineers in the U. K. have jointly started a fund for "Teacher Fellowships in engineering". This will permit teachers to enjoy. At first hand, the experience of what industry is all about, and to use the knowledge they will gain to enhance their teaching techniques. 060,000 has been put aside to Cover the first three years.

Assuming, then that. The right subjects are being studied from 14 years onwards, and an interest in an engineering course has been stimulated, what then? The teachers and pupils must be helped to choose the right courses. The pupil may have a preference for a certain type of engineering, but have no real knowledge of what it means. It is here that we can help by being prepared to spend our own time talking to young people at home or at school, giving the time. That is needed to show them what it is really like en the job.

Together with their teachers, children should be helped to pick the right academic level of training, and here the weakness of many schools in month. Becomes apparent. Mathematics is essential for engineering the level of competence will largely determine the nature of the engineering course and, while some schools have gone in for modern maths, it unfortunately. Does not necessarily fellow, that this will give a potential engineer the right start for an engineering course. It is at this stage that the professional institutions can help by locating possible sponsors, arranging work visit, vacation work and generally preparing the embryo Engineer for the first part of his/her professional course. I am now talking about work experience.

In the UK, very few students pay for themselves; anyone with a certain entrance standard is entitled to a state grant; but in practice this standard is less than that required for entry to a University or a degree course. All grants for further education are subject to a means test of parents' or spouses' income, and therefore there are few cases where students are, in fact paid for privately. All our countries are in desperate need of good engineers and technicians and we, as professional engineers, must try to ensure that no one fails to complete training because of lack of funds; fortunately, many firms is the UK offer sponsorships for boys and girls, so f they have had the opportunity to learn about industry and firms at school. They should then be able to take a course for which they are well prepared.

At Cambridge there is usually nine-month Gap between leaving school, passing; the entrance examination, and coming up to University for the first time. If this period could be spent in an engineering works the Student would have a better appreciation of the theory of the course, also individuals could get the two four-week periods of practical training which is a compulsory part of the Cambridge course. This is not a one-sided bargain. As I point out to employer, they get a long interview with a possible new member of staff, and the equally the individual gets a good look at n potential future employer. If either side finds it is not for them, that is fine no one is hurt. The Army have a. phrase 'Look at Life'. This is a good description of work experience.

The engineering institutions have evolved 'industrial Tutors' to help trainees. Here again the established engineer can help by taking a friendly interest in a newly qualified engineer joining the staff - not to smother, but gently support. Let it not be said of any organization we work for that 'they stuck me in a corner' and took no internet in that I was doing nor could I see my end result.' The young man who told me this happened to him was, completely disillusioned about that firm.

It is not my intention to discuss personal relationships, nor the specialized training within an industry, except. In the context of change and innovation. There is to-day more change in old sometimes in new industries than at any time since the industrial revolution. The boiler has almost disappeared from ship; for propulsion the steam turbine has been, replaced by the diesel and the gas turbine; hundreds of men digging out civil engineering works are replaced by a few large machines; the spit of the steel man has been replaced by solid state instruments. The adage 'one cannot teach an old dog new tricks' is not one that engineers can support. They have a professional duty to learn, and to teach those techniques and skills, which make economic sense to day.

All this requires time, planning and money. The professions Institutions are providing a valuable service in this respect, but now much of this service is known and valued? Far too often one hears the expression 'What is the point of being a member of the institution of x, y or z?' Yet, for some, attending: and speaking at conferences has almost become industry in itself.

For the sake of the young, we must support the schools, go that bright and not-so-bright see how the work at school has relevance to world of earning a living. For the not so young we must help those who wish to widen their engineering knowledge.

At Cambridge we attempt to implement some of these in the following ways: -

Undergraduate's study for the Cambridge engineering Tripos graduate as mechanical, electrical, aeronautical or chemical engineers as a result of the various options available in their final year, or in the case of chemical engineers their final two years. Some 300 per year, as well as engineers, I look after, material scientists and metallurgists, another 50 per year on average. In one year some 350 men and women come to me to talk about what best to do with their qualifications, or what qualifications they might need in addition to the ones they have.

Some 20% of these graduating are already sponsored by industry and know what they graduate, but quite a number start out thinking; they know what they want, then with experience decide it is not right for them and come in to talk about switching in mid-stream. This is to be encouraged, since it is pointless to go on with a course if you find it boring, or if you decide it will not use your whole potential in the future. In these days, also, it is by no means sure that sponsored young people will be offered employment when they graduate. The firm may not have room for them, so they need information on other job opportunities and careers available. In the last 2 years I have interviewed at the rate of 200 during an 8-week Michaelmas or Lent term, and about 100 during the Easter term, making a total including second interviews of around 500.

In addition I see and visit about 30 employers per year and see representatives of another 50-60 when they come to interview candidates. During the Lent term we have a total of some 200 employers visiting the University, and I see as many as possible of those.

I continue to take an interest in those still at school who are planning to come up to university; indeed I chaired a conference of school-leavers last September when we told them, by way of interviews and films, what industry was like. I have chaired debated between industry, representatives of trades unions and sixth-formers themselves. Talking to those taking the course, and who perhaps are not too sure yet of the options to take, it become increasingly clear that one cannot start too young to learn about engineers and engineering.

As I expect you know in Cambridge, many men's colleges have now opened their doors to women students and in return women's colleges are admitting men-which may sound confusing, particularly when you think that a few poor exam results could confuse the issue even more-but I am happy to say that we do have some very unconfused women engineers women engineers studying at Cambridge.

In February; 1978, Girton College, Cambridge, was hostess to all the girls who are reading engineering at Cambridge at the women-42 in all. It was interesting to see how they had heard about engineering in the first place; exactly 50% because they had a father (14) or a near relation (6) to tell then about it. The rest had picked up the information in a rather haphazard way so haphazard; in fact, that it was almost impossible to envisage how they ever came to be doing engineering in the first place.

All the girls were very well aware of the problems they had recently had to face in getting the right 'A' level subjects to gain a university entrance, this, in girls ' schools, is again a very haphazard undertaking although the majority of independent schools were batten than the state school. In theory, pupils at state comprehensive schools can follow any subject of their choice, but it is a fact of life that the girls tend to be steered into the arts subjects and the boys into the sciences.

Other problems included lack of teaching expertise in physics, particularly physics for engineer and in mathematics - again particularly mathematics for engineers. Engineering drawing an a subject was almost non-existent in girls' schools, which again gives rice to problems. A surprising number had actually changed schools in the sixth form, in order to study The right subjects at ‘A’ level – some 15-20%.

An I have already mentioned, 38% of first-year engineering Cambridge (men and women) starting in October, 1977, had, 2’A’s plus 1’B’ at ‘A’ level or higher, which indicates the standard of entry. Gives girls a higher target to aim for.

Many people will say that one of the special problem facing women engineer in is that they do, of course, tend to get married and they do stop work to have children, so that to come back into the profession they frequently need refresher courses. To put this into context, as the numbers are rather less than .1 of 1%, or one in one thousand, the numbers requiring re-training are never likely to be terribly high. It is therefore envisaged that it will frequently be passable for individuals to make their own arrangement with a local. University to “sit in” on lectures and, if the financial cover can be arranged. No doubt they could get supervisions and tutorials as well Many married members of the women’s engineering Society have been able to study at home with the Open university.

The conclusion we drew from this meeting was that there is a need for career advice at school. For l3-year-olds in particular, as this is the age at which children have to decide what they are going to do for ‘O’ and ‘A’ levels they have to be in the right steam or either arts or sciences from this time on. This is the point where they need guidance, and a straight forward method where they can obtain information on the opportunist and the educational, requirement to follow their chosen profession

We all know the need for publicity to overcome the prejudice against the engineering profession. Everyone in engineering is concerned at the low public image, and women engineers in particular have cause for concern in this respect.

Finally, may I say a little about the difference between the UK and France and Germany as far as the University undergraduate reading engineering is concerned? After all with the European Common market, we are all in it together.

Taking the problems in date order, a colleague of mine attended a German Conference in December 1977. The theme was the development trends in industry .Can we call it de-industrialization? The problems to be faced arc unemployment in some fields and in some places.

In Germany the subject at work is strongly linked with the discipline that the undergraduate studies. They tend to specialize in a narrow field. No one will wish to argue against the need for good Hell-trained engineers, But my colleague was greeted with polite astonishment when he said hoe flexible the British philosophy was in training the young person to the point of accepting, say, the arts graduate as a trainee production manager. They felt it could not possibly work here! What is our system? In engineering itself, for example, we cover the basic principles in great detail during the first 2 years of the engineering course. This is duplicated in the science faculty as well as engineering. This brand-based foundation gives the individual the ability to learn fast in the real situation inter. He/she knows where to look for further knowledge. In the final year potential engineers study 4 out of 31 options so that they can specialize in civil, mechanical, electrical, aeronautical or chemical engineering.

Whereas we find the continental training to be too rigid, we believe that a trained mind can accept different situations, and resolve problems as they arise.It can acquire new skills from the new situation.

Obviously we cannot concede that an historian can become a brain surgeon, on even that history is the ideal training for production management, but some historians, are very numerate and do become very good production managers in industry. It is not necessary to extol the virtues of this flexibility when coping with a fluctuating job market.

Finally may I refer to our hostess nation? In France the extremely able get high-level training in the grander ecoles. Industry in France will look askance at a University graduate. These go to become teachers, doctors, and lawyers. Industry recruits from the grenade ecoles, which are highly selective and again offer prestige to those who can make the grade. French universities are not selective. Anyone can go. Inevitably other means are found to decide who industry selects for work.

We feel that our strength is in enabling people to adapt to the needs of industry. Do you agree or do you think we should consider your way of thinking? I'shall be interested to hear.

Gwendojen Howard, Bunty to her friends, is a graduate of Laughborough University, camberley Staff College and Senior management course - Chartered Mechanical engineer. Spent 20 years with the Royal Electrical and Mechanical engineers. A short time in private Industry Now Assistant Secretary to the University of Cambridge Careers Service (formerly the Cambridge University appointment Board). Advises a yearly-graduating group of some 350 first and second-degree men and women qualifying as engineers, Chemical engineers and metallurgists. has constant contact with senior management of British and American companies concerning graduate recruitment and training. Member of Cambridge University military Education committee, and the industrial tribunal panel of England and Wales. A is committee member of the southern branch of the institution of mechanical engineering.past president of the women's engineering society. Member of the engineering faculty of Cambridge University.

CAREER GUIDANCE: A SIGNIFICANT FACTOR IN OPENING ENGINEERING TO WOXEN

BY **charmaine Wisniewski,**
Cincinnati, Ohio, U.S.A.

During the 70's, the women's movement for equal opportunity has made significant strides. In relation to these advancements, many formerly ”male only” occupations and careers have opened up for women. A positive climate exists today where women are encouraged to develop themselves and to make significant contribution to today society.

Though many barriers to women development are falling, many remain moat societies still subconsciously think of women as the “weaker sex" and Continue. To cast them in traditionally feminine roles. This will continue unless accurate information is assembled and disseminated to the masses. Somewhere in this information should be the message that engineering and science are feasible career choices for women

Career counseling or career guidance plays a significant role in opening up however, early guidance is of more potential benefit to women than men. Female role-modulo, i.e.-viable practicing examples of women engineers, are not nearly as abundant as male role models. A little boy has many resources to draw from -- maybe a father, brother, or uncle who is an engineer, a practicing males engineer in the community.or a male engineer he reada about in a book or a magazine. Whereas a little girl will find a growing number of female engineer role models that are still few and far between. She is confronted by a world full of women who are housewives and.

And mothers, teachers and nurses, secretaries and stewardesses. Hance, her career choices seem predetermined by what she is most familiar with—a woman is traditionally female occupations.

Career counseling can help alleviate this stereotyping by making people aware of the opportunities available in today's world. Career guidance should not be restricted to high school or college students1. But should be a continuous process throughout a person's life.parents play an influential role in developing a child's idea about what people do. Pre-Schooler are shaped by all that they come in contact with—storybook, toys, television, movies, people.unfortunately, these all have programmed little girls for career choices that relate not to individuality or personality or capability, but to their sex. Girls are given dolls, teapote, and sewing kits; boys are given tool kite, erector sets, and trains.non-sexist toys are needed, as well as stories which show girls actively and intelligently participating in adventures. A recent Stanford study [2] asked;" what kind of role does the female play in the world of children's literature?" they found that the few females that did appear were most noteworthy for what they did not do.

As a child older, the sex roles become even clearer. If a young boy shows an interest in mathematics, he is encouraged to become an engineer; for a girl with the same interest, she is usually told that she might want to consider teaching, so that she will have, quote,", an interesting job to fall back on in case-god forbid-she should ever have to support herself."

1/ Throughout this paper, high school aged refers to the ages 14-17 and college-aged to 18-22

2/ Sandra L.Bera & Daryl J.Bern, Dept.of psychology, Stanford university, "Homogenizing the American Women: the power of an Unconscious ideology" (October 1972)

Whereas parent: and society are the influences in a young child's life, school becomes an increasing factor in their development lie the child gets older. Children should really have same ides or what they want to do by the time they are in high school. Only then can they take the course necessary for their career choices.

In recent years, the Society of women Engineers (SWE) Las done much guidance work which was aimed at these groups many seminars, conferences, and summer, programs have been held to acquaint both sexes with engineering. From these many publications were developed?

A milestone for women engineers was set back in August 1973, at the Henniker III Conference, “Career Guidance for women Entering engineering”. This was a join engineering conference whose goal was to inform young women that engineering is a perfectly reasonable career for them to pursue, particularly if they have a natural bent in that direction. Role models were presented in the form of practicing women engineers who were enjoying successful careers in industry, government, or academia. Guidance counselors and women from the Federal government who were involved in equal opportunity were also part of the program. The proceedings and ramifications of this conference are now invaluable; in promoting women in engineering.

The college students who attended Henniker III enthusiastically spread the wore to high school girls in their state by organizing “mini-Henniker’s”. These program varied from one-day seminars to week-long institetes. the most popular form proved to be a two or three day conference which was desiened to expose high school girls to the many facets of an engineering career. The emphasis was on personal contact with engineering students. Recent graduates, practicingen engineers, and representatives of government and industries employing women.

One of the first successful conferences was held at the University of Illinois in October 1973, and has been repeated biannually since .it is typical of the many such conferences that have been held over the past few years. Currently, almost all of the Student Society of women Engineer Sections have held such a conference and are conducting ongoing career guidance work. Such a conference world.

- Inform the general public of opportunities for, and the acceptance of, Women in the engineering profession.

- Acquaint high schoo1 teachers and counselors with these opportunities for young, women.

- Identify high school age, women students potentially capable and interested in the study of engineering.

- Provide currently enrolled women engineering students with a greater self-identity through an active participation program.

- Develop and accumulate materials that could be used to inform women of the career potential of engineering.

The program of such a conference may have anywhere from five. to twenty practicing women engineers participating formally or informally? Programs usually consist of

- Luncheon or banquet speakers who are usually prominent women engineers. Topics can cover a description of the speaker‘s life, a technical subject such as solar energy, or words of advice on how to get ahead in a man’s world.

- Contact session which usually feature a practicing, women engineer making a brief presentation to a shall group of students, which to then followed by questions..

- Alumni panels which are common since many of the conferences are put on by universities. This is a small group (no more than 5-6) of graduate with different majors who have been successful in their post-graduate endeavors.

- Student panels which give the younger high school girls a flavor for college life and answer questions on being woman-engineering student.

Campus tours, which feature a general tour of the campus to better, acquaint and interest the high school student in the particular university. Technical demonstration in areas like nuclear engineering cryogenics, solar energy, or biomedical engineering are often given as part of this tour to further Increase the interest in science and engineering.

Conferences such as these are spreading the word that engineering is a viable and perfectly reasonable career for a woman to peruse. Increase is the numbers of women enrolling in engineering have been recorded over the Past few years. Five year ago women made up an average of 4% of all engineering student and less than 2% of all précising engineers Currently, women make up about 10% of all engineering student, with some schools reporting that their entering freshmen class is 20% women. thus come progress has been made in getting women into engineering, but there is still a long way to go to folly integrate them into the engineering profession.

As the level of technology exponentially increases, more and more engineers will be needed to balance the advances of technology with the needs of the material and social environment to make the world better place to live in. if over half the brainpower in the world-women-were excluded from this service to society, that would surely constitute a shameful waste of a much needed resources. Resources are most profitable when properly developed obligations to future generations make the proper guidance and development of women as contributing members of society a must.

SPARKING INTEREST OF HIGH SCHOOL GIRLS IN SCIENCE & ENGINEERING

Betty P. PREECE
Melbourne High School
Florida - USA

INTRODUCTION

For the past four years the physics teacher author and chemistry teacher, both women, at Melbourne High School, Melbourne, Florida, USA, have carried out a program to acquaint students with careers, related to engineering and the physical sciences, where good opportunities were projected. This program was purely selfish its purposes were to counterattack declining physics and chemistry enrollment which occurring locally as a result of drastic cutbacks in the United States space activities.

These programs were neither intended to be nor carried put primarily for girls. However, whenever equally qualified men and women were available, women were chosen to represent engineers and physical scientists. Although girls probably benefited more from these roles models, boys certainly received some benefits from seeing successful women in non-traditional careers.

Melbourne High School and Its Curriculum. In the late 1950's, Principal Dr. B. Frenk Brown brought considerable attention to Melbourne High School by changing from the traditional sequential secondary school curriculum to one which was non-graded and multi-phased.[1] This means, simply that students can take any courses offered for which they themselves feel prepared, regardless of their own year in school. Non-graded classes can and usually do, contain tenth, eleventh and twelfth year students. The classes are set up along ability and prior knowledge levels called "phases". For example, phase 3 classes are designed for students of average abilities and background knowledge. Phase 1 and phase 2 classes accommodate students who need more emphasis on basic skills, usually characterized by reading levels two or more years below normal.

In the other direction, phase 4 classes are for student preparing for college while phase 5 students actually take college-level courses in high school. Above these are the "Quest" level creative students who independently study a research topic of interest under a faculty preceptor.

This phasing has made it possible to accommodate several different levels of students by scheduling chemistry I and physics I for both phases 3 and 4; chemistry II at phases 5; physical science for phase 2. Some students have taken physics II through the Quest level program. Offering these classes in this way somas to encourage many students to take physics and chemistry who otherwise would avoid them as being "too difficult".

Melbourne high enrollments. The character of the community firm which Melbourne high draws its students originally was primarily rural agricultural until the united states opened in 1949 the joint Long range proving ground, which later become the eastern test range of the united state Air force, combined in a few years with the beginning of mercury, gomini, Apollo and other national aeronautics and space administration (NNNASA) activities at Kennedy space center. The surrounding community itself rapidly changed to an overwhelmingly technical one.

Then in the early 1970’s, with the wind-down of space activities after the Apollo program ended, other drastic changes occurred. At one time or another, the lives of at least 60% to 70% of the students at Melbourne high were affected by parents, who were out of work for long periods of time; parents, unable to find work locally, who left the community to work elsewhere while families remained here; former membera of the technical community who wars faced to accept much lower level work, of ten in fields unrelated to their technical training; local business which felt the impact of greatly reduced purchasing power of the community..

Throughout the USA member of the technical community were frantically trying to apply space technology to the energy and environmental problem, which were gaining attention. But, job opportunities, were agonizingly slow to materialize. Thousand of formers engineer, scientists and technical employees and their families bitterly rejected engineering and science careers, at Melbourne High, student reacted by avoiding Courses in physics, chemistry and math which could lead to such career Enrollments declined. The physics teacher and the chemistry teacher sought ways to convinces student that meaningful opportunities for such careers still did exist and, more importantly, that many new ones were developing. Their efforts are described below in the two parts, program which evolved

- The active programs, which very planned and carried out by the sponsor teachers.
- The supplemental programs, mostly provide by or through outside organization, in which Melbourne high students were encourage to participles.

PART I THE ACTIVE PROGRAMS

1971-75. During the summer of 19 74 the physics teacher author had taken a summer course at the department of nuclear engineering, university of Florida, it had explored the technical, environmental and social consideration of nuclear power generation to provide secondary school teachers with materials for classroom use. From this came an expended awareness of the many areas of new technology, which were under development within the state of Florida. The physics and chemistry teachers wanted to share this encouraging information with student. Thus was born the first activity specifically designed to increase the physical science class enrollments at Melbourne high-the symposia on Energy sources and their application in florid.

Companies responding to invitations to participles were University of Miami on hydrogen Fuel, Florid Power Corporation on Nuclear and fossil fuel generating Plants at Crystal River; offshore Power System, inc., on power plants located in the Atlantic Ocean; Florida International University on 1t’s new two- and four-year engineering technology degrees and Florida Institutes of Technology on It’s new Environmental Engineering degree. Films on energy from NASA And the Atmole energy commission were wade available to science teachers. Physical and biological science classes of all level from phases 2 upward participated. Interest of student high because few had much knowledge of these new technologies.

As a follow up the physics and chemistry classes made a field trip to Florida power and Light Company's Hutchinson’s island nuclear plant. Students donned hard hats as company engineers guided them through the site. Since, loading of the nuclear fuel was only a few weeks away, students had a once in a –lifetime opportunity to go done into the reactor pit and then upward to the cat walk just under the done of the containment vessel.

In January 1975, phase 2 physical science students participated in a careers familiarization unit -carried out by the author. The school occupation specialist, and a county career specialist. Selected career films and activities were used to help these students become aware of their abilities and interests as well as of science related Careers at their Capability levels. a field trip to see space activities at Kennedy Space Center offered practical observations of technical work.

1975-76. In the fall or 1975, an enlarged physical Science Careers symposium presented over fifty separate one-hour programs in two days at Melbourne high. The sponsor teachers were assisted by the school occupational specialist in planning and carrying out the symposium. Some of the programs included were; semiconductor, water treatment, food from sea plants and animals, building trades. Technical writing, quality control, women is engineering, astronomy, engineering, physics, chemistry, firefighting, nucleare engineering, meleorology, photogrammetry, aviation, Florida energy resources, agricultural engineering, medical and x-ray technical, computers, solar-energy. At least fifty men and women of the local technical, academic and industrial communities were delighted to have this opportunity to interact with interested students. The sponsor teachers felt that this program was effective in engineering students with many new and old careers open to them.

In April, 1976, a trip to the technical facilities of the USAF Eastern test range was made by math, chemistry and physics student,. They spent a full day touring and communications installations, technical computers, film processing and optical labs, and drafting rooms. Students were interested in seeing both what technical personnel did on their jobs and how science was applied to range-to-range needs. Many students even saw for the first time the equipment on which there own parents and worked.

Later in the yea, the phase 2 physical science students visited “Third century America.” The Bicentennial space exhibit at Kennedy Space center. Many science careers and application were obvious to them in the hands-on exhibits

1976-77. To reduce the work involved in the previous year's programs, the sponsor teachers decided that the 1976 Physical Science Careers Symposium would be limited to one program per class period for just two days. Two criteria used to select topic 1) areas not. Directly covered by regular Melbourml High classes 2) areas on which the sponsor teachers had had many student request for information.

The speakers, were asked to describe their educational preparation, career activities and present work, and to suggest what career opportunities sight be forecast for their fields. Many brought working demonstrations, slides movies, and free information. They were candid about how likely it would be for students to find work in these areas and also rather encouraging about the future job outlook. The programs were specifically tailored for physics and chemistry students although many others attended. Some of the topics were searching for energy in North America, lasers and holograms, astronomy and energy, chemistry—old and new semiconductor design: oceanography, computer design and use, resources technology satellites, energy simulators, engineering.

As part of Engineers' Week in February 1977, Florida Institute or Technology invited local high school students to tour its Melbourne campus. Physics and chemistry students took advantage of the opportunity to see lasers, pollution detection equipment, computers, and semiconductors. Hi-fi equipment.

1977-78 after three years of involved science career activities, the sponsor teachers. Planned 1977-78 activities to consist of one special program each six week of the school year. In the first program, Florida Institute of Technology students in Eta Kappa Nu, the electrical engineering honorary, taught science students to operate pocket calculators. The second program was a discuasicn of CAT X-ray equipment. The neurologist showed slides of normal and abnormal body parts, than discoursed his diagnosis treatment end results.

The third program was traveling science lecture-demonstration on energy presented by a young woman with the US Energy research and Development administrates.

Then, early in 1978, the Melbourne High occupational specialist asked for assistance with planning careers activities during Vocational Education week in February. Over forty different programs were presented to students of all phases during that week in addition to a full day of programe on auto mechanics and small engine repair. Some ware: mechanical and electrical engineering solar energy, women in engineering and science, telephone engineers and technicians, math, chemistry, physics, armed forces technical careers, co-op and minority I programs with NASA and the federal government medicine and medical technology two and four years technology degrees, science research.

For the first time, this year students were asked to evaluate each program at its conclusion. Two questions were asked: Did this program provide you with useful information? Did it help you make a career decision? Nearly all students responded, “yes” to the first question, and about half answered that the Program had been useful in some way. Some discovered specific careers, which they fled where unsuitable for them.

A definite difference in the program this year was the positive outlook for job in engineering and physical science. Apparently this reflects the general improvement in job opportunities that employment ads in the newspaper lndicato. In addition, both students and teachers were very surprised by need most speakers stressed for students to get fundamental knowledge of math, science and English in high school.

In February 1976, Florida Institute of Technology again invited students to Engineer's Week open house. Members of student technical. Societies on campus, including the Society of Women engineers, guided tours to a wind tunnel internal combustion engine lab, pressure vessels for deposes testing, polarized light stress tests, and computers.

Evaluation of the Active Program. What evaluation has been made or the effectiveness of these career guidance programs? Until this year, nothing specific. Special permission was obtained to include such an evaluation in the spring 1978 mailings mandated by Florida law to graduate and early- leavers. Two separate mailing are made: one to all students who complete a vocational program (such as auto-mechanics or work-study) and a second to a 10% sampling of all other students. Through these, the schools try to evaluate the effectiveness of various curricula, vocational programs counseling. The special questionnaire this year asked; while at Marlboro high did you select or change your Career objectives? . How many of the special careers in physical science programs did you attend? Did these programs help you with career decisions? Because many students did not. Fully complete the questions, the results where not as valuable as had been expected.

Of all those who responde, 23% said they had attended a physical science career program and 50% of those felt the programs had been valuable in making career decisions; 55% reported they did not attend any program; and 18 % could not remember whether or not they had attended any programs. Students to whom those questionnaires were sent had graduated in June 1977,and so had not participated in the 1978 activities. It had been estimated that perhaps 30% to 40% of the Melbourne high students attended at least one careers program during the pervious those years; therefore, having 23% respond that they had attended seemed at least reasonable. Further questions will be asked of this year’s class in spring 1979.

Apparently those who did attend found that talking with members of the technical, professional, academic and business communities of Florida about their career preparations, duties and future expectations; becoming aware of many new and old applications of physical sciences and engineering in a variety of work situations; exploring their own career interests and abilities; and discovering how physical science backgrounds and enabling engineers and scientists to adapt to work in many others areas had all been useful. Perhaps most useful of all was that they learned that challenging engineering and physical science careers are open to those who prepare for them.

PART II THE SUPPLEMENTAL PROGRAMS

The supplemental programs, which were available to Melbourne High School students, covered many different activities. Participation of girls in all of these was strongly encouraged by the sponsor teachers and by guidance counselors. It is difficult to divide these activities into specific categories. Some were available by educational institutions, industry, or government. The descriptions follow these categories.

Program within Melbourne high. Included in the program available to students who cannot them were.

Independent study, students may spend one period a day for a whole or half year in independent study of a science problem, either through literature search leading to a scientific paper and oral seminar or through doing actual research in a lab. A faculty member serves as a preceptor to guide the student in the work. This has also permitted the author to teach physics at the college sophomore level to a group too small for a regularly scheduled class.

Inquire program, a student who has completed all graduation requirements to that point may elect to spend the last 6 or 12 weeks of his senior year studying full-time a particular topic under guidance of a professional in the community. Many select science topics for research.

Science research class. Scheduled classes to teach students the fundamentals of science research are a part of the regular curriculum is most of schools in our country. The country pays the teacher small supplemental salary and allocated some funds for each research unit in a school. Many students begin this program as early as the 6^{th} year and continue through the 12^{th} year. Members of the academic and technical community of ten serve as resource persons. And also permit student to use their facilities. For each of the past four year, enrollment at Melbourne high as been at least 35 in science research and, until this past year, has include at least one class in research in the physical sciences. Declining school enrollments will leave only two research classes, both taught by biology teachers.

The format is much the same at all levels of science research but the complexity at the research depends on the student's ability and previous research. Each student plans and carries out a research project, analyses the data and attempts to support hypotheses. In addition, each student must enter at least three of the four related science contours each year. Many Melbourne girls participate and are top-level winners, although not many enter in the physical science categories.

The regional science and engineering fair. the student competes with other county students for awards of money, equipment, scholarships and opportunities to be a representative to the international science and engineering fair, similar awards there are for money, scholarships and equipment as well as trips and summer employment.

2. The Regional talent search. The student presents an oral seminar about his/her research project and answers, questions from the judges. Regional winners compete. In the Florida state Talent Search for scholarships. About half of those entering from Melbourne light are girls.

3. The Florida Junior Academy of science. Each student orally presents either a literature search paper or it paper on an experimental science project. The winner goes to the Florida state Talent Search to compete. Again, about half those entering are girls.

4. Westinghouse talent search. Twelfth year student submit a written report on their previous research along with scholarship records and teacher recommendations. Westinghouse electric corporation provides the funds for the national science foundation to administer the program which awards full scholarship for up to four college years. Final selection of the winners is made after the finalists are interviewed by a prestigious board of national engineers and scientists. In each of the previous two years, a Melbourne girls has reached the finals and one took national third place in biology.

d. Summer research. As a part of its summer academic program, Melbourne High offers science research. For six weeks, students every out the some activities as during the regular year. Usually half or more of the students are girls. During the summer of 1977, the author organized and taught. The first. Class specifically for physical science research

e. Holiday Engineering seminars, Just before the Christmas holiday, former local high school girls (and some boys) are invited by the author to meet informally with interested Melbourne High students to “tell it like it is” in engineering college, Both boys and girls attend and often volunteer to return themselves when they get to college.

f. Open House. An Open House was held in the spring of 1978, in which the community was given opportunities to evaluate curricula, facilities and faculty at Melbourne High. Physics and chemistry demonstrations and a slide/ tape program on the physical Science Career Symposia as well as the 8" reflecting telescope built by the author’s Astronomy club played a prominent part.

g. Rocketry for a number of years, physics and phase 2 physical science students in the author’s classes have built model rockets, designed and constructed firing and tracking equipment, fired the rockets, and analyzed the data. While boys equally build the fanciest rockets, many girls excel in designing and building range equipment and in collecting and analyzing data. Girls who had never engaged in anything that resembled “engineering” found the rocketry projects fascinating

Educational Institutions

College and Universities- Both Florid institute of technology (FIT) and Brevard Community College (BCC) campuses are located near Melbourne light. Through special early admissions programs Melbourne students may complete secondary school graduation requirements while taking one or more college courses and earning credit. BCC impart of the Florida State university system and offers two-year associate degrees 1n the arts and in the technology. High school student there pay fees and receive credits like other BCC students

FIT is a private university offering degree in engineering, science and technology at all levels from Associate through Doctoral. Each term. FIT permits highly qualified secondary students to take c1aese:, at no cost should the student wish credit sent to any calling them or later, he simply pays the fees.. Some Melbourne High students have advanced to sophomore level math and science courses by the time of their high school graduation

Summer Programs. A number of summer programmes at universities are offered in engineering, math and science. In act, National Science Foundation publishes a booklet each year listing over a hundred summer programs, which it funds; there are many others funded wholly or partially by universities themselves. Normally students who have completed the eleventh year are selected primarily on the basis of their previous math and science records. The sessions have two parts classrooms academic work In special topic and effective research, and working in the lab with a faculty researching in a closely related field.

The University of Florida program has been effective with Melbourne biology students for many years but application so extended capacity that the author and another Melbourne. High science research teacher helped set up and fund a similar program held the past two summers at FIT,. This program has strongly emphasized the physical sciences.

The Technical Community.

Canaveral technical Societies. Technical societies in the capo Canaveral area, which form the Canaveral council of technical societies, such as ALAA, IEEE, ASME, AFA ask specific high school son a rotating basis to select two science students and a teacher to attend at no cost their monthly technical dinner meeting. At Melbourne, participants are about 40%-50% girls and women teachers of science; they are selected from classes related closely to topics under discussion.

At its yearly Space congress CCIS uses secondary school students again least half are girls as they may hear the papers being presented CCTS also invites science fair winners to display their project in the exhibit hall for additional prizes

Society of Woman engineers. The Florida student sections of the Society of women engineers each fall hosts a two-day symposium on careers for women of all ages in engineering. Primary emphasis is in two areas interaction with practicing women engineers who serve as role models and opportunities available for women in industry, government, and etc. Several special programs end tours for high school girls are included.

Government Agencies

a. Co-operative Education. In addition to its regular co-operative education program, which contains many women in engineering and science, NASA selects high schoo1 students for a minorities co-op program to fill certain vacancies predicted in engineering Jobs. NASA at Kenne1y Space Center (KSC) se1ects qualified minorities to work at KSC during the summer following high school graduation. The students then attend engineering collage, expenses paid, far the freshman year. Regular co-oping fallows with the student alternating terms of work and study until graduation. Several Melbourne students, including girls, have been participating. One girl was so enthusiastic she returned to the author's classroom where she first learned about the program and asked to tell other physics students about it.

b. Kennedy Space Center Women 's Program. The Federal Women's Coordinator at KSC sponsored a one-day seminar about women in engineering working there for both government and contractors. Ten girls grade ten and eleven and a guidance counselor were invited from each county high school. After opening remarks by a panel consisting of women representation, chemical and electrical engineering and engineering management and a single man who gave male reactions to women in engineering, those attending were encouraged to ask question. Many other women engineers at KSC in the audience helped with answers. Tours and time to talk with these women completed the day. The women Melbourne High guidance counselor declared it to have, been one of the most. Interesting informative programs the handover attended. Several tenth-grade girls leaning towards engineering come back convinced it would their careers.

Department of energy. The US Department of energy offered a two-weeks summer program for high school girls and minority students to explore career opportunities in engineering at northeastern engineering college. One Melbourne physics student, with both interests and talents in the physical sciences, has applied.

Industry:

Minority engineering program. Radio Corporation of America (RCA) completely funds and carries out at each of its larger plants a 12-week course to encourage minorities to enter engineering. A number of Melbourne high students have participated in the program held at USAF Eastern Test Range. It consists of engineering career counseling interspersed with tours. Use of hand tools, computer programming. Use of closed circuit TV. Local high schools select the minority-including women-who apply. Every Melbourne high student who has attended has returns wiot strong interest in engineering.

Energy contest. The local electric power company has a contest for the best energy-saving new idea submitted by a Florida citizen. A Melbourne high girl was encouraged to enter her Fresnel lens solar collector by both her physics and her research teachers. She won first prize.

Evaluation of the supplemental program. The wide variety of programs in which Melbourne high girls are encouraged to both study physical sciences in high school and to consider engineering as a career is avident. Educational institution, industry, technical societies and government all provide different but complementary program. While all girls who might become interested in engineering or the physical sciences do not take advantage of every opportunity every year, a very significant number of girls have participated in every program described. For most, their career goals towards engineering have been reinforced even though engineering may not be their final selection the specific role of the sponsor teachers has been to make sure that girls are aware of the opportunities and that they do enter those activities in which they have in interest.

TOTAL PROGRAM EVALUATION

Declining enrollment at Melbourne high, due to loss of space related jobs and local population changes, makes it difficult to directly compare physics and chemistry enrollments today and four years ago when the programs were begum. When the school population was about 2400 students, four physics classes were offered. Today, with a population of about 1200, there are still three scheduled and one independent study physics classes. Chemistry has always been more popular here. But the number of classes has else remained about the same. Thus the proportion of students taking physics and chemistry has increased while the number of students in the classes has declined very little.

This is in some contrast to the findings of the national Assessment of Educational programs. It released a report in June, 1973,which cited figure that show enrollment of high school students in physics and chemistry continue to decline, and that less than half the high schools in the united states even offer any physics courses at all.[2]

Given these two conflicting sets of date, it appears that the career program at Melbourne high school have been at least contributing factor to keep the number of students enrolled in the physical sciences fairly constants. From their students in the high school physical science classes today will come the engineers and scientists of tomorrow.

It is still too early to fully evaluate the results of these programs. Further, it is difficult to discover how much of the information offered has been used and in what ways. Some students who participated are still in high school; some are in college; others are working, perhaps on "just a job" or perhaps on a job considered as beginning a career. Even career decisions made twenty years in the future may be influenced by these high school programs. In many cases, complete evaluation will never be possible.

Girls, and boys, too, at Melbourne High are being continually supplied with information to enable them to consider the opportunities, rewards and personal satisfactions that an engineer or scientists can derive from being a useful contributor to society.

For the past few years, one or perhaps to girls each year have actually been known to have entered engineering college from Melbourne High. This year at least four girls have indicated their Intention of pursuing engineering careers--not an enormous number but at least a doubling of any previous year. This increase is certainly encouraging to the physics and chemistry teachers who have been sponsoring the engineering and physical sciences career awareness programs.

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BRESIL COMMISSION N^0 3

WOMEN IN SCIENTIFIC AND INDUSTRIAL CAREERS

Clara p. STEINBERG Civil engineer
Rasalina BRAND Civil engineer
Riva BAUZER Social psychologist

I. INDIVIDWAL SEX DIFFERENCES

It is a well known, fact that, broadly speaking, women, everywhere, constitute a very small number of professionals dedicated to science and higher technology tasks. Moreover women, in general, earn less money than men. Prossess less power over their communities than men, have more difficulty becoming eminent than men, and get far, so much less often.

Altogether, as a. group, they have lower status than men and less public prestige. Besides, other things being equal, Women's work is of lower status than men’s difficulting their access and dedication to scientific and technological professions. Very often, in fact, when women reach some new occupational levels, and begin to move in, the occupation starts to loose standing in comparison with others where men predominate.

Surely no one would want to argue that such a situation is good or even tolerable. However, if you want to change a system you have to understand it.

Some heavy critiques on the system are rooted on the assumption then there are no important differences between the sexes (except: reproductive), which are not culturally determined.

We all know, nevertheless, that there is considerable evidence that differences between males and females do not result simply from imposed cultural, discriminations. Such differences

Are also directly related to our animal evolution and occur in such a wide variety of cultural situations.

The social segregation explanation turns out to be incomplete and inadequate in order to help us understand the present situation of clearly defined double standards, socially wide adopted, in the treatment dispensed to male and female individuals.

There are, of course, biological bases for sexual differences, socially stabilized, most likely tied up with ensuring the safety of communities and the healthy growth of children. Futhermore, these differences reach back to early states of our history, as well as to our formative time time as a species. Accordingly sexual differences in physique, hormone secretions, energy, emotional endurance, and, possibly, ever in ways of relating to other people, may be linked to our genetic heritage in direct and influential ways.

According to Dr. Eysenck, among such differences there are the higher aggressiveness and dominance of men while association with other persons and protection are more women's qualities. These conditions are likely to lead women toward submission, because, generally, love is more important for them than for men... And as, then, they seem to be more cooperative they tend to accept more easily a man's world, where they stay on a "pretty pedestal as the home angel".

Nevertheless, to say that these differences have existed for a long time, and have some biological basis is not - as some people too hastily conclude - to say that human beings are condemned to live in ancient arrangements with no hope of real change, inside a society where distinctions on woman's social place are not necessarily sensible, neither logic.

In fact, from one point of view we accept that human beings are unique among all animals, in that they have a made up culture clearly inherited, group transmitted, and individually processed, where social motives apparently can be created and destroyed by cultural influences. On the other side, the ignorance of biological factors may put on risk the legitimate demand for legal and economic equality for both sexes. Moreover, the denial of significant physiological differences can even deter real educational and occupational success of

Women, on account of important vulnerable foundations.

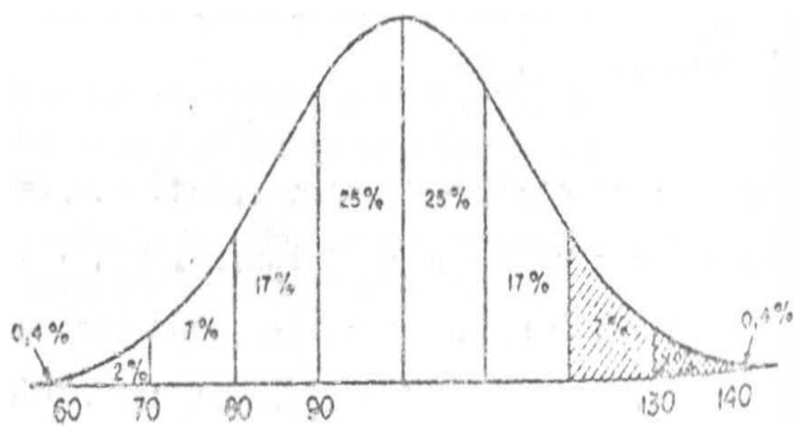
But differences are really an advantage for mankind and we can say that every human being is different from others and as Herbert Read said in his book, "Education through Art", -"as a result of the infinite permutations of heredity, the individual will inevitably be unique, and this uniqueness because it is something not possessed by anyone else, will be of value for the whole community".

II PROFESSIONAL OPPORTUNITIES

Let us look now at another seemingly controversial issue, that of intellectual performance differences between males and females, a very important factor in the professional behavior of scientists, and technologists.

We found no contradiction in knowing that the typical feminine pattern on intelligence tests is to have a higher verbal then mathematical score, although we acknowledge that allover the world there are some women who are foremost among the whole group of mathematicians.

We know that intelligence is largely, but not completely, established by heredity. The extent to which intelligence varies between the sexes as well as in various racial groups is not clear. The fact of inheritability of intelligence, does not dictate that there must be corresponding sexual or racial intellectual differences. On the other side, in the present state of our knowledge, it would be impossible to prove that such differences do not exist. It is a fact that different sex groups exhibit different profiles of intelligence. But, in the average, we may say that in terms of groups the distribution is approximately the same as the Gauss's normal distribution curve shows.



We can say that Less than 10% of human beings have the level of intelligence that allows them to adequately follow scientific and technological careers. It is absurd to waste almost half of such a scarce resource, by loosing women's participation.

Considering that there are differences among men and women, due to cultural and genetic factors, why not recognize that these differences should constitute the feminine specific contribution to society, establishing their condition as equal as well as complementary to men, as one more advantage of their full participation?

Certainly this is also true for different ratial groups. Nevertheless, since both sexual and racial groups have markedly different environments, and receive the influence of different early child-rearing practices, we cannot ignore the possible socio psychological causation of the observed differences.

As Ashley Montague states:

"The greatest personal defeat of man is the difference between what he is capable of becoming, an what he, in fact, became".

<u>In this way, the only sensible thing for society to do should be to provide opportunity for everyone to reach his maximum potential without regard to whether he or she is following, the typical development pattern socially expected for their sex or ethnic group</u>

III SCIENTIFIC AND TCHNOLOGICAL COMMUNITIES

In order that women can reach the work levels settled by scientific and. technological communities it is very important not to fall into the danger of superficial misanalysis, involving the nuclear family.

Let us take a look at child-rearing responsible practices, for instance. Which remain the most labor-intensive task left to members of mechanized societies, and that cannot be speeded up. Day-care centers for children can obviously be

e. Sensible feature of a civilized society. Notwithstanding, since children need inputs of behavior as much as they require food and shelter, there is considerable evidence that those who do not have the constant presence of a mother or mother-figure, on which to focus there affections and security in early childhood, may suffer irreparably difficulties later on. And such development trends involve boys and girls, men and women, as well. Now, it is not clear that fathers cannot do as well, and that many children are saved because they have been duly raised by fathers which did note hesitate to substitute or enrich the mother-figure.

This is one of the reasons why the formation of scientific attitudes must be started as early as possible, at least since the first contacts of children with school life.

The occupational information, mainly related with technological and scientific careers, must receive special attention from all educational agencies (here included the mass media) with the objective in mind of clarifying the whole population. Particular efforts should be mobilized in order to attract to such professions young girls and women, among other qualified applicants. The selective criteria adapted should be clearly expurgated of prejudices related to sex, economic conditions, social prestige, as well as race and religion.

In order that the women's population may effectively engage in specialized occupational performance, participating in the decision-making process concerning comprehensive political, economic definitions, it is that women work, necessarily side by side, with their men colleagues, in the most diversified social institutions, actively offering collaboration in basic political issues adopted by class associations, or in conferences, in congresses and other meetings of specialists groups.

Professional women's associations should and must deliberately work stimulating, encouraging and supporting the active involvement of women in all kinds of tasks linked with the organization and development of the society in which they belong, according to women ample possibilities.

Higher authorities belonging to the executive community as well as the population in general, should be sensibilized in order to stimulate and organize general efforts toward a more

Comprehensive mobilization of the women's task force, with the main objective of enriching the performance of the scientific and technological professional collectivity.

IV THE BRAZI LIAN EXPE RIENCE

The Brazilian Association of Women Engineers and Architects (ABEA) was founded in 1937 with the main objectives of stimulating women engineers and architects in their:

- Educational training;
- Participation in professional's roles;
- Participation in class associations and societies in general;
- Participation in with other professionals.

From the beginning ABEA tried not to be just a Women's Association but one way through which women could participate in general professional associations. Many of our first women engineers and architects have taken part in the direction of other societies, indicates, as council members or belonging into board of directors. As there were only a few in such activities they tried to organize their participation in order to have at least one woman in each representative society, where it was possible, mainly in Rio de Janeiro, where the headquarters were located.

In this way, women engineers have participated of the board of directors and in the council of the clue de Engenharia (the oldest Brazilian Association of Engineers in Brazil), the Engineers Sindicate of Rio de Janeiro, the City Society of Engineers and Architects of Rio de Janeiro and others. Through ABEA's indications many professional women have participated of national and international Conferences, Seminars, Encounters, Symposiums presenting papers, besides being actively present, taking part in commissions, directing meetings.

We believe that we achieved our goal of making many contacts and obtaining the approval of our male colleagues, in spite of the fact that discrimination still exists.

Our Association belongs to the Brazilian federation of

Engineers Association (FEBRAE), which is connected with the pan American Associates (UPADI) and, being an Engineers association, has the right to one chair in the Engineers and architects council.

The ABEA very often has to present propositions during the annual FEBRAM Encounter dealing with women's professional interests. The AREA members have participated as AREA'S representatives in a many conference as the IV construction encounter held in Brazil (1978), or in UPADI'S (pan American union of engineers Associations) also in the 5^{th} inter American congress of Habitations (1976), or still in technical and engineering conference whenever it has been possible.

But, in fact the principal task has been to in form about the importance of women's participation in the field, through technological and scientific work and also by explaining the value of this participation.

For instance at the 5th Interamerican Housing conference (1976, Lima) the appointed president was a Peruvian woman architect.

We had the pleasure of hearing the secretary of the FIIC (Interamerican Federation of Construction) pleading for more participation of women, at the concluding session of the VI Interamerican Housing Congress, held at Medelin - Colombia, in 1977.

Although we have used every opportunity to show the importance of women's contribution, we still rind men against women's work, but as unbelievable as it may sound. There are many women that have support the same opinion and so must also be convinced.

On the other Ride many women are afraid of participating in women's associations because the word "feminine" in such titles has got a pejorative sense, and very often it is necessary to explain to them that we need to get together in order to reach the hoped changes.

As our country is still a developing one, we can say that, so far, we have succeeded a lot with our policies.

As engineering is, in general, considered a male occupation, The situation of Brazilian women engineers and architects is rather satisfactory as we may observe in the figures we are going to present.

In fact, we have, now, about 10% of women students enrolled in engineering schools, in Rio de Janeiro and Sao Paulo and we find about 50% of women students in architectural school.

Brazilian women engineers, architects and agronomist engineers constitute, in average 3,05% of their professional class. Through the last statistics we have in 1975, the percentage of female engineers, architects and agronomist engineers is the follow up:

Engineers			Architects			Agr. Engineers			%
M	F	%	M	F	%	M	F	%	
71.566	1210	1,69	6.676	1490	18,25	15.047	567	3,63	3,05

We don't have sufficient statistics but through our least official census, 1970, we know that only 20% of our labour force is formed by women and it is very little their participation in the higher level.

According to the general income distribution; in our country, in the technological and scientific occupations, shows the following percentages:

	Till 200	201-400	401-1000	1001-2000	2001 01 more
Total	68,1	17,2	11,0	2,6	1,1
Men	66,0	17,9	11,8	2,9	1,4
Women	76,1	14,6	7,9	1,2	0,2

In the metropolitan areas, where the opportunities are greater, we have:

Income in cruzeiros	Till 200	201-400	401-1000	1001-2000	2001 or more
Total	43,6	27,2	21,0	5,5	2,7
Men	35,5	29,6	24,5	6,8	3,5
Women	63,8	21,4	12, 3	7,1	0,4

We can see, comparing men and women that for each woman there are about 9 men in the higher income class. Then we may consider rather satisfactory the women's participation in Engineering and Architecture in Brazil especially, because this participation

V SOME FINAL COMMENTS

What we would like to emphasize, in closing, our comments, on this theme, is that there is always a two-way relationship, which must be identified. The external situation has a selective effect: certain persons are actually being attracted to technological and scientific roles, in detriment of others, in these case women, on the pretense that they are not conveniently prepared. But this situation his also a coercive effect. Once included, the person is molded to fit better and better the expected tasks. This is the kind of dynamic interaction between person and environment, which has been largely responsible for many aspects related to inadequacies of the social position of women not yet duly recognized as a underutilized contributors to the labours-force that pulls nation's development.

Some men are afrai4 of women's work for fear unemployment problems but as Robert Me Namara, the World's Bank President. Said:

"There are so many things to de in our planet that we can be all busy, at the maximum of our capacity. There is no lack of work, there is a lack of new ideas about the way of doing it".

Clever men understand this and we can see it in the statement of Karl Deutsch, associated professor of the International Study Center at Harvard University, U.S.A.:

“We have an extreme deficit of knowledge: we need more members of capable people, trained to do the best use of their talent and disponible information. The developed countries are worrying about the educational training of capable people but the largest percentages of increasing natality are found in underdeveloped nations, half of the adult population is made of women which are very far away from the possibility of making good use of their potentialities".

It would be unnecessary to emphasize, in a meeting as the one, which is now taking place, the importance of our ICWES, as a force to change ideas about women is participation in mankind's general decisions, through:

- National and international information dissemination about women that had participated and are. Now participating in scientific, technological, or other cultural and political works;

- Stimulating of women 's participation in Conferences, Symposia, Encounters etc., even offering financial help to special distinguished representatives in the fields of engineering, architecture, and other graduated professions;

- Persuasive efforts involving government authorities about the importance of disseminating up to-date statistical data, and other pertinent information’s, concerning the contribution of women, as a labour-force group, toward different developing work front enterprises.

Finally, and it gain, it would be unnecessary to emphasize, in a meeting like this one, the relevance of a combined effort' of all associations here represented, in order to engage women to
Participate more in the development of the society.

For instance - some of the subjects here offered, to a rather, "closed group" would probable leave deeper and more permanent

Impressions if this same group of women would take the steps to present their papers and communications, on specific subject Congresses, Conventions, etc., regardless the sex of participators.

We surely think that with such data at hand it will be easier' to succeed in convincing humanity that through serious engagement in the elaboration, presentation, and support of objective policies concerning the formations of more effective scientific and technological labour-forces, regardless the sex, the economic conditions, the social prestige, as well as race or religious groups or professional position of the occupants, we will be surely gearing toward a better world where decreasing un justice trends will make all of us, happier and more hopeful.

Trends in Engineering Education at private Institutions in the United States of America

LOIS GRAHAM Professor of Mechanical Engineering

The 1960’s were a period of tremendous growth and change in higher education. There as a dramatic increase in the number of colleges and programs which were offered. Both public and private institutions expanded their faculties, and degree offerings in response to an increasing student body. Community colleges sprang up everywhere. These 2 year colleges aimed at providing college instruction to "All of the People" (1) in response to student demands for freedom of choice, curricula were modified In response he students to develop their individual educational programs to money was in abundance both for the public (government) supported institutions and for private. This is no longer the case. Accounting to the national center for educational statistic. The number of students earning high school diploma will peak this year at 3,160,000.there will be a continuing decline throughout the 1980’s. the number of high school graduates is expected to level out at 2,700,000 per year;460,000 less than the current figure.

In addition, inflation has made serious inroads on the financial resources of the colleges. Competition for money and students is becoming acute. On the overage, tuition per year at public four-year universities is \$741 compared to \$3,403 for private. Some private universities charge as much as \$3000 more than the average. Students are more and mare likely to choose the less expensive option. On the average, tuition covers 20% of costs at public institutions compared to 60% of costs at private. Private institutions are trying to get increasing financial support from state legislatures and from the federal government. They are trying to convince the states that it is in the public interest to divert some of the states' educational budget to private coheres and universities. At the same time, public supported universities ore look in for support from private foundations and corporations, a major’s mainstay of private institutions. Research at both private and public universities is very largely supported by the federal government. This competition for financial support and students poses serious problems for the future. One may expect to see a decline in the number of private colleges and a. decline in the selectivity of the student body.

Private engineering colleges face all of those problems. With the exception of the most prestigious, changes in the quality of the freshmen class may already be perceived, But other factors are also at work; in particular, the federal affirmative action of these programs.

In 1973, at a symposium convened by the National, academy of Engineering's commission on Education a "target." was set for a tenfold increase in minority e3ngineering students by 1982. The Engineering manpower Commission of the engineers Joint Council reported that, in 1973, there were 2,905 full-time freshmen engineering students from four particularly underrepresented -blacks, Mexican-Americans, Puerto-Ricans and American Indians. The commission estimates that the minority enrollment for Fall 1977 was

At Illinois institute of technology as a result of an extensive program (called “Early Identification") for high school students the minority black and Spanish engineering freshmen enrollment increase from 8 in the fall of 1973 to 144 in the fall 1977. A total of 246 engineering minority students (all four years) were enrolled in the fall 1977, 17% of IIT's undergraduate engineering enrollment, bringing IIT very close to the national goal of 18% minority enrollment in 1932.

Nationally, this increase in minority students has been matched by the increase in 1oIomen enrolled in engineering - from 3,569 in 1970 to 21, 936 in 1976 (2). In 1972 TIT had 38 women in its freshmen class; this increased to 132 in 1978.

This changes composition ha been accompanied by an appreciable change in the performance of the freshmen engineering class. Increasing numbers of colleges report that remedial courses are necessary for a substantial number of the entering freshmen. At IIT, Chemistry, mathematics and Humanities Departments reported that 20- 25% of the freshmen class was not capable of successfully taking the respective normal freshmen courses. It has become common to hear college teachers complain, "freshman can no longer read. They cannot understand and connect the ideas expressed in two consecutive sentences." Another indication of changed performance is the decline in the National Scholastic Aptitude Test scores - a widely recognized testing program used by most colleges along with the American College testing Program test to evaluate students ability to do college level work (3,4,5). It is not clear whether students are less well prepared in general or whether the changing character of the freshmen class, i.e., increased minorities and women, is responsible for the need for remedial work. Probably both are factors. At IIT, we have now introduced our own entrance tests in English, Mathematics and Chemistry. Students identified as weak in Chemistry are given extra tutoring. Special remedial courses at several levels are available in Mathematics and English.

Curricula in engineering were less subject to the non-structuring change, which took place in the 60's in other disciplines. Never the less, an attempt was made to introduce a greater choice of technical electives in the senior year. Also, the general education part of the curricula was less rigid. Courses on "Technology and Society" were introduced to acquaint the student with the broader implications of engineering decisions and the need to he aware of their societal impact. The role of engineering in the legislative process was explored and participation in governmental decision making encouraged.

The subject of "Ethics" is currently receiving increasing attention perhaps in part due to "Watergate". What the impact of this emphasis will be has yet to be determined.

Along with these challenges of declining enrollments, changing freshmen: preparation, decreased financial support and competition with public colleges, then, is tile need for the private engineering college or university to be cost effective and productive. The universities are exploring the use of self-paced instruction as well as talkback TV to bring Engineering education to students who are not on the campus but may be in industry or elsewhere. Imagination will be needed if private schools are to survive and provide an alternative to public education.

- Triton College Announcement of Courses Volume XII 1976-77.

- Women in Engineering: A Progress Report Perspective Vol. II. No.5 fall 1977, College of Engineering, Madison, Wisconsin.

- College Entrance Examination Board (CEEB) reports a drop in SAT scores Chronicle of Higher Education Vol. 1, Sept. 6, 1977, p. 1.

- Reaction to report in declines Chronicle of Higher Education Vol., Sept. 6, 1977, p. 12.

- 1977 freshmen may have lowers scores ever, Chronicle of Higher Education Vol. 1, Sept. 6, 1977, p. 12.

Dr. Lois Graham is Professor of Mechanical Engineering and Director of the E^3 (Education and Experience) Program Center at Illinois Institute of technology, Chicago, Illinois.

La situation des femmes dans 1' Enseignement superiour scientifique an French –marguerite CARDIER

I1 nous parait untile at interessant de donner d'abord des éléments sur is situation dea éléves at dea professeure dans I' enneignement du second degré (I ycées)

Au nivaau du baccalauréat

Ll y a mixité totale de I' enseignement du second degré nussl bien au niveau de in fréquwntation per les filles et los garcone, que per is contone de l'enselgaement. Cependant il y a inégalité dos sezes on face des options de I'azamen

Dana los options littéraires: 60-70%de filles
Dana los options scientifiques: 30%de filles
Dana los sections techniques industrieiles: per de filles, 10 % ou moise,

Professeurs du second degré

Fourtant le corps professoral Donne aux éléves I'image de I'égalité da I'homme et de la femme, puisque méme dana les disciplines scientifiques los femmes professeurs tiennent una grande place; depula 1960 elles sont, an majorité ou Presque, reques au concoura da recrutement dea professeure, appelé certificate d'aptitude au professorate du second degré (CAPES), pour I 'ensemble des sciences in proportion des femmes dans les candidates reque étalt 58.09% on 1960 et 47,28% on 1978,on mathématiques il y a majors de 50% de fommes,il y an a nettement plus on science naturals. Hemarquena que ie percentage eat. Plus faible on 1973 qu'en 1960 at li a tendence a balsser actuellement: casieat co A is conjuncture économique: les homes reviennent and I' enseignement quiets uno profession stable.

Four précieer is repartition actualle des femmes entre les disciplines nons donnone use atetistique des femmos élévea-professure recues au CAPES an 1975(les éléves-professeure sent des étudiants qui recoivent on traintement Durant leure études pour preperer is concoura)

	Femmes inserites	Femmes reques
Mathématiques	46,6%	46,7%
Sciences physiques	34,7%	32,4%
Sciences naturalles (biologic-géologic)	59,1%	58,6%
Construction nécanique	5,2%	2,2%(en nombres (Totaux, 2 femmes reques (Aur 24 candidates

Classes préparatolrea aux grades Ecolas scientifiques

En France, in Majorité des futures ingénteurs font lours etudes Dana de "Grandes Ecoles "n'appartement pas aux universitiés; le nombre dea places y est limited et I'entrés se fait par un concoure de sélection; co dites "classes préparatoires." Durant I'annés is baccalauréat class's appartement aux lycées publics;

-Éléves garcone 17 944
-éléves filles 4 274
Done un pourcontoge cases faible de filles,
Soit 19,1%du total

Co percentages, faible, est pour ant an augmentation constants at cot to augmentation est plus important pour les classes á dominate "biologic", c'est –é-dire pour in preparation á I'antrée dans los Ecoles Aronomiques at les ecoies vétérinaires eá la proportion des filler amines dépaeas amintenant 20%.

Dana les universités:

Nivearetudiants:dans l' ensemble de toutes les universities li y a trés sensiblement autant d' étudiantes que d' étudiants mais la repartition est trés inégale selon les disciplines : les filles vont vers les letters at le droit,les garcons devantage vors les sciences et la médecine il y a 25 á 30% d' étudiantes.

Et la r repartition entre les disciplince est le suivante:

Mathématiques –sciences physiques	20-25%
Chimie	40%
Sciences de al via(biologie)	55%
Sciences de la terro	20-25%
Pharmacie	60%

Nivear enseignants

Les derniéres statistiques établies en janvier 1977 sont les suivantes:

Pour pouvoir postuler les functions de maitre de conferences,(puis de professour), il faut;

Soit (pour les sciences) étre doctour d' Etat,puis solliciter son, inscription sur une liato d' aptitude établic par un college de professours,

Soit (pour la pharmacie) étre doctour d' Etat puis réusair á un concours de recrutement dénommé "aggregation de pharmacio".

Le nombre total des femmes qui soutiannent des theses d' Etat a beaucoup augmenté en ces derniéres années (depuls lo moavement universitaire de 1968):78 théses en 1965,222 en 1973 soit une multiplication par le fecteur 2,8. mais dans le mme temps le hombre des homes a augmenté davantage:295 théses en 1965,977 en 1973,soit un fectour 3,6.

Si bien que le pourcentage de femmes dans le total n'augrments pas et qu'll aurait plutot tendance ébaisser. Il se situs , en 1973(deraiére statistique relevée), á 17%.

Mais, é l' intériour de ce pourcentage global pour l' ensemble des sciences la repartition varie an fonction des disciplines:

Mathématiques-physique	Environ	10%
Chimie-biochimie	Environ	15%
Sciences de al vie (Biologie)	Environ	35%
Sciences de la terre (géologie)	Environ	12%
Sciences appliqués	Environ	0%

Femmes candidates et admises comme maitres de conferences

(a)ences: les proportions de femmes candidates et inscrites sur les listes d' aptitude sont les suivantes pour les années 1973,74,75:

	1973	1974	1975
% f. candidates Total candidates	12,7	14,1	10,3
%. Inscrites Total inscrits	10,9	11,8	10,9

Il semble qu'il y ait jue petite discrimination contre les femmes, on pout également retirer des statistiques la remarque suivants: c'est dans les disciplines ou il y a le moins de femmes candidates, en particulier en mathéámatiques, que le pourcentage des inscrites est le plus fort.

Il faut remarquer également que "étre inscrit aur la liste" ne donns pas automatiquement droit á un poste ; il faut que " l' inscrit " ou " l' inscrita " moit choiai (e) par une université; il y a un poste á fournir et á ce stade, li y a, en general, une préférece pour les hommes

(b) pharmacie: nous citerona deux concoura d' aggregation avec les pourcentage de femmes inscrites,recues et nommées:

	1969	1977
Candidates	27,2%	31,8%
Recues	17,2%	32,5%
Nommées	17,5%	32,5%

Conclusion- Il apparait que la faible proportion de femmes occupant des postes megistraux dans les universities est due á deux causes essentielles:

1) á elles-mêmes puisque la proportion des femmes qui font l' effort de remplir les conditions necessaries pour occuper ces postes (theses d' Etat ou presentation á un cocoura) est encore relativement faible.

2) á un facteur extérieur á elles: même lorsqu'elles remllssent toutes les conditions requises elles sont nommées aux postes moins aisément que les hommes.de plus leur carriére est plus lente:ce point n'a pas été étudié dans cette communication,mais les faits montrent que les femmes mattent plus longtemps que les homes á gravir l' écholon maitre de conferences-professour.li y a cenpendant ou une amelioration on ces derniéres années:espérons que l' état de stagnation dans lequel l' universités se trouve actuellement n' aura pas pour consequence un nouveau retard.

TECHINICAL OPPORTUNITIES FOR WOMEN IN THE U.S.

BY **Charmaine Wisniewski**, The Procter & Gamble Co.
Cincinnati, Ohio, U.S.A.

Over the past 5 years the number of women going into engineering in the U.S .has doubled. This paper examines what the future opportunities are for a woman has doubled. Engineers as their numbers entering the work force continue to increase.

Before examining the technical opportunities for women in the U.S., I would like to offer some perspective on the state of the woman worker in the U.S.

Women make up about 51% of the U.S. population. They currently make up about 35% of the labor force. This number reflects the changing social and economic status of women in the U.S. The number of working women has increased by 60% since 1960, while the number of men has increased by only 20% Only 10 years ago 40% of all adult women worked, today that number is closer to 30%. The Increases in workingwomen have been targeted in the segment of mothers with pre-school age children. Their participation is currently running at about 37% or just about twice as high as in 1960. Thus less women are choosing to drop out of the work force to raise children[1]

One other trend should be noted as it relates to women workers. The more educated a woman is, the more likely she will be found in the labor force. For example, among those who failed to pursue schooling beyond the elementary level, only about 28% are in the labor force, but among those who have earned a high school diploma, the ratio is 47%, and for those with a college degree, this is an impressive 60%. As more women increase their level of education, more women will choose to participate in the labor force. The trend for women increasing their educational level is also there as evidenced the increase in the number

Of bachelor’s degrees to women, in 1950, women were awarded one-fourth of all bachelor’s degrees; by 1972 they earned 41% of these degrees. thus both these trends will work to get more women into the labor force[2]

Why has there been a recent influx of women into the labor market in the U.S.? Many things have contributed to the change, ranging from the American woman’s increasing self-awareness as expressed in the feminist movement and the related improvements in educational accomplishments, to the rapid economic growth U.S which has generated many new jobs, particularly in sectors which have traditional been women's turf (e.g. clericals, service workers, elementary and secondary education teachers, medical workers, and secretaries), birth control procedures have Made it possible for women to control the size and timing of their families, thus making her more available to enter the work force. More free time has become available with the proliferation of laborsaving devices for both food preparation and household duites.all of these factors, coupled with the fact that a working wife has become acceptable to our culture, have contributed to the increase in women participating in the labor force[3]

Unfortunately, woman employment opportunities still tend to be concentrated in relatively few occupation categories. In 1970, about 40% of all employed women were working in the expanding service sector, which created many unskilled jobs and part-time employment. Four categories - clerical, operatives, sales, and service - comprised 77% of all jobs held by females in 1970. Currently, women comprise only a small percent of the professions: 3% of engineers, 7% of doctors, 3% of lawyers, and 7% of dentists, even though the career opportunities in these professions are excellent.

An examination of the opportunities in engineering and technology jobs shows just how good these are. In the years 1970-1975, people with nor-technical degrees made up almost 70% of all college graduates. Yet they received only Engineers and other technically degreed graduates received the other 16% of the jobs that were. Available in business and industry during that 5-year period. Engineers and other technically degreed graduates received the other 84%.

How does the job market shape up for the future? The Bureau of Labor Statistics has estimated that by 1985 the number of new college graduates will exceed jobs requiring degree by almost one million. Even with the one million oversupply, it is expected that a balance or even a shortage of new graduates for jobs requiring engineering and a few hard science degrees will exist. The excess new and in the future will continue to be extremely high in the humanities, and high in the life and social sciences.

This means that career opportunities are best in the engineering and hard science areas for both men and women. In addition, as the law of supply and demand holds, the engineering and technology areas demand the highest salary offers as seen 1nthe following table.

Chart 1 Number of offers to new graduates

Curriculm	Number of offers reported	National Avg.monthly salary offer
Accounting	3955	$1118
Humanities	271	835
Social science	384	842
Math	160	1150
Chemistry	103	1206
Engineering:		
Aeronautical	222	1348
Chemical	2305	1510
Civil	1219	1289
Electrical	3055	1351
Industrial	532	1353
Mechanical	3335	1396
Metallurgical	278	1413
Mining	77	1481
Petroleum	432	1646
Engineering technology	432	1271

Excerpted from “CPC salary survey” for period Sept. ‘77 to march,’78.

Those figures tell story as to the demand and salaries of today. Projections indients continued demand in the next 8-10 years. As more women enter the work force, the engineering and technical areas look extremely attractive due to the continued demand and because of the high starting salaries.

In addition, the outlook in these areas is particularly bright for female and minority graduates. Affirmative action programs and the women's movement have made both women and minorities more aware of engineering as a challenging career area. These programs have also helped companies make better use of the growing resources of women and minority engineers.

Thus it seems only logical that the increasing numbers of well-educated career-oriented women that will be entering the work force take advantage of the opportunities that an engineering or technical degree can offer them. It is also from these areas that women and men can best make contributions to solving the technological problem that face the world.

END NOTES

- Linden, febian,"women, worker," across the board, March 1977, p.25.
- Lazer, William and Smallwood, john E., "the changing demographics of women," journal of marketing, July 1977, p.16.
- McCall, Suzanne H., "meet the 'work wife'," journal of marketing. July 1977, pp.55-57.
- Ferber, Marianne A., and Lowry, Helen M, "women's place: national Differences in the occupational mossic," journal of marketing, July 1977, p.28.

PROGRAM

Sunday 3 September

18.30 Welcoming Party (Hall Romée, Palais des Congrès).

Monday 4 September

08.00 Opening of Conference Office at the Palais des Congrès.
10.00 Inaugural Session
12.30 Lunch
14.30 – 16.30 Working Sessions
17.30 Reception at l'Hotel de Ville by the Mayor-Senator

Tuesday 5 September

09.30 -11.30 Working Sessions
11.30- 12.30 Informal meetings in discipline groups
13.00 Lunch
15.00- 17.00 Werking Sessions
17.00 - 20.00 Sight-seeing tour of Rouen
20.00 Dinner for National Representatives

Wednesday 6 September

Technical Visits:
- Rouen Port Authority
- Shell, etc...

18 h 30 Reception at the Commerce Chamber.

Thursday 7 September

09.30 - 11.30 Working Sessions
11.30 - 12.30 Informal meetings in discipline groups 13.00 Lunch
15.00 - 17.00 Working Sessions
20.00 Banquet, «Halle aux Toiles» (Evening Dress).

Friday 8 September

10.00 - 12.00 Concluding Session.

POST – CONFERENCE TOURS

1) NORMANDY: A region abounding in beautiful buildings and historic sites.
2) PARIS and VERSAILLES.

FRANCE COMMISSION N^{0}3

SITUATION DES FEMMES INGENIEURS & I'ELECTRICITE GAZ DE FRANCE

Hèlène BLANCE Ingènieur EDF-GDF.

Le concreiallsan et à ls distrieuer. Des deux entrecrises unt eri Plusieurs directions, principalement celle de la distribution et du personal. EDF et GDF sont deux sociétés nationalisées, ce qui signifie qu'elles sent contrôléns par l'état: chaque société a un Conseil d'Aministration don't les 2/3 des meberes sont nommés par le gonvernement.

Edf- gdf employait au 31.12.1977 128 158 personnes parmi lesquelles 106 298 hommes et 21 860 femmes.

Parmi ces agents il y avait à le meme date 15 327 cadres masculine, don't 5 582 ingénieurs diplômés avent recrutement, et 830 cadres féminins, don't 200 ingénieurs diplômes avant recrutement (voir tableau I).

RECRUTEMENT

La repartition des ingéniéurs homes et femmes en function de leur ancienneté est indiquée pàr les figures I et II.

31% des femmes ont moins de 5 ans d'ancienneté, 23% d'entre elles ont entre 17 et 21 ans d'ancienneté, Chez les homes, dans les tranches equivalents, on trouve respectivement 18%, 12% et 28%.

On peut en

Des femme’s inèaicurs embèuchèes sortalt des ècoles du groupes ce qui n’èlait pas le cas pour les ingèbnieurs homes et femmes en function du groups de l’ècola d’origine lvoir tableau III. Glohalement on peut dire que in nivear de formatied des ingèieurs femmes actuellemnt è EDF-GDF esr moins èlevè que celui des ingèbnieurs hommus.

Dans les embauches rècentes.une part importante des femmes ingèbnieurs sort des èceles du groups A et une part relativement moindre sort des ècoles de groups D. cette nouvells tendance se reflète dans la repartition des homes et des femmes en fonction du groups de leur ècele d’origine pour les ingèbnieurs embauches en 1977 tveir tablear III). II est intèrressant de mantionner que deux des jeunes filles embaucchèes en 1977 sortent de I’ecole polytechnique.

SITUTION DES FEMMES INGÈBNIEURS A EDF

Quelle position occupant ces femmes qui sont entrèes è EDF-GDF avec un diplome d’ingènieur.

27% d’entre elles sont encore ingèbnieurs debutants.69% sont ingèbnieurs confirmès,4% sont cares superieurs (voir tahlear IV).

Group des femmes tegènieuts a III GDF eat done relativement jonne peisqee 27% EST encore au nivear cadre debutant contre 16% seulement chez has horsing

Deux raisons majeures sent invoqures pour expliquer ia distertion enter les carriers des homes et des fammes. D'une part les femmes sent moins mohiles que les homes or dans certeins services on demande aux cadres è EDF-GDF une mobilite relativement grande.D'autre part,paemi les ingènieuts les plus anciens le niveau de formation des femmes est globalement moins èleves que celui des homes.

Ce dernier argument est en train de tomber. Espèrons que ie premier ne suffira pas è bloquer is carrière des gènètrations futures de femmes' ingènient

SITUATION DE FAMILLE

Parmi les 200 femme's ingèbnieurs è EDF-GDF. 42 sont cèlibataires, 149 sont mariėes et 9 sont veuves, sèparèes ou divorcèes (voir tableau V).

Les femmes marièes (ou qui I'ont ètè) ont peu ou pas d' enfant, 40% environ n'out pas d'enfant; 10% environ ont 3 ou 4 enfants. On pent mentionner que is moitiè des femmes cedres superieurs a 3 enfants.

Dans I'analyse de ces chlifres II femt tours complete default les femmes ingèuieurs è EDF-GFD sent elles enviroment mains de 30 ane

Je remercie très vivement les personnes de la direction du personal-service etudes prèvisionnelles-recrutement –emploi et service moyens et studes de gestion qui m'ont très aimablement fourni toutes les donnèes necessaries è l'èlaboration de cette etude.

TABLEAU I

	Homes	femmes	Total
Execution	44 376	11 358	55 734
Maitries	46 595 82,8%	9 972 17,2%	56 267 100%
Ingèbnieurs diplomès 5 582 Avant recrutement 96,5%		200 3,5%	5 782 100%
Autres	9 745 93,9%	630 6,1%	10 375 100%
Total	15 327 95%	830 5%	16 157 100%
Enaemble du personnel	106 298	21 860	128 158

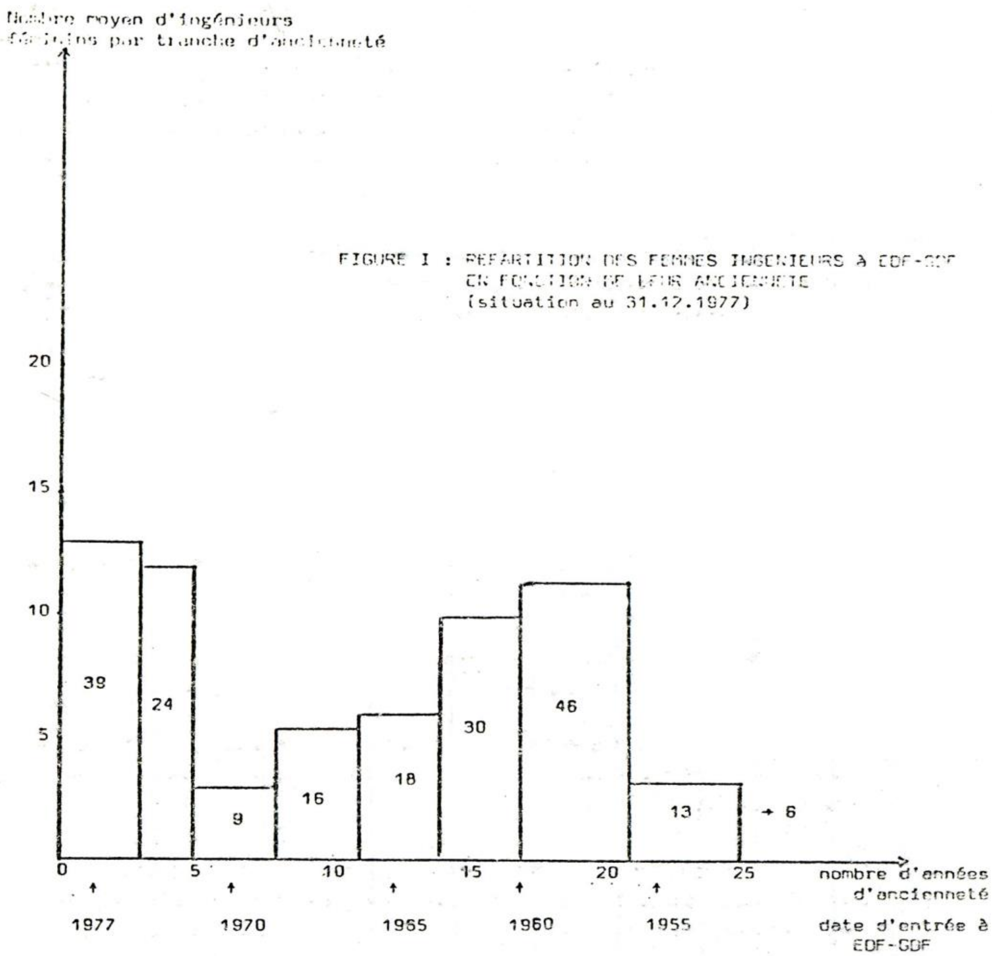


FIGURE I : REPARTITION DES FEMMES INGENIEURS A EDF-GDF EN FONCTION DE LEUR ANCIENNETE (situation au 31.12.1977)

Le chiffre qui figure à l'intérieur de chaque rectangle représente le nombre d'ingénieurs féminins dans la tranche d'ancienneté correspondante.

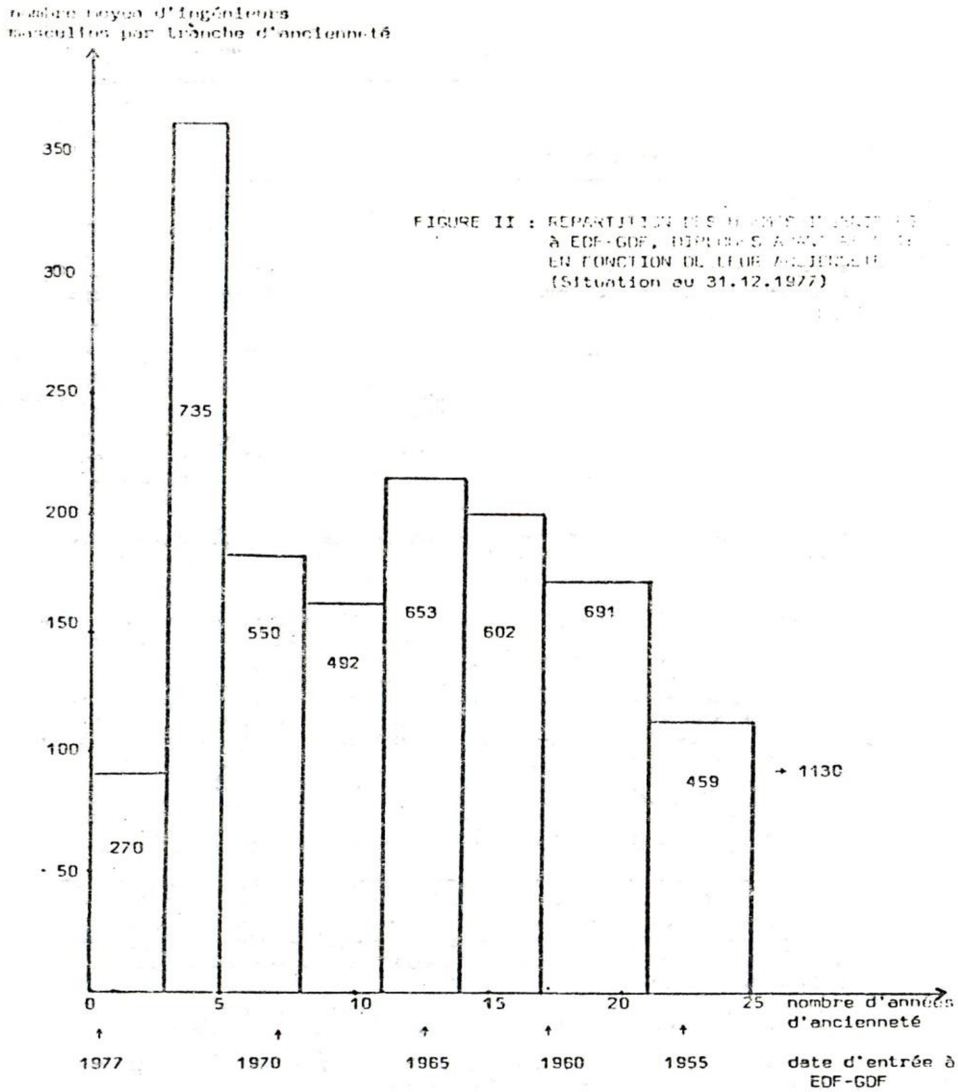


FIGURE II : REPARTITION DES [illegible]
à EDF-GDF, DIPLOMES [illegible]
EN FONCTION DE LEUR ANCIENNETE
(Situation au 31.12.1977)

TABLEAU II

Ecole d'origine	Homes %	Femmes %
GROUP A	34	14
GROUP B	36	12
GROUP C	12	4
GROUP D	18	70
NUMBER TOTAL D'ingènieurs	558%	200

TABLEAU III

Ecole d' origine	Homes		Femmes	
	Nombre	%	Nombre	%
GROUP A	86	38	10	40
GROUP B	86	38	6	24
GROUP C	28	12	2	8
GROUP D	29	12	7	28
TOTAL	229	100	25	100

TABLEAU IV

SITUATION DES INGENIEURS MASCULINS & FEMININS ÀEDF-GDF AU 31.12.1977

	Ingèbnieurs Ddèbutant	Ingèbnieurs Confirmè	Care Supèrieur	Personnel de direction	Total
Homes	869 18%	2 687 48%	1 482 26%	544 10%	5 582 100%
Femmes	54 27%	138 69%	8 4%	-	200 100%

Parmi ies ingèniieurs ayant plus de II ans d'anciennetè
-112 femmes don't 6 cadres supèrieurs soit: 7%
-3550 hommes don't 1470 cadres supèrieurs soit 41% et 531 cadres dirigeants soit:15%

TABLE V

SOTUATION DE FAMILLE DES FEMMES INGÈBNIEURS EN FOUCTION DE LA POSITION DANS L' ENTERPRISE AU 31.12.1977

	Ingènieur Debutant	Ingènieur-confirmè	Cadre supèrieur	Total
Cèlibataires	25	15	2	42
Marlèes	28	115	6	149
Vivant seules	1	8	-	9
Total	54	138	8	200

Vivants seules: veuves-sèparèes-divorcèes-

FRANCE COMMISSION N^{0}3

LE PERSONNEL FEMININE AU C.N.R.S

J.CACHELOU ingènieur de I'Eco'e Supèrieure d'optiqne

PRESENTATION DES STATISTIQUES

Le center national de la recherché scientitique (C.H.R.S) eastern grand organisme d'etat qui compte aujourd; hui plus 20,000 percentage.

LE PERSONNEL FEMININ AU C.H.R.S

Trés schématiquement on distingue au C.N.R.S deax grandes catejories de personnel:

- Les chercheurs,tous diplomés de l'universite on d'urs grands école etqui travaillent á l'amélioration des connaissances,seuls ou le plus souvent en équipe;

- Les ingéaieurs, les technicians et les administratifs (en abrégé ITA) qui accompagaent la recheches et don't le role consiste á faciliter le travail des chercheurs dans leuts investigations.

On voit donc que les chercheas ont un céle prépondésant; dans cette etude, on s'attachera done plus particulement au des femmes dans cette catégoric de personnel.

L'une des particularité du C.N.R.S. est d'employer heaucope de femmes 43% environ et de ue pas les tecruter uniquement pour les táches méneur en effet, en 1977, la repartition du personnel du C.N.R.S. était la suivante(tableau 1).

EVOLUTION DE LA SITUATION DES FEMMES AU C.N.R.S DEPUIS 12 ANS

Depuis 1966,le nombre de femmes-chercheurs au C.N.R.S. a sans cesse augmenté mais seuiement en valear absolue. En effect on 1967,les femmes représentaient 34% des chercheques et depuis 1976 elle représentent moins de 30%(tableau 2).ce pourcentage ne cesse de décreitre puisque le taux annuel d'embauche feminine dans te cadre des chercheurs est de I'ordre de 20-24% depuis 10 ans .

Qu'en est-il dans les autres categories de personnel?

Les femmes-ingénieurs passent de 40,8% en 1968,37% on 1977(table au 3) mais le 5 globle de personnel féminiin de C.N.R.S. reste aucour de 43% en effet le nombre de femmes devient plus important dans les categories qui demandent moins de qualification:

L'emploi des femmes au C.N.R.S. se devalorise.

QUI SONT LES FEMMES-CHERCHEURS AU C.N.R.S.?

Tout d'aberd, et sons statistique, il semble ntilc de préciser que la majorité des 2.000 femmes-chercheurs du C.H.R.S. sont mariéqs et méres de famille.

Toutes ont suivi les cours de I'enseiquement supérieur; ciles sont di-plomées de I'université ou d'une école d'ingénieurs.

Traditionnellement, les femmes ont plutét tendance à s'intéresser aux disciplines humanists ainsi qu'à la bioloqie et ces quute se retrouvent dans la repartition des femmes dans les grandes disciplines scientifiques(tableau 4).

Une premiéer remarque s'impose.les valeurs de ce tablear doivent étre compares is population feminine dans les universities et les grandes écoles

Le C.N.R.S a done bién une tradition d'embauche feminine.

Les grades nde chercheure au C.N.R.S sont les suivants:

-Stagiaire de rocherche (S.R.) (ce grade n'existe plus en 1977)
-Attaché de recherché (A.K.)
-Chargé de Recherché (C.R.)
-Moitre de recherché (M.R)
-Directeur de recherché (D.R)

El le pourcentage de femme est trés variable d'une discipline scientifiq; é l'autre, pern contre, on trouve une grande homogénéité dans I'évolution des carièeres féminines

En effect, quelle que soit la discipline, le pourcentage de femmes parmi les directeurs de recherché est toujours intériour au pourcentage moyen de femmes-cherceurs dans la discipline scientifique considérée et par contre le pourcentage de femmes parmi les charges de recherché est toujours superieur é ce méme pourcentage moyen (tableaux 6).

Ce decalage entre homes et femmes ne s'explique ni per l'ége ;la femmes chercheur est en moyenne plus agée de 2 ans que le chercheur-homme,ni par l'ancienneté;la femme- charcheur a en moyenne 2 ans de plus d'an-clenneté que le chercheur-homme.

En Résumé, et toutes disciplines confondues, len femmes chercheurs(29% de femmes parmi les chercheurs) ont deux fois mains de change que les chercheurs-hommes de devenir directear de recherche(14% de femmes parmi les directeurs de recherché).

La comparasion de la situation en 1966 et en 1976 montre que pourcentage de femmes dans les differents grade reste le méme(tablkeau 7).ilfaut cependant noter une exception importance;le pourcentage de femmes dans la grade le plus has(attaché de recherché) a cheté; c;est mettre en évldence la chute du taux d'embauche de femmes ches les chercheurs debutants.

OUI SONT LES FEMMES-CHERCHEURS AU C.N.R.S.?

Tout d'abord, et sans statistique, il semble utile de préclser que la majorité des 2,000 femmes-chercheurs du C.N.R.S sont mariées et méres de famille.

Toutes ont suivi les cours de I'enseigaement supérieurs; clles sont diplomees de I'université ou d'une école d'ingénieurs.

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MINORITE FEMINICE ACCENTUER DANG LES

Indépendant de son travail de perquement dit, le chercheue peut participer aux instances de I'cisions se la l'cherchy de desecrates maniéres.

- Il peut éter responsible d'une formation de recherché, diriger une éuipe ou mieux dirique un laborites compose de plus sieurs equips
- Il pent éter appelé aupr és du director general DE C.N.R.S.commes directeur scientifiques.
- Il pent également éter member du comité national de la Direction scientifiques.

Quelle est done la place des femmes dans ces instances de d écisions propers au C.N.R.S?

Responsabies de formation de recheren (tableau 80)
sur un total d'environ 1200 formations de recherché il y en a moins de 100 qui sont dirig és par une femme.

Directeurs scientifiques.il existe actaullement 8 sectrurs scientifiques au C.N.R.S.; aucun d'eux n'est dirilg é per une femmes.

Comité national.(Tableau 9)
Le cas du comité national de la recherché scientifiques ent particuliérement intéressant élant donné le role et le mode de constitution dce ce comité.

Le comité national tient un grand role puisqu'll donne á la direction du C.N.R.S. son avis, avis trés écouté, sur la attributions de credits aux formation de recherché, sur le recrutement et sur l'avancement du personnel cherchcue.

Le comité national cst compose de 41 section de 20 membres chacune.

13 membres sont élus par la communaut, scientifiques franqaise et le crops ensciganant des unniversiés:

3 mombres sont éluse par les ingéntere, technicians et administraties. Du C.N.R.S.:

5 membres sont nommés par le minister de l'education national.

5 memebres sont nommés par le minister de l' education development industriel et scientifiques.

En 1976,le corps électral compremite 60,000 personnel.

Li est done intéressant de notre que les femmes se sont présentées dans les instances élues que dans les instances nommcés.

- Il faut également relever que,toutes proportions,gardées,les femmes ingèbnieurs,techniciennes et administratives sont beaucoup mieux représentées au comité national que les femmes chercheurs.

LES FEMMES SONT-ELLES DE SONS CHERCHEURS

- 30% de femme's parmi les chercheurs du C.N.R.S.
- 15% de femme's parmi les directeurs de recherché
- 7% de femme's parmi les responrables de formation de recherché.

Face á ces statistiques, on peut se demander si les femmes soatrde hons chercheurs.

Indépendamment de l'opinion générale (homes et fommes) qui est unanime á trouver que 'les femmes sont de bons chercheurs,an peut relaver les faits suivants:

- Malgré sa diminution par rapport aux années 60, le taux d'embauche des femmes reste relativement élevé ;
- Un relevé des publications effectué sur 22 femmes chargées de recherché sur une période de 4 ans, montre qu'elles publient autant, sinon plus, que la moyenne des chercheurs de leur secteur.
- Par contre, il semblerait qu'elles deponent beaucoup moins de brevete. (sur 102 brevets déposés en 4 ans au nom du CMRS, 19 d,eutre aux comptent une femme –ou plus- parmi les inventeurs).
- Enfin, le tableau des médaillés du C.M.R.S est eloquent puisqu on accorde (ou que les femmes acceptant) beaucoup plus facilement une médaille aux femmes-chercheurs (15% de femmes parmi les médaillés), qu'on ne leur confie (ou qu'elles acceptant) la direction d'une formation de recherché (7% de femmes parmi les responsables).

A partir de ces tableaux chiffrés, il semble que l'on puisse faire ressortir les points suivants:

- les femmes sont attires par la recherché;
- les femmes sont de bons chercheurs;

- l'emploi des femmes au C.N.R.S. se dévalorise;
- les femmes – chercheurs sont peu nombreuses aux postes- clefs du C.N.R.S.

Il y a donc une contradiction entre I’ affinité qui semble exister entre les femmes et la recherché et le pouvoit don’t elles disposent.

Il faut done essayer d’en voir les causes.

N’étant personnellement ni sociologue,ni psychologue,je vais simplement pro[oser queiques hypotheses,en essayant de mettre en evidence;

- Le role de l’environement économique et social
- Le comportement des homes
- Et l’attitude des femmes elles-mémes

<u>POURQUOI LES FEMMES-CHERCHEURS SONT-ELLES NOMDREUSES AU C.N.R.S.?</u>

<u>La recherché est un métier nouf</u>

Donc sans traditions, sans priori.

Dien sûr, l’image du savant est celle d’un homme,mais le C.N.R.S. fut fondé par JOLIOT-CURIE et dons la familles curie, les femmes sont aussiillustres que les homes.

<u>La recherché s’est développée après la querre 1939-1945</u>

C’est –á-dire á une époque oû il fallait reconstruire la France.le manqué de main-d’oeuvre était general; tous les travailleurs homes et femmes,de toute qualification étaient les bienvenus.

<u>L’ université s’est démultipliée dans lesa ánnées 50-60</u>

Il faut á peu prés les mémes diplomes et les mémes reference professionnelles pour faire carriére au C.N.R.S. et pour foire carrier á l’université les possibilities de promotion étaient plus grandes á l’universite qu’au C.N.R.S. les homes sont done allés de préférece á l’université et… ont laissé les femmes au C.N.R.S.,

Il serait intéáressant de comparer disciplie scientifiques opar discipline scientifiques, 10% de femmes dans le crops professionnnal des universities et le % femmes-chercheurs au C.N.R.S.

<u>La recherché est perque comme un métier feminine</u>

La recherché n’est pas directement productive donc, aux yeux de public travailler dans la recherché ce n’est pas concurrencer l’homme dons le travail.

Il a’y a pas d’impératif de production,pas d’impératif de productivité, pas de délais á renir.les risques de conslit entre vie familiate et vie professionnelle sont donc moins grands que dans heaucoup d’autres mtiers.

L’image du travail de recherché et l’image de la féminaté sont compatibles; instructuion, patience, calme, minutie

Les femmes envisaquent dons volontiers d’entrer au C.N.R.S et les homes les y poussent

POURQUOI LES FEMMES SONT-ELLES ST DEU DANS LES INSTALCES DE DECISION DU C.N.R.S.?

Rappel

- 30% de femmes parmi les chércheurs C.N.R.S.
- 15% de femmes au comité national
- 7% de femmes parmi hes Responsabies de formations de recherché
- aucune femme directeur scientifiques.

NOTORIETE ET PRESTIGE DE L'ECOLS D'ORIGINT

Comme dans becaucoup d'autres organisms les postes de direction du C.N.R.S sont tres souvent comfiés á d'ancien éléves des grandes écoloes et en particulier de l'ecole normale supérieure de la rus d'ulm.

Les anciennes éléves de l'ecole de sévres ne jouent pas un role equivalent á celui de leurs coliégues de la rue d'ulm.

RESISTANCE DES HOMMES

La direction d'une équipe, la gestion d'un budget,les decisions d'embauche dans une enterprise sont des priviléques masculies que les homes n'ont aucune envie de céder aux femmes.

RETICENCES DES FOMMES

Ces réticences s'expliquent surtont par les risques de contries entre vie privée et vie professionnlle.

Les postes de responsailités comportent souvent des horaires plus lourds et débordent les emplois du temps classiques.

Devenir directeur de laboratoire apports un certain presting,fait entrer dans le cercle des notabilities (suriout en province) et peut poser un probleme de préséance dans le couple.

En résumé les femmes, responsables d'unités de recherché sout confrontées aux mémes problemes que toutes les femme's qui ont une foustion de direction dans la via professionnelle.

POUROBOL LE TAUK D'LMBAUCHE DES FEMMES-A-T-IL CHUTE

Récession économique et reaction masculine

Est-ce un hazard si les taux d'embauche des femmes-cherecheurs et des femmes-ingénieurs au c.n.r.s. ont commence à regresser en 1968? On peut piutôt penser que ce phénoméne s'inscrit dans la recession générale de l'emploi.

Les taux d'embauches de charcheurs au C.N.R.S. ent considérablement diminué; les promotions internes se sont ralenties. A l,université la situation s'est complétement bloquée. Le C.N.R.S. est devenu un meilleur amployeur que l,Université. Alors les homes se sont portés candidates au C.N.R.S. et le taux d'embanche des femmes a diminué.

Les qualities professionnelles des femmes inqénieurs et scientifiques dans le domaine de la recherché sont reconnues. Malgré cela, elles n'échappent pas à la loi générale du travail feminine, considéré comme un travail d'appoint; en période de besoin, on les incite à enter dans le monde du travail, en période de recession, elles sont rejetées.

Manque de solidarité des femmes entre elles

On peut quand méme s' étonner du recul si important du taux d' embauches feminine (.)). Curieusement,le recul le plus important a lieu dans le secteur des sciences de la vie ou les femmes-chercheurs étaient á égalité numérique avec les homes.

Quand on sait que les diplomes de l' université sont de plus en plus nombreuses et qu'elles rencontrent des difficultés é trouver un emploiest-il normal que les femmes on poste acceptant que le taux d' embaucho feminine diminue ? il me semble qu'on peut l' expliquer par un manqué de solidarité des femmes emntre-elles éá tous les niveaux.

Passivité des cadres supérieurs féminins.

A l' heure actuelle,les cadres supérieurs féminins sont toutes des femmes exceptionnelles car il fallait faire preuve d' une grande force de caractére pour entreprendre des etudes scientifiques dans les années 30-40 et pour ensuite réussir une carriére professionnelle.mais toutes ces alnées ont conscience de leur valeur personnelle; elles ont durement lutté et beaucoup d' entre elles ne sentient aucune obligation de cendre le chemin plus facile é leurs cadettes.

Mangue d' intérét pour les candidatures féminines ou comité national

que ce soit par manqué de candidatures féminines ou que ce soit par vote des femmes pour des candidates masculine,les rsultats soat lá les femmes-chercheurs sont minoritaires dans toutes les sections de comité national .

Et pourtant,chacun soit au C.N.R.S.., que les commissions da comité national donnent leur avis sur les embauches,les advancements et les budgets.

Les femmes-chercheurs constituent done une minrité non organisée elles assistant,déteachées (et passives) á la défeéáminisation du perdsonnel chercheur du C.N.R.S.

Note: Il N'y A Paas De Recul Du Laux D'embauche Féminin en sciences physiques pour l'ingénieur et Presque pas en mathbématiques sciences physiques.

CONCLUSIONS

On peut donc expliquer la frote implantation des femmes-checheurs au C.N.R.S. per des conditions psychologiques, des conditions de travail et un contexte historique favorables.

Malgré leur importance numérique,
Malgré leur culture universitaire
Malgré leur travail qui exige un esprit de réflexion

Elles sont rares aux postes de decision,

Elles constituent une minorité non-organisée

et

La situation des femmes-chercheurs au C.N.R.S. est vulnerable

IMPORTANCE RELATIVE DU PERSONNEL FEMININE DANS LE GROUE C.N.R.S.

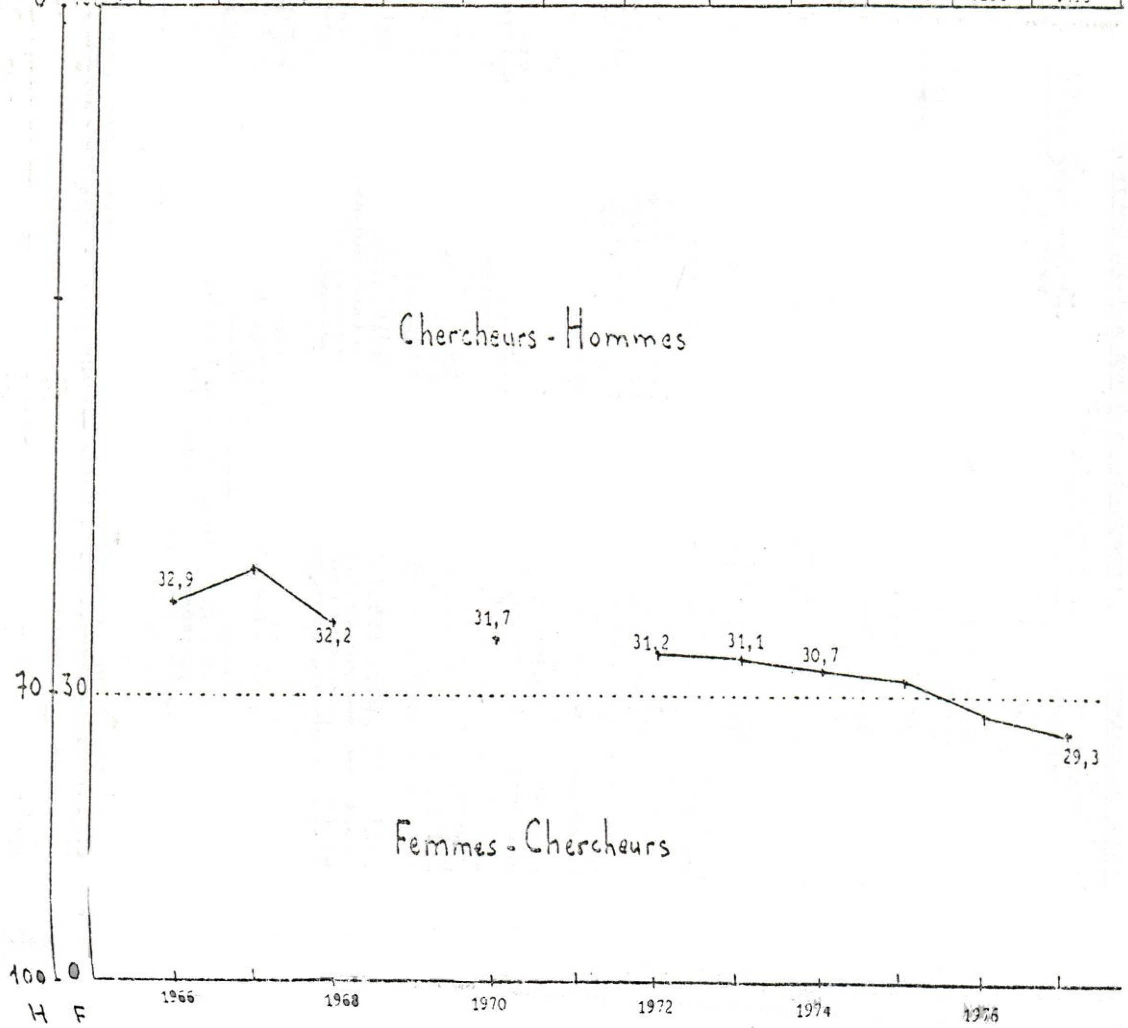
<u>EN 1917</u>

Catégories	Effectifs	Don't femmes dans chaque catégorie	
		Nombre	Pourcentage
Chercheurs	7.493	2.196	29.32
Ingénieurs (*)	2.536	939	37.0
Technicians	8.193	4.117	50.2
Administratifs	1.875	1.708	91.1
Divers	874 342	51 158	
<u>Total general</u>	21.313 Hommes et femmes	9.169 Femmes	43.02

(*) il ne faut pas confondre la catégorie ingénieur C.N.R.S. (on y trouv des ingénieurs diplômés, mais aussi des médecins, des pharmaciens, des docteurs en droit, en économie, des bibliothécaires, etc..) avec le titre d'ingénieur diplômé d'une ecole.

ée et nbre total chercheurs

1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
4.862	5.264	5.704	5.957	6.005	6.201	6.401	6.550	6.692	6.868	7.256	7.493



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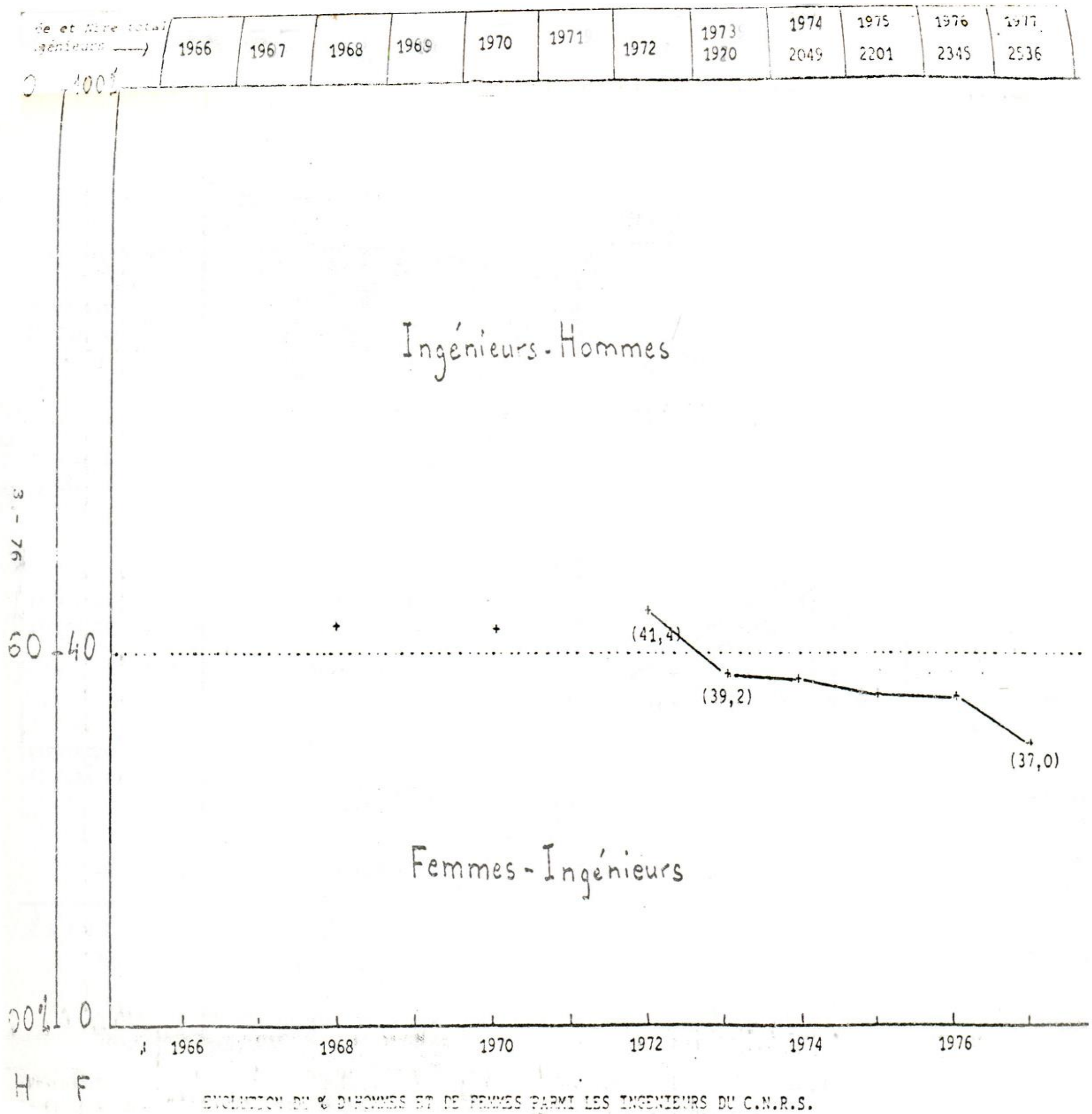


EVOLUTION DU % D'HOMMES ET DE FEMMES PARMI LES INGENIEURS DU C.N.R.S.

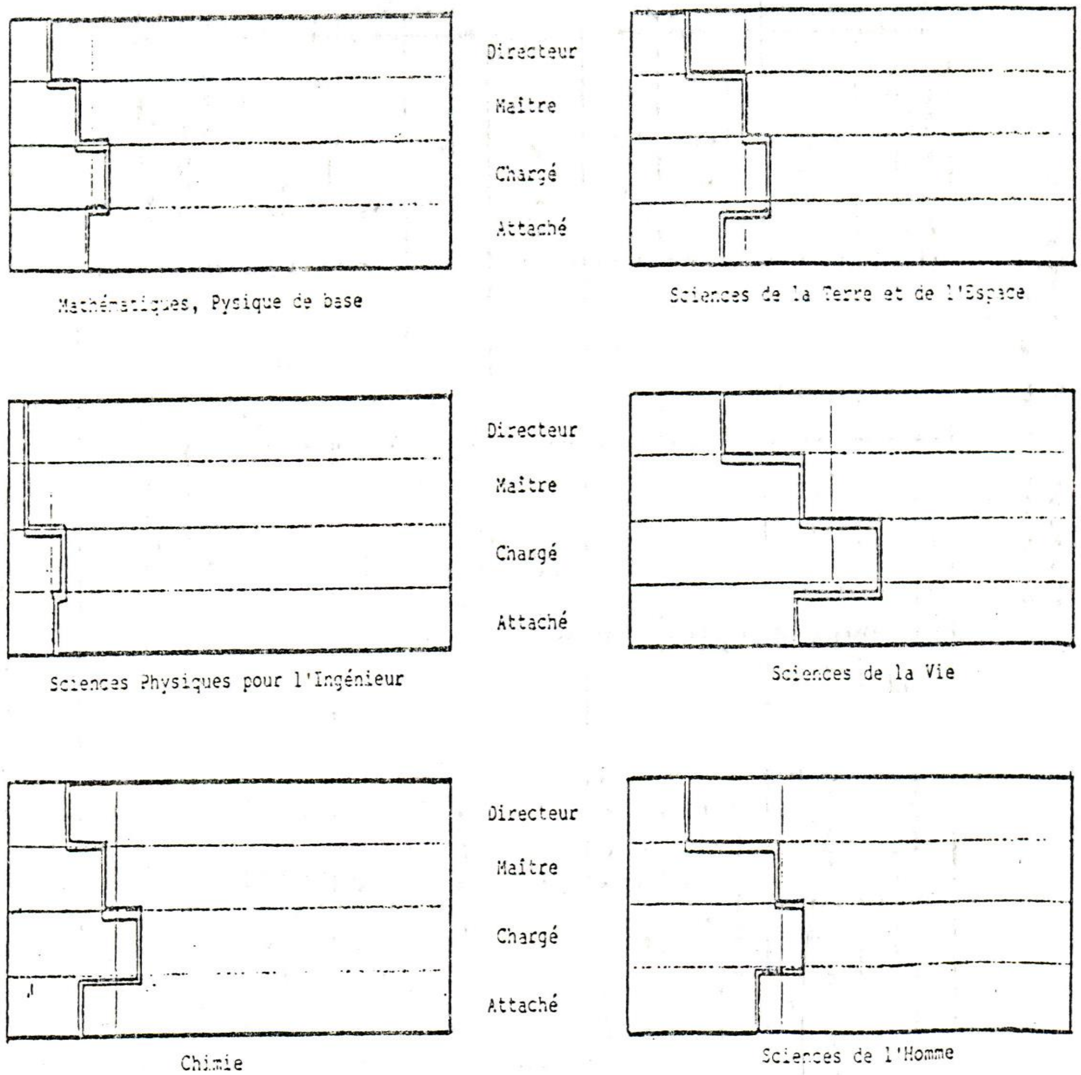
REPARTITION DES CHERCHEURS HOMES ET FEMMES DU GROUPS DU GROUPS C.N.R.S

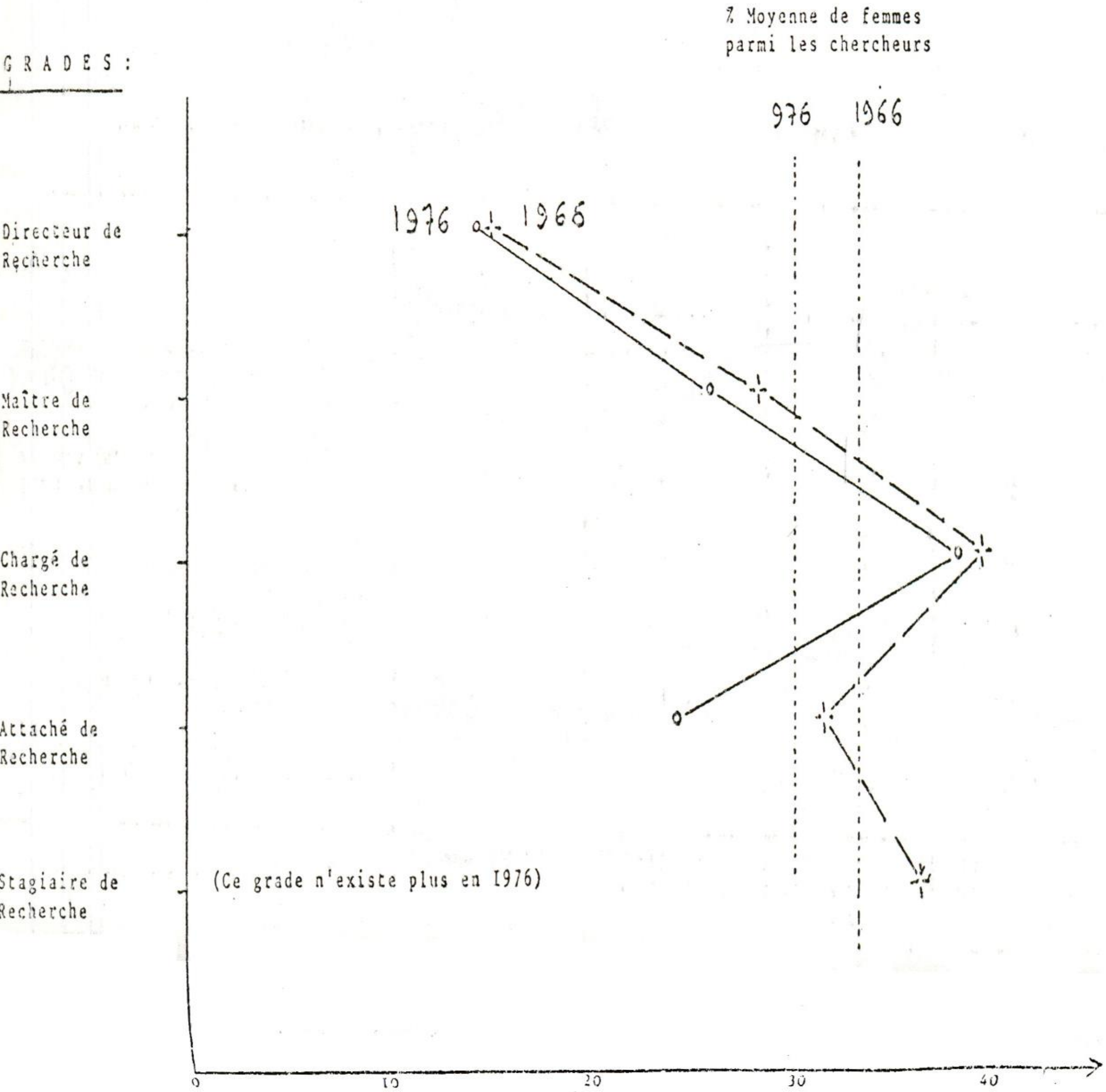
DANS LES SETEURS SCIENTIFIQUES

SECTEURS	Hommes	Femmes	TOTAL	POURENTAGE Femmes
Physique Nucléaire et physique des particules	302	45	0.347	13.0
Mathématiques, physique de Base	840	184	1.024	18.0
Science physiques pour l'Ingénieur	491	49	0.540	9.1
Chimie	1.145	1358	1.504	23.8
Sciences de le Terre et de l'Espace	519	173	0.692	25.0
Sciences de la vie	1171	966	2.137	45.2
Sciences de l'Homme	822	421	1.243	33.9
Autres	6	-	6	
TOTAL GENERAL	5.297	2.195	7.493	29.3 %

POURCENTAGE D'HOMMES ET DE FEMMES
DANS LES DIFFERENTS GRADES DE CHERCHEURS
EN 1977

Femmes
Hommes




% Moyenne de femmes
parmi les chercheurs
GRADES :
976
1966
1976
1966
Directeur de
Recherche
Maître de
Recherche
Chargé de
Recherche
Attaché de
Recherche
Stagiaire de
Recherche
(Ce grade n'existe plus en 1976)
0
10
20
30
40

RESPONSABLES FEMININS
DE FORMATION DE RECHERCHE DU C.N.R.S.

Secteurs scientifiques	Nembre de formations de recherché	Nombre de responsables féminins	% de formations diriqées par une femms	% de femmes-chercheurs dans le secteur
De Pays les Nucléaire Physique	14	0	-	13%
Physique de Base	140	3	2.2	18%
Physiquespour l'Ingénieur	100	2	2.2	9%
Chiman	180	12	7.2	24%
Sciences de la Terre, ocean, Atmosphere, Espace	100	4	4.2	25%
de la vie	300	32	44.2	48%
Sciences de l'Homme	400	34	8.82	34%
			Moyennes générales	
Totaux	1200	87	7.2	29%

Valeurs ce ces deux colonnes sont données à car le peintaqe exact est difficile à fair

Les femme’s au comite national de la recherché scientifiques

Secteur scientifiques et sections correspondantes	Femmes chercheurs	Femmes ITA	% de femmes au comité national	% de femmes chercheurs des les secteurs correspondanes
Physique nucléaire et physique des particules section VI	1	1	8.0	13,0
Mathématiques,physique de base sections I,V,VIII,XII.et XIII	5	4	6.9	18,0
Sciences physiques pour l’ingénieur sections II,III et IV	2	1	3.8	9,1
Chimie sections IX, X, XI, XVII, XVIII et XIX	11	7	11,5	23,5
Sciences de la terre et de l’ espace section VII, XIV. XV, XVI··	5	1	4.2	26,0
Sciences de la vie section de XX é XXIX	38	18	21.5	46,2
Sciences de l’ homme sections de XXX é XLI (XXXVIII··)	54	17	22.8	33.9
TOTAUX	116 soit 165 femmes sur 1066 memnres	49	Moyennes générales Femmes au CN 15.5%	Femmes cherche 25% femmes au CNP 43%

. Section sans aucune femmes
.. Section pt49sid49e par une femme

MEDAILLES DU C.N.R.S 1972 & 1977

Secteurs scientifiques	OR		ARGENT		BRCNZE		Femmes chercheurs dans de domains
	Homes	Femmes	Homes	Femmes	Homes	Femmes	
Mathématiques,sciences physiques	2	-	26	-	47	1	15%
Sciences de la terre et de l'essace	1	-	10	-	12	2	25%
Chimie	1	-	15	-	31	2	24%
Sciences ce la via	1	-	11	4	16	15	45%
Sciences humaimes	1	1*	18	7	52	15	34%
Totaux	6	1	80	11	164	35	
			Soit 12% de femmes		18% de femmes		

- cécernée en 1975,année de la femme.

LA FORMATION ET L INFORMATION DES FEMMES ONT-ELLES LE MEME ASPECT EN PROVINCE ET DANS LA CAPITALE

Sylvia **HOPPILGARD**

Ingénieur civil à la direction
Des constructions aéronaveles

Introduction

Le role important que penvent jouer les femmes pour orienter l' usage des techniques dans un sens favorable à l' ensemble de l' humenité, qui a été souligné dans les exposés de ce congrés, impose qu'un nombre croissant d'enter-elles soit formé dans disciplines scientifiques et techniques.

Ce role est percu dans notre pays ou tous les moyens de formation technique sont accessibles aux femmes er leur ouvrent l'accés à des.emplois plus nombreux et mieux rémunérés.

Etant donné que les universities,les institutes et les èceles de formation des scientifiques,des technicians et des ingèbnieurs sont largement repartees sur le territoire et que des réseaux de communications routier,ferroviaire,aérien,denses permettent de joindre entre eux les points màme les plus reculés on pourrait penser que la proportion des femmes recevant une formation technique serait la méme dans tout le pays.

Nous avons pour nous en assurer regardé le phénoméne phénoéne pour la region provence, alpen, corse, 6 départments du sudde la france, au voisinage de la méditerrannée,et nous avons compare les chiffres recueillis avec ceux de la region parisienne.

LES FAITS

Les chiffres cites se rapportent,pour la plupart, à l' année scolaire 1976/1977, ile concernent:

- La scolarité de base suivie dans les lycées at colleges,,jusqu'au niveay du baccalauréat
- La formation des technicians dans les institutes universitaires de technologie ,rattachés aux universities,qui délivrent après deux ans d' etudes, suivant le baccalauréat, un diplome de technician superieur.
- Les éléves des écoles d' ingèbnieurs

Dans les grandes lignes, on peut en déduire que la population feminine est moins scolarisée dans la region considérée que dans l' ensemble de la france et suttout que dans la region parisienne.

Par contre,si le pourcentage des jeunes filles est inférieur dans les classes scientifiques des lycées et surtout des colleges techniques, ainsi que dans les écoles d' ingèbnieurs, en provence,al proportion des jeunes filles dans les disciplines scientifiques des institutes universitaires de technologie,est plus grande que dans la égion parisienne.

Les données chiffrées sont les suivantes:

A.1- Lycées et colleges

La population scolaire feminine repésente 49% de l' ensemble de la population scolaire en France.

Dans les classes préparant au baccalauréat, pour l'ensemble du pays, les femmes représentent:

- 33% de l' effectif des classes scientifiques
- 78% de celui des classes littéraires
- 7% dens les classes mathématiques et techniques

Dans le département du var par example,cette population est inférieurs á 30%.

A.2-colléges techniques

Les femmes représentent 42% de l' ensemble, mais 66% sont orientées vers le tertiaire (professions de burean, commerce, gestion des enterprises etc..), et dans la region considérée elles sont 78%.

B. - Institutes universitaires de technologies

Pour l' ensemble des disciplines enseignées et pour touts la France, les femmes représentent 32% des éléves:

Region parisienne	32,5%
Académie AIX-MARSEILLE	27,8%
Université de TOULON	27,6%

La ventilation seion les disciplines est la suivante:

Disciplines du secondaire

Formation	- Formatique
scientifiques	- Genie chimique
Et technique	- Genie mécanique
	- Genie physique
	- Etc.

Region parisienne :

PARIS	16%
CRETEIL	
VARSAILLES	

Provence:

AIX-MARSEILLE	20; 4%
AIX-MARSEILLE+TOULON	18,8%

Dans le département du var la participation des jeunes filles á ces disciplines est extrêmement faibie, environ 4 %. Le département est peu industrialiséet son université est de creation récente.

Disciplines du tertiaire

- Gestion des enterprises
- Carriéres juridiques ou commerciales
- Emploi de bureau
- Etc…

Region parisienne	47,7%
AIX-MARSEILLE	37,6%
Avec TOULON	41%
OULON seul	48%

c. Ecoles d' ingéenieurs

pour l' ensemble de la France,11,9% des éléves des Ecoles d' ingénieurs sont des jeunes filles. Les proportions deviennent:

AIX-MARSEILLE, ensemble des Ecoles	4,83%
Ecole d' ingénieurs de MARSILLE E.S.I.M.	6,3%
PARIS	9,37%

Dans les classes préparatoires aux Ecoles d' ingénieurs,les pourcehtages sont de:

- 30,5% de jeunes filles pour la France entiére
- 17 á 22% pour la region.

TENTATIVE D' EXPLICATION

Une premiére raison á la disaffection pour la formation scientifiques ou technologique est sans doute la faible industrialization de la region et,peut étre, une mauvaise adéquation des formations proposes aux emlcis offerts.

D' autre part, d' une enquête rapide cifectuée auprés des dirigeants d' établissement d' enseignement, li resort que les éléves et leus familles sont mal informés,mais les séances spéciales d' information reserves aux éléves en dehors des indications fournies ex cathédre par les professeurs, en classe,n' ont aucune assistance.

Enfin les attitudes traditionnelles qui ont tendance á maintenir la femme dans les situation du tertiaire ou á son foyer, sont sans doute plus tenaces dans les pays méditerranéens.

Il y acerainement,encore d' autres causes que nous n' avons pas découvertes au cours de notre enquéte.

LES REMEDES

Un des meilleura remédes serait sans doute trouvé dans une bonne information, per des moyens modernes.des éléves et de leurs familles, sur le dérouement des carriers scientifiques et techniques et le contenu des etudes qui y préparaent

Les voies traditionnelles de l' information par lesx professours ou les conferences organisées l' intérieur des établissements scolaires n'ayant plus guére d'efficacité.

Il semble qué des ameliorations pourraient étre apportés par:

- Des information S télévisées ou radiodiffusées
- Des journées portes ouvertes dans les enterprises et les laboratories.
- Des bandes dessinées dans presse
- Des journées d'information groupant,en dehors des établissements,les members de plusieurs disciplines,telles qu'en organisent certains clubs professionnels.

Peut-étre aussi la conception et la diffusion de certains jeux de société pour familiariser les enfants,dés leur jeuns âge, à l' exercice de certaines activités professionnelles.

Conformer les formations aux besoins de l' activité régionalem,inciterait,par des emplois possibles à l' issu des etudes.les étudiants à se diriger vars les enseignements offerts.

Enfin surtout,une action des femmes dans leur entourage,dans la cite,pour infléchir les coutumes dans le sens d'une ouverture de toutes les jeunes vars les métiers techniques.

Cet exposé sset echématique n'a d' autre but que d' initier la discussion sur les moyens d' information et d' orientation des femmes vars les carriers scientifiques et techniques à travers tout un pays.

WOMEN ENGINEERING STUDENTS-WHO ARE THEY AND WHAT HAPPENS TO THEM?

DORMER ELLIS

Why is it that to very few Canadian girls prepare for a career in engineering? In my province, Ontario, which includes one of the most important industrial regions of the country, there are thirty thousand licensed professional engineers. Fewer than a hundred of them are women.

One looks in vain for evidence of overt sexual discrimination in the educational system or in the professional associations. One can only explain the rarity of women engineers in terms of social customs and sex-role expectations. it is not that the Ontario girl decides against entering the engineering profession it is that the idea of doing so is unlikely to even occur to her.

Almost a decade ago, a master's thesis in sociology at an Ontario university surveyed by means of a mailed questionnaire, women registers in any Canadian province. a major finding was that the respondents were mainly women who had immigrated to Canada after qualifying as engineers in countries where such a profession is not considered very peculiar for a girl, or were the Canadian-educated daughters of emigrants from such countries. Canadian born daughters of candian-born parents were found to be a minority within the minority of women engineers practicing in Canada

The situation is now changing. The percentage of women students enrolled in university engineering programmes has increased ten-fold in the last few years and is now as high as three or four percent in some universities. What is even more significant is the fact that about half of these women students are from families that have been in Canada for many generations.

What has caused this increase in numbers and change in family background? It is an unexpected result of changes in the age distribution of the Canadian population. During the During the years when we had a particularly large number of people in their late teens or early-twenties, university faculties – including engineering faculties - expanded enormously. Now we are in a period of declining enrolment and there is a great deal of competition among universities and among faculties within each university in an effort to attract qualified entrants. Our university funding system is such that each student registered brings a certain number of government dollars to the faculty, For the first time in our history, engineering faculties are actively trying to attract young women, The government gives the university the same amount of money for each student - regardless of sex.

A long term, educational research project entitled "WOMEN ENGINEERING STUDENTS - WHO ARE THEY AND WHAT HAPPENS TO THEM" was initiated in 1976 and will. Continue at least until 1982. I am the research director of this project, which is a joint undertaking of the University of Toronto where I am a professor of research and, the Council of Ontario Deans of Engineering.

There are ten Ontario universities that offer degrees in engineering. All the women students who enrolled in the first year of an engineering course at' any of these universities in September 1976 were designated as research subject. There are 165 of them

As the project is one or longitudinal research, each subject is to be followed individually year after year to see what does in fact become of her during the four years of training and the first couple of years after graduation.

A great deal of information has already been collected during the first two of this research. Information comes directly from the women students themselves

By means of periodic questionnaires, which are handed to each woman by the dean of engineering of her university and which, she completes and mails to me. The woman can be completely frank in their responses as no one at their university - and certainly no man - ever sees what they have written.

During the first year of the project, I visited each of the ten engineering faculties as the guest of the dean. I addressed the women students of all years and also interviewed individually many of these who are the subjects of the research.

Other sources of data that are useful to me are secondary school and university records of individual women students' access to which has been granted to me by the provincial educational authorities.

The data bank now includes personal characteristics (such as age, place of birth and I. Q.), family background factors' (such as fathers' occupation, number of siblings and family income), academic achievement and test scores - that is to say - factual information. In addition, I have the women's subjective responses to questions about WHO encouraged them to study engineering, WHO had attempted to dissuade them and the reasons given for so doing. Their feelings of acceptance or rejection by classmates, professors and women students in traditional courses have al so been explored. Their success in getting part-time and summer employment and their personal experience on the job are being documented systematically.

When we meet for the sixth international conference of women engineers and scientists, I will be able to give you the final report of this intensive study of a complete cohort of Ontario women engineering students, who, by that time, will have graduated from university and, hopefully, found employment in their chosen profession.

Today, I can only tell you that they are now in the third year, of their four-year course, their grades are higher than those of their male classmates, they feel

Comp1etely at home in their engineering faculties, they believe that their fathers and brothers are proud of them but that their mothers - the majority of whom are housewives - wish that their daughters were following more traditional paths. The research subjects themselves are confident and ambitious. They fully expect to combine family 1ife and professional career although many of them are not quite sure just how they are going to do so.

I look forward to sharing with you, at our next international conference this research concerning Canada's first crop of "home-grown" women engineers.

THAILANDE COMISSION NO 3

EDUCATION & INFORMATION OF WOMEN ENGINEERS IN THAILAND

Anna SAENGBANGPLA
Sasithron BOON-LONG
Department of Chemical Engineering-CHULALONGKORN Univ.

1. INTRODUCTION

Education in the past or the present has been developed to meet the needs of the individuals or the society in which we live, or in other words, it is a reflection of the environment and the words, it is reflection of the environment and the level of that society, Thailand is an agricultural country. Her economic development slow. In the past her agricultural production is sufficient only to meet her own immediate needs. With this type of activity in the country she does not need any specialized knowledge. Education in Thailand then means, to be able to read and write, to know what is right or wrong, to know and under-stand the principles of mora1 and to keep the culture and tradition of the country.

However, nowadays with the progress in industry and technology, the needs for specialisation in the field of science and technology must follow in order to meet the requirements of the society. Thus education must be improved to meet these requirements.

The form of the educational system bares in some respects a relationship to the system of government. Thailand is a democratic country, its education has been designed so that the population will know and understand democracy, know their rights and duties, know how to think, how to choose, how to make decisions and how to be good citizen. Furthermore, the country's religion, culture and tradition also have a strong influence had a marked effect in the past, woman were not given the freedom to choose the type of education, as woman were then considered inferior to men, therefore the society restricted women's activities to those suitable to them; such as house-keeping and child minding. Education for them was designed to meet these

Needs: home economics subjects were taught, such as cooking, pastry making, sewing, etc. Women were not taught to read or write, those who could read and write were few and they were usually women of the royal courts. It is only within the last 100 years, in 1880, that King Chula Chom Kiao (Rama V) established “Sunantalai School” as a first boarding school for girls. From then on women have the opportunity to be educated.

Education for Thai women began to develop, women have the opportunity to study and have shown that they are able to work side by side the men in helping to develop the country and its society. Only a few years ago, scholars and economists realised that if women were given the opportunity to participate fully in the country’s economic progress and the goal set will be fulfilled even faster.

At present, women have a trend of working more and more outside the home, maybe for economic reasons or just to open their eyes and ears to the outside world. We find Thai women working in many types of professions, such as employees in industries, doctors, engineers, civil servants, seiling goods in shops and department stores, etc. However, there are certain professions, which the Thai law permits men only, for example officer-in-charge of a district or governor of a province.

Inspite of the acceptance of women’s activities and their importance to the Society and the country; Thai society still restricted women’s roles and refused to realise their abilities, especially in administrative type of work. The society still considered women inferior to men, as women are temperamental and are afraid to make a decision on their own. However, if a women is firm and has high aspirations to do her work well, the society condemns her as being a radical and no employer would employ her because she is too avarice, but if it’s a man, society would say that he has done the right thing! In some places women have reached administrative power, they do not have a definite position, their role is always inferior, such as an assistant. The reason behind this is the country’s culture and tradition, which is buried deep down in every Thai man’s outlook on Thai women that is a woman should be gentle, humble and be a follower rather than a leader.

The majority of Thai women themselves regard work as second important, they do not wish to work holeheartedly nor to bear the responsibility of work, they work only to supplement the family's income. To them family is more important than work.

However, education in Thailand at present have been designed so that men and women have equal opportunity to study. They have the liberty to choose their own fields of specilisation. At the same time, women are trained to have responsibilities, to be able to make a definite decision and to be leaders in various social activities and have a role in developing the country.

It can be concluded that there is no discrimination in education in Thailand.

2. EDUCATION SYSTEM IN THAILAND

Education, according to the National Education Plan 1977, is a continuous process, which goes on through life. Its aim is to raise the standard of living of the Thais and to serve the society so that they can live n harmony.

The education programme is divided into 4 levels, as shown below

Education System In Thailand

	Approximate age (year)	Education system in school		Extra Curricular Education
1	3 - 5 (2)	Kindergarten		
2	6 - 11 (6)	Primary	Special / Welfare	
3	12 - 14 (3)	Secondary I	Special	
	15 - 17 (3)	Secondary II	Welfare	
4	18 - (3,4,5,6,7,8)	Higher Education		

3 - 93

1. Kindergarten

The account is bringing up the children and to prepare them in every aspects before they enter compulsory formal education.

A Kindergarten school or a Child Minding Center can achieve this aim and normally takes two years.

2. Primary

In this level the students are taught basic knowledge, to be able to read and write and to be able to calculate. At the conclusion they are able to take up a profession suitable to their age and abilities and be law abiding and be law-abiding citizens

This level is compulsory and takes 6 years. Educational establishments may be governmental or privately owned.

3. Secondary

The curriculum is designed to give students educational and professional knowledge according to their needs, their interests and aptabilities, so that each and everyone understands and knows how to choose his professions that will be of use to him and to the society.

This level is deviding into 2 sections, 3 years per section. In the first section, students will learn general professional subjects. In the second section, emphasis is laid on the students to choose groups of subjects, so that they can take up a profession later on.

4. Higher Education

This level is intended to develop the student's intelligence

And their ways of thinking, as a consequence it is intended to create manpower in advanced educational and professional knowledge to help develop the country.

This type of education can be achieved in a college, a university or an open university. The duration can be 3,4,5,6,7,or 8 years depending on the type of professional education chosen, for example a vocational study takes 6 years, and for graduate studies the duration would be longer.

Special Education

This type of education is intended to develop certain professional skills which need training from childhood and take a long time to develop, for example dramatic arts and music, or a special education for the handicapped or the mentally retarded.

This can be achieved in a specialized educational establishment; an institute or it can be incorporated in an ordinary school according to its suitability.

Special Welfare Education

This type of education is designed to aid the underpriviledged, its aim it to give them an opportunity to be educated. The courses could be of the same type as those given in ordinary institutions or it could be courses leading to various professions.

In all levels of the educational system mentioned, men and women have the right to equal education. For entry into universities, examinations are taken, which emphasizes that both the men and women have the right to choose whatever is suitable for them. At present the percentage of women to men studies in the universities in 50/50. However, the majority of women students usually choose to study languages, arts, education and medicine, only a few could choose technical, technological and engineering studies.

3. WOMEN EHGINEERING STUDENTS

Although the university established the Faculty of Engineering 65 years ago, women engineering education began only in 1947, which is about 30 years ago. In the beginning there were only one or two women students who applied to study and in certain years there were none. However, in later years, i.e. after 1961 there were women students each year and the number increased gradually. In the years that follow there were about 19 women students among approximately 350 male students, which is about 2%. The stated figures refer to women students in the Faculty of Engineering, Chulalonglorn University only. In 30 years, there are about 150 women engineering students and 100 have already received their engineering degrees, as shown in Table I , and the distribution in various departments is shown in Table II.

Table I

Statistics of Women Students in The Faculty of Engineering
Chulalongkorn University

Year	Total number of students	Women
1947	447	-
1948	447	-
1949	496	8
1950	505	5
1951	479	3
1952	521	4
1953	631	4
1954	656	8
1955	735	6
1956	859	4

Year	Total number of students	Women
1957	1002	6
1958	1077	5
1959	1178	6
1960	1129	4
1961	1078	7
1962	1157	15
1963	1267	21
1964	1342	31
1965	1440	29
1966	1536	32

Year	Total number of students	Women
1967	1504	30
1968	1566	33
1969	1645	27
1970	1721	31
1971	1824	30
1972	1835	29
1973	1902	38
1974	1850	40
1975	1818	37
1976	1772	39
1977	1687	36
1978	1618	36

Table II

Graduate Women Students in various departments of the Faculty of Engineering, Chulalengkorn University

	CE	CP	ChE	EE	IE	ME	MN	MI	SA	SV	Total
Total	13	2	11	29	21	18	-	2	5	2	103

From Table II, it can be sent that there are women students in almost every branch of engineering, which shows that they are free to choose their own specilisation. For some department there are few women graduates, is because the departments have recently been established and the total number of students of the department is small, so there are few women students. The department that women students choose to study the most is the Department of Electrical Engineering; it is also the department having the largest number of students. The reason for this large number of students is that work in this field is vast and graduates can find a job easily.

After 1967 the Faculty of Engineering was established in many other universities, which are new and in their early steps of development. The number of students in these universities are small especially the number of women students, and only few departments have been established, mostly there are the Department of Civil Engineering, followed by Department of Electrical Engineering, Department of Mechanical Engineering and the Department of Industrial Engineering. At present their universities and

And institutes that have established the Faculty of Engineering are:-

Kesetsart University
Chiengmai University
Sengklanakarin University
Khonhaen University

and Phra Chom Klao Institute of Technology

These five establishments have produced about 40 women engineering graduates; see Table III, which is considered small compared to Chulalongkern University. At present these establishments have expanded, but the number of women engineering students remains small.

Table III

Women Graduates from other Universities and Institutes

University/Institute	Number of Women Students
Kesetsart University	16
Sengklanakarin University	5
Chiengmai University	3
Khonhaen University	8
Phra Chom Klao Institute of Technology	7

There are the major problems for women students studying in the universities. They are able to study the theory and do practical works as well as

Male students. The only problems for women students while studying is that owing to a small number of women students, they have to divide their time to various activities, especially in sports, administration work of the student organisation of both university's and the faculty's which put them under pressure and do not leave them much time of their own to study. Despite this there have been a number of women students who have graduated with first class honors and a considerable number of them received second-class honours. Most of them studied at their own pace without any difficulties.

4. ROLE OF THAI WOMEN ENGINEERS

Graduated women engineers have taken up professions, which suit them, best and they serve the society by helping to develop the country in various aspects. They work in government bureau, state enterprise and in private firms. Their choice of work is summarized in Table IV.

Table IV

	%
Government bureau	43
State Enterprise	27
Private Firm	30

This survey shows that the majority of women engineers prefer to work.

In government bureau, the reason for this choice is that in government bureau there is no discrimination of wages or status. Apart from the work and wages, in governmental works there are not much pressure, i.e there is no competition and decision-making. Thai civil work is divided into levels and policy has already been set, therefore working in this system is not competitive and do not require much decision-making. If a problem arises and a person is not sure how to solve it, he can always turn to his superior to make the decision. Women Engineers prefer to work as a civil servant because they prefer to follow other people's ideas rather than their Own. Thai women, from their early upbringing have been taught to let the men be a follower rather than a leader. However, there is still a large number of women engineers working in civil effaces and a number of them have achieved high positions as leaders and have to help solve problems and make decisions.

Women engineers who work in state enterprises have played a part in developing the country especially in public works. They too have advanced in status and received equal wages as the men. In work there is no Discrimination, except a restriction from working at higher shifts. According to the views of some welfare Organizations, it is not safe for women to work late and also this could be the cause of broken homes. A proposal has been made at several countries to set a rule preventing. Women from working late into the night and many working unites, Organisations and industries in Thailand have supported this view. In order to do

To encourage more than to choose engineering studies. Various associating have arranged talks to students in schools every year to encourage women students to take up technology and engineering studies. Responses have been fair. However, another important problem arines, that is, how can a woman engineer put herself wholeheartedly into her work without relating the culture and tradition of the country because a women have a duty of caring for the family and brining; up her children, at present, that men have esntributed some of their time to family activities and this should increase in the future. Both should share the family's responsibilities, which would give that women were opportunity to work to the best of their abilities and not having to worry about trivial affairs as it is at the present.

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BIOGRAPHY:

Graduated as a mechanical engineer from Chulalongkorn University in 1961 and received her M.Sc.degree from Manchester, England in 1968.she has worked and researched for several years in France ad England. At present, she is an assistant professor in the Mechanical Engineering department, Chulalongkorn University and is also a registered mechanical engineer and a member of the women engineering society.

SASITHORN ROON –LONS

Received a B.Sc. (industrial chemistry) degree from the university of the south vales, Australia in 1971,Diplome d'etudes approfondies (chi-te thyaicuo); 1974 and docteur de troisieme cycle (genies chimique) in 1976 from institut national polytechnique de touloe, France, at present she is a lecturer in the department of chemical engineering. Chulalongkorn University

URRSS COMMISSION ^{0}3

LES FEMMES ET LE PROGRAMS SCIENTIFIQUE, TECHNIQUE ET SOCIAL EN URSS

Z.P POUCHAVA directeur de la fabrique
De tissage a IVANOVA

Chéres amies!

Notre rencontre be passé dans le célébre temps pour I' union soviétique, dans ia premiére année de I' adoption de la nouvelle constitution de I'URSS. La principale direction de cenouveau, qu'il y a dans la constitution, -c'est un suivant élargissement et approfoundissement de la démocratie socialist dans les conditions du socialisme développé.

Le plus frappant témoignage du veritable caractére démocratique de la société socialiste est une égalité absolueet veritable des femmes et des homes dans tous les domains de la politique, économique, sociale et culturelle via de not re pays.

La nouvelle constitution de I'URSS comprend un large aspect des droits et des libertés de chaqun citoyen de notre pays – ce sont le droit au travail et au repos,le droit á pariciper á l' administration de l'etat et des affaires publiques, le droit á la protection de la santé ,sécurité sociale, I'instruction,la jouissance des resultants de la culture, liberté de la creation scientifique,technique et d'art,ect.

Il faut dirre que ces droits pour tous les citoyens, malgré leurs naissance, condition sociale et de biens, nationalité et race, sexe, instruction, languague, pieté, lis n'ont passeulement proclamées, mais ils sont appuyés per les garanties matérielles pondérables, En premier temps ce sont la ferme.

Croissance des forces productives de la société et l’absence du chomage, I’instruction gratuite et la qualifiée assistance medicale gratuite, assurances socinles des ouvriers, empolyés et kolkhoziens, les pensions pour des vieux et des invalids.

Ces considérables indices de I’emploi des femmes sovitiques ont été réalisables grace l’utilisation planifiée de tout complexe des faceturs dans les conditions du socialisme á savoir: socials et économiques, juridiques, morals et politiques, demographiques, et ethniques

Il faut indiquer que dans l’union soviétique le travail des travalleurs administratifs- ingénieurs et techniciensse pays á la dépendance de volume et caractére de travail, degré de la responsabilité,stage, instruction et qualification. Les femmes et les homes recoivent un méme traitement de base á la condition égale du travail, nous pouvons aussi dire cela au sujet de la prime pour cause de l’amélioration des indices du travail.

Les mutations progressives se passent dans la structure professionnelle et de qualification du travail des femmes; le poids spécifique de travailleuses occupies de travail manuel et peu qualisié réduit,les rythmes de croissance du nombre des femmes dans beaucoup des professions et des genres du travail mécanisé et automatisé,lies avec le controle,direction des appareils,machines,mecanismes,eves la realization de functions analytiques augmentent.

Le nombre des femmes avec l’instruction aupérieure et secondaire spéciale augmente sans cesse.au présent en URSS les femmes composent 59% parmi les specialists aves l’insti-

Tution et secondaire specials, permi les economists ce chieffre est 60%, Presque moitié de ingénieurs dons l'industrie est femmes.

Plus de 2,400 femmes ont le titre d'académicien, member correspondant de l'Académic des, professeur, plus de 32,000-chargés de cours, travailleurs scientifiques supérieure.

Le sentiment de le sincere deference éveille les femmes-savants qui ont trouvé leur vocation dans la médecine.72% de nombre des médecins dans les républiques de l'union soviétiqus sont femmes, les millieux scientifiques connaissent bien le nomde professeur dans le domine de microbiologic zinaida ermolova.ls recherches théoriques ménent avec sa participation immediate, on met en pratique les nouveaux et les nouveaux antibiotiques.son nom on indique parmi les savants qui ont surmonte'la redoubtable maladie-poliomyélite.

Dans la pratique mondiale clinique a été largement appliquée "la méthode de poutchkovskaia"-la méthode de transplantation de la cornée.le professeur nadejda poutchkovakaia-chef de l'institut Ukrainian de recherché scientifiques de maladie des yeux et thérapeutique de tissu filatov-opéredes miracles en rendant la vue au people.

Dans l'union soviétique il n'y a pas de branche de l'économie nationale ou lea femmes soviétiques ne pourraient pas manifester leur capacities et talents.

A ce moment envrion 800 femmes ont évé accordees une grande decoration de notre pays-le titre de lauréat du prix lenine et du prix d'Etat pour leurs mérites remarquables de la.

Science, technique et culture.le physician Olga bazilevskaia est.un lauréat du prix lénine.il faut ajouter encore que cette femme-savant pouvait former quntre enfante les deux parmi lesquels sont devenus physiciene comme leur mere.

Le soviétique mathématicien remarquable Ludmila keldyeh est la mere de cinq enfants, trios leurs file ménent déjá euxméme le travail scientifiques avec success

Les femme's soviétique se passionnent pour la science d'océan, cosmos, geologic maritime. "La femme de plus grandes profondeurs dans le monde" habite en union soviétique, le docteur és sciences, professeur valeria troitchkaia. Elle est descendue au fond de la mer méditerranée dans bathyscaph avec les savants francais, L'essentielle branche de ses recherches est la physique du champ magnétique.

Tout le monde connait bien valentina térechkova, qu'on s'appelle "la femme á plus haute altitude du monde entire".

C'était seulement des examples de quelques femmes-savants, qui sont de gloire de notre pays, mais dans notre pays il y a beaucoup de mémes femmes, les principales raisons de cette participation sctive des femmes dans les recherches scientifiques se trouvent dans la droit á l'instruction pour les femmes. Dans ce fait a étá jetée une de principales conditions de la liberation réelle de femme comme une personne,as participation active á la vie de société.

L'naalphabétisme a été liquidé dansnotre pays en bref délai historique el avant tout l'analphabétiame parmi la population feminine, qui a atteint 88% jusqu'á la revolution.

Les femme's soviétiques jouissent largement d'un droit á.

L'instruction, les portes de toutes institutions sont ouvertes pour les jeunes filles. L'instruction de tout degree est devenue gratuite.les étudiants des Ecoles d'apprentissage, secondaires et des institutes supérieure recoivent l'aide de la part de l'etat dans la forms de bourse et divers advantages.

Les femme's soviétiques participant plus activement á l'augmentation de l'efficitivité. De production sociale sur la base de l'accéleration du progress scientifique et technique. Elles portent une contribution considerable á la mécanisation et automatisation de procédés, á l'augmentation de qualité et diminuation de prix de revient, á la dépense retionnelle des resources matérielles, en matiéres premiéres et de main d'oeuvre. Elles unissent avec success leur travail á la production á l'institut et á l'établissement avec la grande activité publique.

Environ 3 million de femmes ingénieurs et savants sont members actifs des sociétés scientifiques et techniques de l'URSS qui unissent main tenant plus de 8,5 million de members et qui contribuent par leur travail au développement d'initiative de creation et d'activité des intellectuals scientfiques et scientifiques et techniques, au perfectionnement professionel font la propagande des resultants de la science, technique et experience progressive de production.

Plus de 16 mille de conseils d'administration et des soviets dans les républiques de l'union, soviets de territoire et de region,et aussi de l'organisation de base de ces sociétés dans le cadre de productions et les institutes sont sons la direction de femmes.

Pour example on peut nommer martchenko lidia-la premier

Vice-ministre de l'industrie légére de Lettonie RSS, qui est la president du conseil d'administration de SST (société scientifiques et technique) en lettonie; Digourova Eléne-vice-ministre de l'industrie de l'alimentation de RSS autonome d'ossétie du nord,kajorova zinaida –vice-ministre de l'industrie de l'alimentation de RSS de biélorussie qui ont aussi été éluse les presidents des conseils d' administration de SST de l'industrie de l'alimentation dans leurs républiques.

Environ 2 million de femmes sont members de la société de l'union des inventeurs et des rationlisateurs que se compose preque un quart de members de cette société

Dans les conditions du progress scientifiques et technique dans notre pays s'est élargi le nombre de professions pour l'assimilation desquelles il faut avoir maintenant non seulement I'instruction générale mais la preparation professionnel le fundamentals.

Come on sait. Les échangements colossal s'étaient passes dans le domaine de l'instruction dans notre pays. Nous avons fondé un large systéme déployé de l'instruction et de la preparation professionnelle. Naturellement,qu'une travailleuse qui a recu pareillement l'instruction secondaire et la preparation professionnelle(par example á l'école d'apprentissage) peut plus vite assimiler une technique nouvelle ou un nouveau processus technique,elle pent plus vita avec les moindres pertes pour elle échanger la sphere de travail.

Aprée l'école secondaire la jeune fille choisit librement sa profession,elle peut commencer á étudier á l'école d'apprentissage ou faire l'apprentissage directement á l'entprise elle pout auase fairs étuder aux techniques et our institute.

Supérieurs, Aujourd'hui les femmes se composent une moitié du nombre des étudiants de nos institutes supérieurs.les femmes se composent 40% du nombre des étudiants de nos institutes techniques.il faut noter spécialement que dans notre pays a été élaboré un systéme de planification de la formation des cadres qui a garanti le travail pour toute la promotion des établissements en conformité de leur specialization et qualification.

Le systéme du perfectionnement professionel des ouvriers et travailleurs d'ingénieur et technicien et des autres spécialictes est bien développé dans notre pays. On peut perfectionner ls profession avec aoandonner l'exercice de la profession (dans ce cas on paye unn salaire complrt ou partiel) et sans abandoner l'exercice de la profession,c'est-à-diere sans suspension du travail.il y a beaucoup de formes du perfectionnnement professionnel immédiatement aux enterprises et aux établissements; des écoles de production et technique,des écoles d'expérience progressive,l'instruction pour avoir deuxiéme et connexe profession.

Dans les conditions du progress scientifiques et technique dans l'URSS la formation et reformation de cadres se réservent une premiére place au systeme de l'instructionn.mais nous avons quelques problemes du perfectionement professionnel des femmes qui existent encore conformement aux demandes de la revolution scientifiques et technique et nous les résolvons avec nos plans. Ici il y a encore leurs complexities spécifiques.la femme a la possibilité égale avec d'homme de perfectionnner sa profession. Kais la femme-mére n'utiliese pas toujours ces possibilities vu son chargement dans la femille,elle a à sa disposition moins du temps pour perfectionner sa preparation professionnelle.

Vu Ce qui precede les plans du développement social d'entreprise prévoient des measures spéciales d'amélioration des conditions du travail et de la vie courante des femmes, on modernize les formes de l'instruction professionnelle et du perfectionnnement professionnel à l'entreprise pour les femmes travailleuses compte tenu leur àge et obligations familiales. Le grand travail pratique dans le domaine de leur orientation professionnelle.

En modernisant le systéme du perfectionnement professionnel de femmes travaillées notre parti et etat reflechissent non seulement aux exigencies de l'époque de RST mais aussi aux aspects socials et psychologiques de ce problems.

Plus besucoup des femmes seront occuper par le travail qualifié, plus ce travail dens l'économie sociale sera intéressent pour elles, plus grande signification prendre les facteurs morals du travail, plus grend role jouera les femmes dans le développement social et économique de la société, plus veriée et riche deviendra ia personnalité femme.

La nouvelle famille socialiste s'est basée sur l'union de' marriage volontaire d'indépendants économiquement des homes et des femmes et les époux ont mémes droits dans les relations femilisles, les necessities d'amour et de contacts amicaux, de maternité et paternité,de formation des enfants,de via coranteharmonique se satisfont le plus bien dans la famille,qui favorise sans aucun doute le développement de personnalité de chacun member de la famille.le caractére de famille, sa aisance matérielle,la santé d'esprit et morale déterminent essentiellement la mentalité d'homme,son activité socuale et travaillée,habilc education de la jeune rénration.non par

Hesars la preoccupation de la consolidation suivants de la famille determine dans la légielation soviétique comme un den plus importants buts de l'Etat soviétique.l'article special de nouvelle constitution indique que la famile se trouve sous la protection de l'Etat,que l'Etat side la famille au moyen de creation et du développement des réseaux des établissements d'enfants,de l'organisation et modernization de service de la vie courante et de l'alimentation collective,de l'octrol de subvention et d'avantege pour les familles nombreuscs,du payement de la subvention á cause de la subvention á cause de la naissance d'enfant.

Les plans d'Etat du développement de l'économic nationa le prévoient toutes ses measures.par example,au present nous avons 12 millions de places aux établissements d'enfants prescolaires et pendant les années de dixiéme quinqunnat ajouteront encore 2,8 million de places.le suivant élargissement reverra le réseau de groups de " la journée prolongée" pour les éléves.chaque année l'Etat dépense environ 2 milliaras de roubles au payment de subventions pour les familles nombreuses.

Comme un résultated nouvel role de femme á la société et d'échangement de sa position dans la famille est détruit son stereotype; une bonne qui sert des besoins des autres members de la famille de tout á tout ou principalement. Aujourd'huiune femme avec son mari organize la maison, éléve ses enfants.

On sait qu'un-important role pour développement de personnelité joue le temps de loisir.dans notre pays l'augmentation du temps loisir est á valoir sur la diminuation du semaine du travail á chiq jours, c'est-á-dire 41 heures du travail .les conditions historiques de l'activité vitale de sexes déterminent une certaine difference de la grosseur du temps loisir

Des hommes et des femmes, au mesure que nous avons le développement des forces productives á base du progress scientifiques et technique.l'élargissement de service de la vie courante individuells, la nouvelle repartition du travail dans la famille,la rupture parmi le temps loisir des hommes et den femmes diminue peu á peu.

Vu l'acuité et l'importance pour la société de probléme de la combination par la femme de son activité á la production,publique et familialequestion est spécialement soulignée dans le documeiondamental-le programme du PCUS-ouelle formulae comme la nécessité d'écartement des restes de position inégale de femmes dans la vie courante.

Plus loin notre société avance vers la haute stade de notre développement-vars le communisme-plus haute est devenue l'activité sociale de nos citoyens,plus large et profound les travailleurs entrainent á l'administration de l'Etat et de la société.

Le parti communiste et l'etat soviétique se basent surle fait que le développement du pays depend beaucoup de l'initiative politique et créateur,talent et enthousiasme de tout people,les hommes et les femmes,.le parti aspire stimuler l'englobement de toute population adulte par les divers formes de la creation politique et de la participation á l'administration dans ce fait est un trait caracteristique du systeme de Démocratie socialiste.

Comme on cait les soviets des deputes de travailleurs sont le plus pleine interpréte de la volonté social et le représentant du pouvoir de l'etat dans notre pays.

Plus d'un millior des travailleuser sont Ecoles dans les.

Soviets locaux,que se compose d'environ une moitié de deputes. Dans les soviets supremes des républiques de l'union et autonomes travaillent plus de trios mille de femmes deputes.dans le soviet supreme de l'URSS de la derniére convocation ont été.

Élues 475 femmes,que se compose un tiero de tous les deputes. Le nombre de femme's que nons élisons dans notre parlement soviétique augmente constamment avec chaque nouvelles elections. Parmi ces femmes il y a travailleuses, kolkhoziennes, représentantes des intellectuals.

Pandant les siécles les meilleurs esprits de l'humanité revaient au temps quand la femme pourrait occuper dans la société la haute position proper á elle,pourrait diriger tous ses capacities vars les buts du progress social.

La position de femme dans la société,ses possibilities de favoriser le progress general de l'humanité dependent de beaucoup dea facteurs,et le plus important fecteur est un régime social et économique.

Avec ce fait on ne peut s'empécher de se rappeler les opinions de l'utopiste-socialiste francais du XVIII-e siécle cnarles fourier:"le degree de l'émancipation de femme est un critére de l'émancipation générale".

Les femmes d'aujourd'hui participent activement dans la vie économique et sociale de la société. Mais lour réle pourrait étre plus important si dans le monde entire,dans tous les pays étaient créées les plus grandes possibilities de la pleine emancipation des femmes, des conditions necessaries qui permettront aux femmes á unir l'activité publique et de production avec execution des functions de maternité.

L'expérience de l;union soviétique et des autres pays est un témoisnars elatant de cels

MODERN TRENDS IN THE UK. & THEIR EFFECTS ON WOMEN ENGINEERS

Dr Elizabeth LAVERICK Ceng.FIEE, FInstP FIEEF

Introduction

Women first entered the field of engineering in the UK in any numbers as a result of the 1914-1918 war. Their interest was aroused by working in munitions and in factories generally as well as in other occupations traditionally (at that time) undertaken by men, such as in public transport and agriculture. The 1939-46 war added a further impetus, breaking through the traditional barriers. Women in the Armed services were trained to carry put supportive functions which brought them into contact with engineering and both boys and girls were encouraged by means of state bursaries to study science and engineering subjects at university and, when trained to work on defence projects in industry and in government laboratories.

However, it is noticeable that, between wars, custom takes over and, even in the 1978; engineering in accepted only by the enlightened few as a suitable career for women. Yet the country is in the throes of change, economically and legislatively, and slowly too, attitudes are changing.

Trends

Surveys carried out over the last few years indicate clearly that the pattern of employment for women in the UK is changing rapidly. Women now represent at least one-third of the total working population. More than 66% of women between the ages of 40 and 54 are working and this the highest activities race for this age group in the whole of the European Economic Community. It is predicted that between 1976 and 1981 three quarters of the projected growth of the labour force in the UK will consist of women workers, and married will represent 46% of that growth.

The rapidly growing contribution of women, and particularly married women, to the economy, in a direct result of improvements in birth control (or “the pill revolution”) resulting in small families, and of the increase in the expectancy. These combine to give married women a period of the order of thirty years between having a family and reaching what is generally accepted as retirement age, i.e. 60 years old.

A large proportion of the female working force however is engaged in semi-skilled and unskilled work in industry, and the rest mostly traditionally accepted occupations for women, such as teaching, secretarial work, nursing, hairdressing. The proportion of women entering the professions is increasing, but Table I indicates how small the proportion is in engineering compared with other professions.

Dr. Laverick is with the Institution of Electrical Engineers (London)

TABLE I

Of 180,000 chartered engineers in the UK only 200 are women (i.e. 0.19%). It is encouraging therefore to note from figures published by the Universities Council, that of the total, of 9,600 home students

Total Membership Numbers		Women Members	Percentage of Women/Total Membership
British Medical Council	22,015 (National Health Service only)	3,301	15 %
British Dental Council	18,746(UK only)	3,301	17.6 %
Pharmaceutical Society	31,358	9,305	29.7 %
Law Society	42,062	3,514	8.4 %
Institute of Chartered Accountants	66,285	1,985	3%
Institute of Chartered Surveyors	52,600	300	0.6%

entering universities last year to study engineering and technology, 498 (about 5%.) were girls (2). Of these, 165 (out of a total of 5,673 ie. about 3%.) entered Civil, Electrical or Mechanical Engineering.

Influences

Much has been said and written about the reasons behind the low numbers of women engineers in the UK. However, it is useful to re-examine the position at school-level, post-school, i.e. during graduation and training, and in employment.

At school, the main problems are associated with girls' attitudes to certain relevant subjects such as mathematics and science and the tendency to have to choose between arts and Science at an early age. This situation is not helped by the teacher’s general lack of appreciation of the engineering field and industry generally. Then again there are imitations in the subjects, which are made available, and the timetabling in some cases also limits the choice of subjects unfavorably. Finally in many cases resources and facilities for work in the scientific field are restricted.

When it comes to choice of career, quite apart from the fact that engineering may have already been ruled out because of the subjects taken at 0 and A level, it is unlikely as a matter of tradition that engineering would be would be suggested by the careers adviser, the teacher or the parent.

At the next stage, although Universities and Polytechnics welcome girl into the engineering faculty, it can prove difficult to obtain industrial sponsorship for them or practical training within industry. Industry is not always convinced that the woman professional engineer is a good investment. Indeed, up to a point industry could be said to be correct in this assumption, unless and until its attitude changes towards the position of the married women engineer with family responsibilities who wishes to return to her engineering career.

Changes

The main two areas where changes are taking place, which could have an impact on women in engineering in the UK, are in the educational and in the legislative fields. In addition there is a growing awareness by industry of the need to make better use or women's contribution to the work force

In education, in the public sector, more and more schools are becoming 'comprehensive', with a view to providing a much wider range of subjects than hitherto, for pupils of all abilities. Some would claim that as a result the higher ability child suffers in that classes are larger and support facilities and resources are not necessarily available. Although there is unemployment among teachers in some areas, the standard of teaching of mathematics and the sciences has been subject to much criticism recently. In 1977 the Department of Industry published a discussion paper "Industry, Education and management" which considered as a separate issue the increased role, which it was felt women, can and should play in industrial management.

In 1977 the Conservative Party set up a Task Force to enquire into the relationship of education to industry. Their terms of reference were:-

(i) To examine the relevance of engineering education to present day industrial needs and recommend improvements in the nature and quality of existing provisions.
(ii) To examine the nature of post-graduation professional training in the engineering industries and recommend improvements in the type and quality of existing provisions.
(iii) To examine the relationship of schools and further and higher education systems to industry and to industry and to recommend ways in which such a relationship might be improved.
(iv) To consider what incentives may be required to create an environment in which our ablest young people will find an industrial engineering career attractive.

A summary of their main recommendations is given in the Appendix (3). They include a 5 year degree for engineers, the setting up of special engineering schools; improvements in careers advice and closer links between industry and universities.

Attention is also being given to the education and training of engineers in the UK and to what extent industry's needs are being met. The government have set up a Committee Inquiry under the chairmanship of Sir Monty Finniest to examine this question and also whether statutory registration and training of engineers would be of advantage to the nation. (The Women's Engineering Society have submitted evidence relating to women engineers). This follows a period of some ten years in which the government operated Industrial Training Boards have been advising and encouraging industry to improve training facilities and opportunities. Special attention is being given to the training of girls in engineering, particularly at technician and to a lesser extent at professional level.

Greater emphasis is being laid on the necessity for all engineers to update themselves (thereby maintaining competence) and to retrain in new fields as certain technologies become out dated. This is leading slowly to the provision of more educational aids, e.g. Courses, colloquia, vacation schools, aimed at assisting the engineer with his/her career development. Such educational aids could be of assistance to the woman engineer wishing to re-enter the profession after 'the gap'

The recent enactment of the Sex Discrimination Act and the Equal Pay Act, impose certain legal obligations on employers relating to the recruitment, training, promotion opportunities, pay and terms and conditions of service of men and women, and these too will have an effect. The Sex Discrimination Act (1975) set up the Equal Opportunities Commission (EOC) whose duties are to work towards the elimination of discrimination and the promotion of equal opportunities and to keep under review the working of the Act and the Equal Pay Act (1970). The EOC has powers to conduct forward investigation for any purpose connected with the carrying out of these duties, and to make recommendations for change.

Particularly relevant to the encouragement of girls into engineering is in particular the EOC's concern about the provision of equal opportunities at school, in particular equal choice in subjects, examinations and school activities generally for boys and girls of equal abilities. The EOC have carried out investigations in areas where discrimination is suspected.

The EOC is also concerned with the increased provision of training opportunities and the basis for selection for such courses. Positive discrimination in training, particularly in those areas in which members of one sex or the other have been previously excluded is acceptable under the Act. Where women have a dual role, bringing up a family and pursuing a career, the EOC advise that the repercussions of that role should be taken into account so as not to place women at a disadvantage at the selection stage compared with men. It is interesting to note that the European Centre for Development of vocation Training (CEDEFOP) is sponsoring a survey of training initiatives for women in EEC countries. Their investigations will include a review of new initiatives aimed at achieving equal opportunities for women entering, already in or re-entering employment. All nine EEC countries are participating and the UK contribution is being organised by the, Manpower Services Commission.

A further area of investigation by the EOC is in connection with Income Tax. A consultative document has been produced with a view to stimulating both the Government and the public at large to consider reform of the present system to end tax discrimination against married women. This in itself could encourage more professional women to pursue their careers after marriage. Other areas where legislation should begin to have some effect are, firstly, in the Maternity Provisions of the Employment Protection Act 1975 and secondly with regard to Occupational Pensions. In, the former case the employment of the woman who stops work in order to have a baby, is protected for 29 weeks (assuming the woman has met certain employment criteria) in that her job will be kept open for her. Regarding Occupational Pension Schemes the Department of Health and Social Security have recently issued for comment a Consultative Document on equal status for men and women in Occupational Pension Schemes. The Government' s avowed intention is to introduce where practicable, legislation on equal treatment for men and women in occupational pension schemes.

Conclusions

All in all, it would appear that the economic, educational and legislative climate in the UK is in a state of change. Although the enforcement of laws will not in itself achieve equal opportunities, the realisation by employers, employees and trade unions of the importance of women's contribution to the work force will help to change attitudes and lead to improved opportunities for gir1s. Educationally, girls should become better equipped for careers in engineering. The main problems

Outstanding then, will be how to attract them into engineering and to encourage them to make the most of the opportunities, and to persuade industry to meet the needs of the married woman wishing to continue her career, after the family gap. It is in these fields perhaps above all else, that more needs to be done.

REFERENCE

(1) Population Trends No.7 1977
(2) Universities Central Council on Admissions (UCCA) 15^{th} Report
(3) "The Engineering Profession – a National Investment" Conservative Political Centre, London.

APPENDIX

Summary of main recommendations

EDUCATION AND TRAINING

1. The engineering profession should consist of a two-tier structure with C. Eng. and T. Eng. Levels of qualification with a route from the lower to the higher qualification.

2. Those engineering works, which could affect public safety or welfare, must be validated by charted engineers.

3. The EUSUE definitions of professional engineer and technician engineer/technician should be adopted henceforth to define the work of the charted engineer and technician engineer respectively and training requirements should have regard to those definitions.

4. The minimum training for charted engineers should be a five-year integrated course qualifying for a mandatory award, followed by a further two years of supervised professional practice – the '5+2' package.

5. The academic content of the charted engineers training, together with the post-graduation and supervised professional practice elements, should be rigorously monitored by the professional engineering institutions.

6. The costs of all post-experience and up-dating courses for engineers of up to one year's duration, together with any associated costs of retraining, should be directly allowable for tax purpose.

7. An Engineering Training Council should be set up with terms of reference, which include the identification of those organisations willing and able to provide post-graduation training of a high caliber to maintain a register of such organisations and to function as a central clearing agency for allocating industrial training places to trainee engineers.

8. The training of chartered engineers should only be undertaken by designated engineering schools. There will inevitably be some selection from amongst the existing institutions, but this will not be imposed from above. Academic Institutions willing and able to set up integrated five year training programme to the satisfaction of validating bodies should receive special designation as engineering schools with appropriate earmarked funds. Such schools would comprise comprehensive Faculties of Engineering closely integrated with industrial engineering practice.

9. A society for Engineering should be established, charged with the duty to examine, on a continuing basis, the problems facing engineering education and to propose solutions. Furthermore the society should strive to raise and maintain the esteem of engineering in schools and promote a wider involvement of employers and trade unions in the education and training of engineers.

10. A number of competitive State Bursaries should be made available for engineering students. These should not be subjected to any form of means test and should be such as to attract the most able students.

11. Steps should be taken to inform those responsible for careers guidance about the training facilities and job opportunities open to technician engineers.

12. Certain prescribed O-level and A-level courses should count towards apprenticeship time for technician training, the differences between the English and Scottish systems of education being taken into account.

13. Block or day-release should be a right for all trainees up to the age of eighteen who wish to benefit from further education. (Paragraph 3.32)

14. Consideration should be given to the institution of adult training schemes of up to two years' duration for the technician engineer qua1ification.

15. Special grants should be made available to technician engineers to enable them to meet any outstanding education requirements necessary for chartered status.

SCHOOL / INDUSTRY LINKS

16. Universities and polytechnics should be encouraged to play a more active part in school /industry /higher and further education links.

17. The widest publicity should be given to the large number of school/industry liaison schemes currently available and the proposed Society for Engineering Education should be responsible for evaluating them and annually a guide to such schemes. (Paragraph 4.16)

18. Local education authorities and schools should set up advisory committees to encourage a close working relationship with local industries.

19. Government should further encourage schools, industry and local education authorities to make more use of schemes, which provide pupils with a greater awareness of industrial environments. This might be achieved through greater use of the work Experience Act, coupled with appropriate publicity and financial incentives.

CAREERS EDUCATION

20. LEAS should be asked to review their provision for careers advice: and schools should be enabled to designated a senior member of staff as Head of Career Education who would enjoy the same status and remuneration as other major heads of departments

TEACHER DEVELOPMENT

21. Contractual encouragement and secondment should be provided by EAS for school teachers, particularly those in science subjects, so that they can undertake projects in industry at suitable times during their careers.

22. Teacher training courses should include some industrial experience, and a study of technology's contribution to our present life-style.
The polytechnics should be encouraged to concentrate on producing more high quality technicians.

THE INDUSTRIAL ENVIRONENT

23. It should be the special responsibility of a Cabinet Minister to consider and organise the incentives, which might be required from time to time in order to create an environment in which our ablest young people will find an industrial engineering career attractive.

24. Immediate steps should be taken to improve the image of industry and the engineering profession in general through a series of national public relations campaigns. A lead should be given in public appreciation of the role of the engineer by the Government itself in its creation and naming of official bodies such as the Science Research Council

Commission 4 (C 4)

RESPONSABILITÉS DU CHERCIIEUR SCIENTIFIQUE
Responsable : Marguerite ***RIBEYROLLES***
Erna HAMBURGER

Le chercheur scientifique peut estimer que sa responsabilité est engagée à trois titres :

- devoir d'infonnation du public sur la recherche,
- contribution de la recherche au progrés,
- finalité de la recherche en général et de sa propre recherche.

Les femmes chercheurs scientifiques ont-elles ici un rôle spécifique à jouer ?

C4 - l **Devoir d'information du chercheur à l'égard du public.** (Discussion en français).

C4 - 2 **Devoir d'information du chercheur à l'égard du public.** (Discussion en anglais).

C4 - 3 **A quelles conditions la femme scientifique estime-t-elle que la recherche est facteur de progrés?** (Discussion en français).

C4 - 4 **A quelles conditions la femme scientifique estime-t-elle que la recherche est facteur de progrés?** (Discussion en anglais).

C4. 5 **Finalité de la recherche.**
Les femmes ont-elles accès aux instances qui décident des objectifs prioritaires de la recherché ?

Commission 4 (C 4)

RESPONSIBILITIES OF THE RESEARCH SCIENTIST

Convener:Marguerite RIBEYROLLES

Erna HAMBURGER

The research scientist may consider that he has personal responsibilities under the following three headings:

- a duty to keep the public informed about the research,
- the contribution of the research to progress,
- the ultimate objective of the research in general and of his own part in it.

Have women scientists a specific role to play here?

C4-1 The duty to keep the public informed about the research. (Discussion in French).

C4-2 The duty to keep the public informed about the research. (Discussion in English).

C4-3 Under what conditions does a women scientist consider the research to be a contribution to progress? (Discussion in French).

C4-4 Under what conditions does a women scientist consider the research to be a contribution to progress? (Discussion in English).

C4-5 Ultimate objective of the research.
Are women ever in a position to decide the priorities of the research goals?

SYNTHESE DE LA COMMISSION N°4
SUR LES RESPONSABILITES DU CHERCHEUR SCIENTIFIQUE

Il lui est apparu nécessaire de développer dans le public un vaste courant d'intérêt pour la science et les techniques, de manière à susciter le goût des études correspondantes.

Trois types d'actions ont été recommandés pour lenr caractère réaliste :

a) dans les écoles (garçons et filles), demander (par une démarche auprès du Ministre de l'Education) que les cours de sciences physiques et de chimie soient illustrés par des travaux pratiques portant sur le fonctionnement d'appareils de la vie courante, et particulièrement d'appareils ménagers.

b) auprès des foyers, que les associations de femmes ingénieurs, associés à d'autres organisations féminines, entreprennent une campagne d'information tendant à rendre un service évident puisqu'il s'agira d'expliquer le fonctionnement des appareils en usage dans Ces foyers de manière à éviter les erreurs de manipulation qui pourraient provoquer des accidents.

c) auprès du public en général, faire un effort important de vulgarisation de qualité. Pour cela, une organisation féminine (de femmes diplômées) devrait créer des contacts entre les chercheurs des différentes disciplines afin de susciter des chroniques scientifiques susceptibles de fa ire sentir l'impact de la science et de la technique dans la vie moderne, chroniques à diffuser avec le concours des mass-media.

Examinant ensuite la situation des femmes dans les activités de recherche, la Commission note que les qualités requises du chercheur ne dépendent pas du sexe, qu'il s'agisse de l'enthousiasme, de l'imagination, de la rigueur, de la patience, etc...

Les femmes se heurtent cependant à une pierre d'achoppement : l'insuffisance disponibilité :

. Disponibilité psychique : trop de femmes manquent encore de confiance en leurs capacités ; déformation ancestrale; qui régresse mais lentement.

Disponibilité matérielle : trop de femmes ont encore à assumer, le plus clair de la charge du foyer ; hommes et femmes doivent reconsidérer ensemble le partage de leurs attributions et faire évoluer l'organisation de la vie sociale de maniére à mieux traiter les problèmes du foyer.

Sans minimiser l'évolution à accomplir au sein du couple, la femme doit se persuader que c'est à elle à prendre l'initiative du changement.

La commission a enfin réfléchi à 1a finalité de la recherche :
- au regard de l'économie, naissance d'un produit, sa protection industrielle par le brevet, et l'utilité de la normalisation pour les échanges internationaux ;
- au regard de l'individu et de la société, il entre dans la responsabilité de l'ingénieur de s'assurer qu'un produit conçu en fonction du résultat d'études de marketing, ne risque pas d'avoir un effet nocif sur la vie humaine ou sur la collectivité.

La commission a conclu :
- que le monde scientifique vivait trop en vase clos ;
- que les femmes ingénieurs et scientifiques ne participaient pas assez à la vie publique et étaient trop souvent absentes des obédiences politiques .

Elles doivent faire'un effort de notoriété et briguer les postes de responsabilité, elles doivent entrainer leurs soeurs dans un élan de solidarité et faire connaitre les conclusions de leurs travaux aux instances internationales concernées.

LISTE DES COMMUNICATIONS

NEUROENDOORINOLOGY – ITS ROLE IN SOCIO – ECONOMIC WELFARE OF HUMAN BEINGS

- **K. Chandrasekhar**, Surgical Reasearch Laboratory, institute of Medical science, Banaras Hindu Uninersity, Varanasi. INDIA.

"Population pressure" is a vital problem that is fecing the world today. It is an eye-sore to the scientists, demographers, statemen and the political economists of the developing countries and calls for evolving safe and acceptable measures. This is particularly applicable to India.

Factor respinsible for world population pressure were first pointed out by Malthus (1872). Later he announced that population tends to increase in geometrical ratio whereas, the means to survival increased only in arithmetical proportion. Though malthus said this as long back as 1872 and inspite of the scientific and technological advancement since then, still his statement holds good even now. For, the production of means for survival has not kept pace with the population increase. While this is so generally, it is particularly applicable to some of the developing countries and India. Herbert Spencer in 1890 said that generally the power to sustain life and the power to reproduce are inversely proportional, that is 'individuation and genesis' vary inversely. Later kar and mukherji (1956) pointed out that 'individuation' not only depends on genesis but also on other factors, one of them being the rate of genesis which determines the quality of individuation. According to Kessler and Standley (1974) the benefits of research *on* family planning are manifold. It has helped reduce infant mortality because of the invention of preventive medicines, safe methods for terminating unwanted pregnancies and measures to limit families.

As a consequence of researches on family planning, arose the important question of Q fertility control'. The Neuroendocrinologist has to play an important role here, because, a major task in this area is to find out a suitable agent that would lower fertility causing the least psychological or physiological side-effects. This, naturally, excludes permanent prevention to child bearing.

The chemicals used currently to control fertility are mostly aimed at immobilization or destruction of the sperms before they gain access to the uterus (Gamble,1952).This is done either by producing mechanical obstruction to the passage of sperms or by lowering, the PH, of the media (Woodbury, 1954). Condoms, the mechanical device used as contraceptives, unfortunately, are not cent percent effective.Further, it has failed to make a dent in the not too well educated rural population of India.This was followed by the coming in of the steroid contraceptives in the mid-1950s (Pincus, 1955 and Pincus et al, 1958).Being steroid hormones, they brought in many undesirable side-effects and so were not easily acceptable.Minipills (small daily doses of progestogens) were developed in the mid-1960s, which prevented pregnancy to some extent. Minipills apparently proved effective in the veginning. Later many metabolic changes were seen to let in such as manstrual spotting, break-through bleeding, variations in monthly cycles and occasionally amenorrhea. Rudel (1970), Aref at al (1973). Edgren (1974), Black (1975) and Moghissi and Syner (1975) have demonstrated that the effectiveness of these steroid oral contraceptives depend on many factors, both intrinsic and extrinsic. These may be the particular type of progestogen used, the dosage, and finally the metabolism peculiar to the user. The noted effects of the progestogen - only pills, are

(i) Some uncvulatory cycles;
(ii) Alteration in tubal motility and corpus luteum function;
(iii) Change in curvical mucus which impair sperm motility or viability;and
(iv) Alteration of the endometrium so that a fertilized ovum cannot implant.

Roland (1968 a. band1970) is of the opinion that progestogens interfere with sperm capacitation. Rudel (1975) considers that the detectable changes seen in the reproductive system, attributable to low-dosages progestogens, for example, changes in cervical mucus, LH patterns, and, the endometrium, may be, in fact, only side-effects.According to him the mode of action needs to be under-stood.

Intrauterine device (IUDS), one of the mechanical modes of fertility regulation, has also not proved effective because it brings in irregular bleeding, pain, ulceration and expulsion.

In recent years, the much-sought-after prostaglandins have also been tried to regulate human fertility, Ronalt Shalita (1975).Unfortunately, the role of prostaglandins in the process of evulation and ovum transport in the humans is as yet poorly understood. However, their role in the lower mammals is being assessed and is yielding promising results.

The Delhi Centre for Research and Training in Animal Reproduction, sponsored by the World Health Organisation, after sustained researches, has come to the conclusion that low doses (2 Ug steroid / day,for ten days) of progesterone inhibited ovulation. Fromt..the 5th Annual Report of the WHO (1976), it becomes clear that very low doses of progesterone or norethisterone administered intranasal1y to monkeys inhibited ovulation as judged by plasma progesterone levels and inspection of the ovaries at laporectomy .Immunization of non-immunized pregnant baboons With 50 ml. of sheep anti-3-HCG (antibodies against the beta sub-unit of human chorionic gonadotropin) serum resulted in immediate abortions (Stevens, 1975).However, the main objective on immunological methods for fertility regulation is to develop a vaccine consisting of only a small fraction of B-HCG molecule, which would act as an anti-fertility agent.

In view of the importance of fertility control for the well-being of society. Much more has been carried out in this area. But Laumas et al (1973) state that "Not much is known about the precise mode of action of progestational steroids and more so about the parent compound, progesterone".

Thus studies on the physiology of reproduction of mammals and finally of human beings can only be achieved by sustained probe on many of the known as well as unknown areas of reproduction.It is now an established fact that the hypothalamus, hypphysics, the thyroids and the reproductive glands act synergetically to

Produce the end result, that is REPRODUCTION. Therefore, a proper understanding of their interactions is necessary for a study of this kind. It may not be out of place to add here that Kar and Karkum (1954) have demonstrated that the secretion of the thyroid gland has a marked influence on the processes of maturation of the follicles. It has also been pointed out that experimental interference with the thyroid activity leads to various alterations in functioning of the sex glands (Kar and Sur, 1953; Kar et al. 1955; Roy et al, 1955 and; kar et al, 1954). This has been brought out to show the interdopendence of many of study of' the interactions of all the hormones in important if it is to be benefits to human beings.

A perusal of the existing data brings out that all efforts are diverted towards finding a cheap, non-toxic and acceptable oral contraceptive for fertility control. It may not be out of place here to quote the review by the Academic Press as late as 1978 which reads - " Existing contraceptive methods have had so small an impact on the world population explosion that few people can doubt the need for developing new methods --- only when a wider range of products is available, to suit more groups of people, will there be a lessening of the rate of population increase." Earlier work in this laboratory using the Homeopathic drugs, Pulsatilla end Caulophyllum have yielded promising results which served as an impetus for further research.

Physiology of reproduction is an interaction between the hypothalamic centres in the brain and the endocrine glands. The action of the Homopethic drugs on the neuroendocrine centres is being studied to fathom the mode of action of these drugs. We already achieved good results to show that the drugs inhibit ovulation without bringing about any harmful side effects particularly on the endocrine centres.

In the near future, we hope to popularise the drugs' advantages and thus help in family planning. There cannot be a cheaper, harmless and easy method than the Homeopathic drugs in the control of fertility. This is perhaps the greatest service a neuroendocrinologist can do in the service of human socio-economic welfare.

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SAFETY OF INDUSTRIAL PROCESSES A PROGRAM REVIEW

Presented at

V th CONFERENCE
OF WOMEN ENGINEERS AND SCIENTISTS

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By

Connie A. Christensen
SAFETY AND ENVIRONMENTAL ENGINEER
LEDERLE LABORATORIES

ABSTRACT

SAFETY OF INDUSTRIAL PROCESSES

Industry has the responsibility to analyze their process systems for safety. Failures which can cause injuries to people, loss of production, and loss of company assets, are no longer acceptable in today's industrial world.

A complete program to examine the safety of processes, to design protection, and to be certain that the system operates as intended will be presented. Specific areas to be discussed are:

1. Review of new system designs.
2. Control and review of changes to existing plants.
3. Training for workers in awareness of safety hazards.
4. Incident analysis.
5. Inspection of manufacturing plants and testing of safety equipment.
6. Use of written safe design and safe operating standards.
7. Documentation of safety studies.
8. Scheduled reviews by process safety specialists of the program effectiveness at the manufacturing plant.

Safety of Industrial Processes
A Program Review

Today, the world knows when a major failure causing injuries and economic losses occurs. Being more cognizant of the occurrence of failures, and being fearful of potential disasters stemming from rapidly advancing technology, the public has grown less tolerant of industrial mistakes. Because of this growing concern and the threat of large economic losses, industry has had to initiate programs to control hazards.

The intent of this paper is to present a sample of elemental parts of a complete safety program designed to prevent process incidents and protect against injuries. The program elements as described have been used by manufacturing plants. Although the chemical production plant process safety program is used as a basis, some of the concepts may also be relevant to improving the safety in other environments.

The areas to be discussed are: safety reviews of new process designs, documentation of studies, standards, control of changes, training, safety equipment testing, incident analysis, and reviews of the program effectiveness. The program areas will be defined and their purposes described. Methods used will be summarized briefly. Finally, some key concepts which affect the success of the program will be identified.

Review of New System Designs

The purpose of the safety review of a new system is to prevent failures by predicting them early and designing to eliminate or reduce the potential of their occurrence. At the time when the new process is in the planning stage the safety review can be most effective. Designs can be changed more easily than after construction. In addition, safety concepts can have a large Impact on major decisions made at this point. For example, in vegetable oil processing, a review of the fire and explosion hazards involved with a process using flammable solvents has at times Justified use of a less efficient non-solvent process, Later, the safety review during the design of a system will specify safety equipment, define safe operating procedures, and contribute to the design of processing equipment and control instrumentation.

Consistent with the importance of a thorough study, considerable research has been done to develop methods for analyzing hazards and predicting failures. The very basic method used has been to base design improvements on memories of past failures. These past incidents have been documented, and forums, such as technical conferences, have been established for safety engineers to share "war stories" of personal experiences. Thus, a dynamic, collective memory is established. But one can still ask the question "what if the future process is not like the past?"

Today it is not acceptable to neglect prevention of accidents which have not yet occured. The philosophy that learning from our mistakes is not enough led to a more questioning approach to safety review. The “what If?” method was developed; it asks numerous questions, throughout each step of a process, in the form of "What if this device (or procedure) fails?" Protection is then provided to prevent or counteract the failure. The Imperial Chemical Industries of England have formalized this approach. Other methods combine experience with the questioning approach. One of these, Job Safety Analysis, analyzes hazards related to each step of an operation (job). Another similar technique is to analyze hazards as related to specific equipment.

These methods have worked adequately for detecting simple failures, caused by up to three or four simultaneous events, but as systems become more complex, failures have been occurring due to five or six simultaneous events. In an effort to predict and reduce these failures, the aerospace and nuclear industries have used Fault Tree Analysis. The "fault tree" is a logic diagram describing a system in terms of the paths to failure. It has been used so effectively to detect subtle failure causes, that applications for this method in the chemical industry are becoming increasingly appealing.

Although the methods described are available, the more thorough studies require more effort and expense than small companies can justify. It is not uncommon for a study of a single chemical process to require at least 3 months of effort. The real applications, then, are limited to:

1. the larger company which has the people and resources necessary and

2. the industries which have strong pressures from the government and the public to provide safe systems (ie. nuclear and aerospace). Boeing spent 80 worker years developing a fault tree on the747 jet.

Documentation of Safety Studies

A safety study should result in a document usable to the people with responsibility for safe operation of the plant. There are two reasons for good documentation of safety studies. The first is legal. In the USA, safety directors and plant managers are being held personally liable for deaths and injuries and have been arrested on charges of criminal negligence. Documentation of sound safety decisions is an essential part of a defense against these charges.

The second reason for documentation is to provide a reference base for making future decisions about changes in operating procedures, equipment, and materials.

Standards

Written safe design and safe operating standards are needed to be able to answer the question "how safe is safe enough?" Written standards enable an engineer to design systems consistent with others in industry. The standard may also be used in evaluating the degree of safety in a system by measuring the variance from the standard.

Most large companies have developed their own standards In addition to using industry standards such as the National Fire Protection Association Codes (USA and Canada). The keys to successful use of written standards are the ability to update standards for changing industrial needs and the ability to enforce them.

Control and Review of Changes

Absolutely the most challenging part of a safety program is controlling changes to existing systems. With rapid improvements in processes and rapid increases in production needs, changes are happening quickly and continually. Yet, each change affects the validity of the original safety study. Changes occurring without adequate review have caused many serious accidents. The recent vapor cloud explosion that killed 28 people and leveled the plant at Flixborough, England was caused by the failure of a bellows expansion joint installed without study of the stresses placed on it.

A way to combat this problem is to require approval of any proposed change by a person knowledgeable in the safety hazards of the plant. The method consists of a written form which requests work to be done, describes the proposed change, and requires the signature of the manager responsible for safety. After approval, the safety manager marks the change in the safety study document and on, process flowcharts or drawings that describe the system.

Because this approval procedure slows down the change, a temptation exists to bypass the safety review. Although this happens, the number of these unauthorized changes can be evaluated by periodic audits of the safety studies and flowcharts. The difference between the documents and the actual system gives an indication of the number of unreviewed changes, the reliability of the documents, and, most importantly, the amount of unknown hazards in the system.

The method of change control described has been used most successfully at manufacturing plants where:

1. funds for the change are not available until safety approval is granted,

2. workers making the change understand that if approval is not received, they are responsible for accidents which may occur, and

3. workers are aware of hazards in their process.

Safety Training

Safety awareness training is a necessity for the success of the total safety program. It is also one of the most fascinating program areas.

All people in an industrial plant will need training in safety, but the training needs will be at several different levels. Individuals, of course, must be trained to the extent of their responsibility. The general unskilled worker must know safe work procedures and general hazards. The worker operating a process must know what hazards exist for that process, as well as what procedures to use. Those making changes to the system must be able to judge when a safety specialist is needed to study the change. The person reviewing changes and updating studies needs to have a thorough knowledge of the nature of the hazards present and of how to prevent accidents caused by those hazards. That reviewer must also know how the original study was done in order to interpret the effect of the proposed change.

There are a wide range of training techniques available for use and a myriad of topics for selection. Upon considering the training needs, the vast array of potential work is soon evident. The training array can be built from films, booklets, courses, manuals, discussions, or seminars on the topics of fire, explosions, reactive chemicals, toxic materials, hygiene, and many others. These can be approached from many perspectives; procedures, designs, analyses, prevention, protection, or accidents are only a few approaches.

But before one gets carried away by this stream of possibilities, the apparent training needs should be carefully assessed. For example, it is easy to tumble into the trap of labelling a motivational need as a training need. When a person could accomplish a task, if his or her life depended on it, but does not accomplish it normally, then the need is motivational. For the motivational need, the system of reward and punishment needs scrutiny, not the training program. Another trap is to believe that "once trained" means "always trained". Especially when one is learning a new procedure, such as operating a process or writing a safety study, the initial training needs reinforcement by use or by repeated training.

Three key characteristics of good safety training programs are:

1. The learning objectives are clear. That is, what the trainee should be capable of doing after training is described clearly and can be evaluated easily. An example would be "the trainee can operate process A without causing any accidents".

2. The training techniques are participative. The trainee actually performs some of the expected tasks during training. This has been more effective than a lecture format in maintaining the trainee’s interest and increasing learning retention.

3. The skills learned are used soon after completion of training in order to reinforce learning.

Testing of Safety Equipment

Safety device testing is a fundamental, established part of the safety program. The purpose of the testing is to lower the probability of failure of the device. This increased reliability is accomplished by regular maintenance of the device and repair or replacement if it fails the test. Regular testing will also limit the time that a malfunctioning device remains in the system. The end result is a lower probability of that device failing simultaneously with a system upset signaling it to operate. The following are typical inspection frequencies for some safety devices:

Device	Time between inspections
Relief Valves	I yr
Ruptive Discs	I yr
Orifices	2 yrs.
Vents	I yr.
Instruments	3-6 months
Combustion Safeguards	I week.

Incident Analysis

Any safety program has an inherent feedback loop. Despite the best prevention measures, some incidents will happen. These incidents provide data for evaluation of the program if reported adequately. The report of a safety incident should include as a minimum:

1. a thorough description of what occurred,
2. the amount of losses and degree of injury,
3. a statement of the cause (if known), and
4. a plan for corrective action to prevent reoccurance.

With the data from these reports available, trends in types and numbers of incidents can be identified. The program can then be adjusted for improving its effectiveness.

Unfortunately, this feedback system is random, and often quite slow. Incidents can be the effect of programs of past years, in which case their relevance to improving the program is lost.

There are, however, other methods for evaluating the health of the total program. The periodic program review can accomplish this.

Review of Program Effectiveness

The review usually starts with an inspection of the manufacturing plant to identify hazardous conditions and unsafe procedures being used. Some stop at this point. The review is more useful, however, when it also covers the working problems of the several program elements. This will allow assessments to be made of how well the program is handled. Going one step further, if after the review, a plan for improvement is made, an assessment can be made about how committed people are to correct inadequacies, by periodically reviewing the status of the improvement plans.

The reviews can be made either by trained people internal to the plant or by safety specialists based elsewhere (in the large company possibly from the main company headquarters). The most successful efforts seem to be a combination of self-auditing by the plant with less frequent reviews (every 1 to 2 years) by the external specialist.

Conclusion

Eight basic parts of a safety program have been described. Of those eight, change control (retaining adequate safety while rapid changes occur) is the most difficult. Since safety technology itself is also advancing rapidly, the techniques are available for analysis of the safety hazards present in the new and changing systems. Use of these techniques and programs does have its price, however. The amount of resources allocated to the purpose of improved safety will depend on the value people assign to the human life and the quality of the working environment. How much is enough? That query is yet to be clearly answered.

How does the intensive safety program affect our freedoms? For the engineer or scientist it means less freedom in choosing chemicals, materials, processes, and designs. For the industrial worker it means less freedom in working habits. For the company with limited resources, it means fewer production opportunities.These limitations can be valued in monetary units.

But what is the value of the rewards? How much is increased freedom from the fear of holocaust worth? What is the value of freedom from the anxieties and stresses of occupational risks and injuries? Is the value simply the cost of lost working time? Whether we realize it or not, we are making choices.

BIOGRAPHY

Connie A. Christensen

Bachelor of Science in Chemical Engineering in 1973 from the University of Nebraska, U.S.A.

Employed from 1973 to June 1978 at Procter and Gamble company Engineering Division.

Positions:

Shortenings and Oils Process Engineer.
Process Safety Engineer - Expertise in safety of food and chemical processes involving flammable gases and liquids and combustible dusts.

Employed from June 1978 to present at American Cyanamid Company, Lederle Division.

Positions:

Safety and Environmental Engineer
Response abilities include safety and employee environment for pharmaceutical, biological, medical, and toxicology research laboratories.

President 1977-1978 - South Ohio Section of the Society of Women Engineers, USA.

UNIVERSITẢ DEGLI STUDI DI NAPOLI
FACOLTẢ DI ARCHITETTURA

80134 Napoli, <u>20/4/1978</u>
Vie Monieoliveio, 3 – Palazzo Gravina
Tel. 321. 963

TITUTO DI STORIA DELUARCHITETTURA

arch. **TERESA COLLETTA**

L 'IMPORTANCE DES NOUVAUK TECHIQUES DANS D'ETUDE ET LA CONSERVATION DES BIENS ARCHITECTURAL ET D'ENSEMBLE

<u>Resumé :</u>

Après avoir commencé avec le sujet plus général c'est-à- dire l 'importance aujourd' hui de la" conservation intégrée" des milieux historiques et de l'architecture là presente welont les préceptes de la "Charte d' Amsterdam"; on donnera l 'opportune relief aux considerations et anx proposnés dans la collaboration européenne, sur les nouvelles technologies de la restauration <u>et de la conservation</u> des monuments. On dire done ces technologies nouvelles sur l 'étude préventif de l 'object architectural : le relèvement photogrammétrique, le documentation aérophotographique at photographique, aux rayons infrarouges et <u>laser ,</u> oldhoretion des dennées (avec les plus modernes ordinateurs élesctroniques), examen analytique de la dégraduation des structure des édifices avee "forces de recherché" et la thermographie. On donnera des examples italions et étrangens pour demontrér que l 'exacte connaissance des structures monuments est le fondement unique et indispensable pour une. Correcte nise en traire de la restauration.

WOMEN'S ROLE IN SCIENTIFIC AND TECHNOLOGICAL RESEARCH IN UGANDA:

M.J.N. Okwakol, Department of Zoology, Makerere University, Uganda.

Abstract:

The present paper examines and evaluates the role of women in scientific and technological research in Uganda.

The survey was made by posting questionnaires to individual researchers in institutions where scientific and technological research is undertaken. Specific information was requested for on the numbers and the relative role of women in different displines.

Result obtained indicate that the number of women engaged in research is very small. The majority of women tend to go in for biological or related sciences, where the ratio of men to women ranges from 5.3 to 16.0. There are no women carrying out technological research. This trend of things is largely attributable to the nature of work in the field of Engineering.

It was also noted that there is a mildly negative attitude of society and this probably stems from both cultural and religious background. Such attitude tends to make woman rather defiant, and in extreme cases changes a natural enthusiasm into absolute apathy.

Suggestions and recommendations of ways and means of increasing the participation of women in scientific and technological research programmes of the nation are made.

Introduction:

One of the inevitable facts of the modern world is the impact of scientific and technological research on social and economic life of the people. It is an established fact that science and technology are capable of bringing about improvements in the conditions of the developing countries, of which Uganda is one. Ordinarily, all investment in development projects involve the application of scientific studies and results (Ibukun, 1966).

On the occasion of the First International Conference of Women Engineers and Scientists in June 1954, a statement on Africa expressed the existence of "a serious shortage of qualified engineers and scientists". To a great extent this observation still applies today. As such, there is urgent need for full exploitation of the potential manpower. Women must play their role.

The purpose of the study was to assess the role of women in scientific and technological research in the country. Here scientific/technological research is essentially carried out in the University as well as Government Research Institutes. This study, focuses attention on skilled and semi-skilled research staff only, and does not take into account the supporting technical grades.

Methodology:

The survey was carried out by posting questionnaires to individual researchers in the University and Government research Institutes. Specific information was requested for on the numbers and relative role of women in scientific and technological research programmes of the nation. This report is based on the information given by respondents in 55 completed questionnaires.

Results and Discussion:

1. The number of women researchers.

The numbers of women researchers at the different institutions investigated varied. The percentage of women, as compared to men, was higher at Government Research Institutes than in individual University faculties (Table La). Recruitment for University research posts requires much higher and better qualifications than for those in Government Research Institutes. Majority of women tend to go in for biological or related desplines where the ratio ranged from 16.0 to 5.3. Physical Sciences are generally avoided, a tendency partly attributed to the fact that in developing countries research in these areas is not as long established as in biological fields and partly because of the nature of the work involved. Of special interest is the absence of women in the Faculty of Engineering of the University (Table lb), and this, according to

Table I: The percentage of women among persons involved in scientific/ technological research in Uganda (September, 1978):

(a) at Research Institutions: The number given for research workers- indicates the average number per faculty or institute.

(b) In different faculties of Makerere University.

(a)

Institutions	Average no. of research workers	% approx women
University Makerere Faculties university	53	7.5 (4)
Government Research Institutes	15	22.0 (=2)

(b)

Faculty	No. of Research Workers	approx. % of women	
Agriculture and Forestry	56	8.9	5
Medicine	88	3.4	3
Science	65	13.8	9
Veterinary Medicine	23	4.3	1
Engineering	31	0	0

Most of the respondents seems to be related to the fact that the profession is regarded as a characteristically masculine one.

One noteworthy factor is the consistently very small number of women involved in research at all the institutions investigated. This is a reflection of the male/female ratio of the output of first degree graduates (Table 2). A good first degree is the minimum qualification required for recruitment in the various centres where research is undertaken.

2. <u>Efficiency of women researchers.</u>

54.5% of the respondents observed that men and women are equally efficient, and that those that are not are potentially efficient but are handcapped by biological and related problems. However, 25.4% think that women are less efficient than men, and that this is attributable to the many social obligations faced by the women. There is a general agreement among respondents that the nature of work could contribute either to the efficiency or, inefficiency of women, as they seem to do better in the laboratory than in the field.

3. <u>The Attitude of Society to Women research Scientists.</u>

It was noted that there is a mildly negative attitude of society as a whole towards women scientists, as indicated by 55.5% of the respondents. Society is generally prejudiced due to the supposed to be life pattern of a woman which is not suited for the scientific work particularly field and industrial. Such attitude stems from a mixture of cultural and religious background, and has been observed to make women rather defiant, and in extreme cases changes a natural enthusiasm into absolute apathy. Nevertheless, a reasonable proportion of society holds positive views in this respect. This aspect also presents a challenge to women scientists in general, considering the majority viewpoint among women is that their life-long happiness is expected to come from marriage and the family other than from a career.

Table 2: The percentage output of first degree women graduates for the years 1975. 1976, 1977:

FACULTY	YEAR 1975		YEAR 1976		YEAR 1977	
	Total number of graduates	1fPgn	Total number of graduates	approx %Women	Total no. of Graduates	approx % Women
Agricu1ture and Forestry	103	7.3	93	17.2,1'6	85	15.3 3
Medicine	72	15.3 1.1	66	9.1. '6	76	7.9 6
Science	186	11.8 2.2	115	20.9 29	163	14.7, 24
Veterinary Medicine	22	13.6 3	31	12.9 ,,4	26	3.8 ,1
Engineering	17	0	28	0	55	
TOTAL	400		333		405	

4. Effect of martial status.

Marital categories were based on those manipulated by Huber (1975) namely(a)married - those presently married with spouse present (b) unmarried - those never married or currently divorsed. The study revealed that the following aspects tend to affect the progress of women research Scientists:

i) Increased domestic obligations lower the capacity of married women to work, as they are not able to pay the required attention to research. This is aggravated by lack of adequate domestic appliances in developing countries.

ii) Long interruptions due to child birth and maternity leave are a drawback. Here the researcher is faced with what slater (1970) called “Spockian Challenge", namely that child rearing is the most important task for any woman. Unmarried women are less affected in this aspect.

iii) The satisfaction and contentment offered by the husband and home reduce the urgency for advancement of a married woman in her job. Nevertheless, this fact is counterbalanced by the reduction in the need for her to pay undue attention to her looks thereby making her more settled to her work.

5. Effect *oi* the Education System:

It was generally observed that there has not been sufficient career guidance in secondary schools. As a result Women students avoid subjects like Chemistry, Physics, Mathematics or Biology, and. subsequently miss the opportunity of taking courses like Agriculture, Medicine, Veterinary Medicine and Engineering which require adequate knowledge of these subjects. In addition some of those who qualify for such courses opt out for the supposed to be feminine courses namely education, social science and arts subjects.

The number of women who do post-graduate work was noted to be regrettably small. Influencing factors include lack of interest on the part of qualified women as well as the gap that exists between women's qualifications and the requirements for postgraduate research jobs.

Suggestions and Recommendations

The following suggestions and recommendations are aimed at increasing the participation of women scientists / technologist in national research programmes.

(1) In order to achieve genuine professional success. young Women ought to have interest and Motivation. This is only possible if they are made aware of the value of science and technology, opportunities for research scientists and the role of the research in National development. Trained and experienced women in the various desplines should give encouragement to young oncoming women who have shown an aptitude for scientific / technological fields.

(2) There is a need for an education system that is geared towards offering increased trained facilities for women, where need be, including training more at undergraduate level in scientific/ technological fields.

(3) Cultivation of an attitude of Society that encourages women to became research scientists.

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GEOLOGIC HAZARDS WHAT CAN BE DONE ABOUT THEM?

by **Mary Ellen Russell** U.S.A.

The most common natural hazards are volcanic activity, and earthquake, avalanche or landslide, coastal erosion, drought, flood and ternado or tropical cyclone. Other weather patterns, such as fog, frost, hail, snow or lightning can do considerable damage. Man is a geologic agent. His very occupancy may cause hazards, or aggravate existing ones. Man's interference with fluvial systems can set off an entire change of events. He takes materials from the environment. Can he return them? Pollution of air and water are a result of his activities. What can be done?

Earthquake are one of the most disastrous events in terms of life and property. World-wide mapping has been accomplished, indicating the areas where earthquakes have been centered in the past and will occur is the future. The theory, that the earth's crust consists of moving plates, is generally accepted in a modified form, based on geological, physical and geochemical evidence. There is a global grid of faults, mountains and volcanoes, also rifts and trenches in the ocean deeps the represent boundaries between these huge moving plates. Earthquake-prone and volcanic areas lie on their margins.

The great Chinese earthquake of July 29, 1976 may have been the result of the collision of three major crustal plates. The Chinese have made earthquake prediction a grass effort with amateurs dectecting precurser signs, such as water level changes in wells, ground will variations and changes in ground electronic currents. As a result, the Chinese have issued warnings for at least eleven earthquakes. Though not all predictions have been successful, the evaluation of housing in the quake of February 4, 1970 an Liaoning providing may have many lives.

Villagers were interviewed in Turkey after the November 24, 1976, magnitude T. 3. earthquake, which killed 4000 and dentroyes of home. A wide variety of precursors were observed before the quere. Booming sound like thunder were heard several times during the two weeks before the event. Unusual sounds came from a lake and an increase in the water supply of one spring was noted. The dogs began to bark and howl a few hours before the occurrence. During another quake in Turkey in 1975, brightening of the evening sky was observed the night before the event. This brightness has also been observed in Japan prior to two quakes. One theory is linked to the piezoelectric effect in quartz-bearing rock, which due to stress before the earthquake could result in a discharge. Further research is necessary to resolve this question. Is the glow truly an earthquake precursor?

The San Andreas fault system in California lies on the boundary between the North Pacific end North American plates. Estimates -indicate that motion along these plates is at least 6 mm. per year. Records have been kept for40 years of this area. There were over 7000 earthquakes with a Richter scale reading of 4 or more. Tilting of the earth, thrusting and bedding was recorded by tiltmeters. A more dense and comprehensive network of these instruments along with other precursor observations might provide warning of the next large earthquake in Southern California. In addition, the population are being urged to avoid building in hazardous areas, and to build earthquake-proof homes and workplaces as well as to upgrade existing ones.

Another criteria used in earthquake prediction is the cycle of occurrence. If, in the past a major: earthquake occurred every 50 or 100 years, it might be expected to follow this pattern in the future. The date cannot be pinpointed, but it suggests the time to look for precursors. There appears to be a relationship between seismic and volcanic activity. A Geologist found that a major earthquake, magnitude 7, was preceded by a surge of volcanic activity followed by a dormant period extending from several years to ten of years.

Earthquake prediction is in its infancy. Worldwide research of information and constant monitoring of critical areas may lead to better criteria. Greater effort should be made to prevent building in areas of faulting where damage can be excessive. The design of earth-quake proof buildings needs more study. Japan has the world’s largest earthquake simulator and also the world’s largest facility for testing architectural models. Their research could be valuable in building design and the Japanese laboratories serve as a pattern for similar development in other countries.

Increasingly sophisticated monitoring of subsurface magma in volcanic areas has produced better understanding of the activity and possibility of eruption. In 1977, the population evacuated from threatened areas prior to eruptions saved thousands of lives. The Geological surveys of many countries have prepared volcanic risk maps and an improved monitoring system could contribute much to the loss of life and property. The Smithsenian Institute Washington, D.C. operates a Scientific Event Alert Network end solicits histories of individual volcanoes with a chronologic listing of eruptions for their volcano date bank in order to better understand global volcanism and predict times of activity.

The idiesyncracies of weather effect the crops of the farmer and the homes and industry of an urban population. Weather is monitored with the aid of satellites, airplanes, ships and weather stations and warning given of possible catastrophes. Thus many lives are saved, but warnings do not reach areas where communication is minimal or does not exist. Sometimes it is a matter of education. The attitudes and culture of the people involved may prevent their taking remedial action to save lives and property. Bangladesh is a good example. It's coastal areas have witnessed flooding due to cyclonic storms for hundreds of years. In this area, farmers build their homes on their own fields. According to the laws of inheritance, family clots are subdivided among the heirs. As a consequence, buildings are grouped in clusters, housing 30 or more persons. These scattered family groups are very vulnerable to storm. Following a disaster, the people return to the same area and rebuild as before. Only the government, already committed to a policy of social welfare, can implement actions to minimize the lost of life and property in hazardous areas.

Several suggested actions applicable to Bangladesh could be utilized in similar situations. The present communities, particularly after a disaster, when the people would be willing to accept some changes, could be relocated. Future settlements, avoiding hazardous areas, might be clustered around a multistoried community center capable of giving shelter during cyclonic events. The center could be responsible for giving storm warning signals and also provide recreational and educational facilities.Brick-bui1t houses houses on piers and community housing should be encouraged. A cooperative system of farming, rescheduling of the crop season or new varieties of crops might be introduced. An improved network of roads, connecting the coastal area with the interior, would permit quick evacuation of vulnerable areas when a severe storm is predicted. Embankments could be constructed, where feasible, to prevent saline intrusion on crop lands. This kind of effort would be an ongoing plan based on long range planning with technical assistance and involving the people living in the hazardous areas.

Avalenches and landslide are associated with earthquakes and sometimes volcanic activity. Excess rainfall or snow may trigger them in areas composed of clay which has a tendency to slip when saturated. Timber cutting on steep slopes may aggrevate the condition, because it leaves no vegetation to absorb moisture or root structure to hold the soil in place. Avalanche areas are not designated and this information provided the general public as in the case of other natural hazards.More study and publicity regarding slide areas is necessary. Local government should prevent the development of homes and industries in such areas. They could be set aside for recreational use or reforestation. Building codes could incorporate measures to make a site less subject to hazards. For example, diversion of ground water might be a simple solution. This procedure has been successful in Seattle where many areas are subject to landslide due to the underlying glacial clay.

Man may trigger catastrophe. There are many examples of land subsidence due to energy resource extraction, such as oil, gas and coal, also in mining for gold, copper and other minerals. The United States now requires restoration of the soil after strip mining and reforestation to contain ground waters. Man is attempting to reduce the risk, of ten endangers himself. Dams built to control floods and provide water for power and agriculture, may be built in the wrong location, or its structure be insufficient to contain extreme conditions. Building of dams and dikes to contain flooding of ten encourages people to establish their homes in an area previously considered unsafe. An example is our Teton Dam in Idaho State.

The Teton Dam was designed as a multi-purpose earth-filled facility to provide water for irrigation, flood protection, electrical power and water based recreation. On June 5, 1976 the dam collapsed as the water behind it was approaching full capacity for the first time. This failure caused the death of 14 persons and destroyed millions of dollars of property.

Investigation has shown that the engineering design for that area was at fault. The result has been in depth studies of previously built dams and also those presently being built. Work has been stopped on the Auburn dam and reservoir project in California and it may be abandoned because of earthquake hazards and a questionable choice of dam site and design. Failure of this dam would wash out the folsom dam and Sacranento as well as other towns in its path, endangering the lives of over 750,000 persons. An independent consultant has stated that the Mt. Eloert, Colorado dam not be filled until engineering studies indicate satisfactory stability and seepage control and the remote, control system and emergency instrumentation is modified. They have also recommended that reservoirs at Puebla, Colorado and soldier crock. Utah not be raised above their present level until further studies, testing and instrumentation to assess threats to the safety of these dams are completed and remedial action taken, if necessary,

It has been found that earthquakes may be triggered in the vicinity of dams or lakes as they are filled to capacity. Since most of this data is of a statistical nature, some doubt is held as to a relationship. Particular geological conditions are necessary for the release of shocks the nature of the strate, faults, etc.). It cannot be overemphasized that extensive geological studies be made before choosing a site for a dam or reservoir. Then the design should be carefully engineered to conform to the geology.

Governments provide disaster relief, often in terms of low cost loans for rebuilding. This relief might be shifted from national to local control. Too liberal disaster relief policy reinforces the individuals decision not to protect himself against further disaster. The community could first reduce potential losses by enforcing adequate land-use measures and building code regulations. Then some form of disaster insurance could be required of those who build. Rates should reflect the immediacy of the hazard. New residents would pay the full required rate since they have the option to choose where they locate. Rates for former residents could be reduced when they upgrade their homes or buildings. Government aid could then be directed only to major disasters.

Some types of geologic hazards have been discussed and remedies suggested. In order to cope with the hazardous occurrences in our environment. Nations must share their skills, experience and research capacity. The United Nations and the International Geophysical Union have initiated such programs. Their efforts should be expanded.

Technology alone is not the solution. Engineering devices, land management and social regulation must be integrated into a workable program. Government program will fail if the people concerned are not consulted. Their perceptions of the hazards and ways of adjusting to them must be considered. On the other hand, the public needs education concerning the risks involved and methods for protecting their lives and property. Scientists must recognize that they of ten have failed to communicate adequately with their government of the public. Education should be adapted to the level and culture of the individual. Obtaining public interest is long range management with the aim of reducing risk is one of the first terms in a successful women.

It is hoped that these remarks will .Can you get the message across to our government officials and educates the public through your mass media, such as magazines, newspapers, radio and television? With effort on your part and …. Of all our resources, we will be better able to control our environment. will our world be safer place to live for future generations.

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RESEARCH IN TRITIUM TECHNOLOGY FOR FUSION REACTORS*

Jan B. Talbot

Chemical Technology Division
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37830

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RESEARCH IN TRITIUM TECHNOLOGY FOR FUSION REACTORS *

Jan B. Talbot
Chemical Technology Division
Oak Ridge National laboratory.
Oak Ridge, Tennessee 37830

Despite the wide divergence in estimates of future world energy and economic growth rates, the dominant conclusion of these surveys indicates an increasing global per-capita demand for energy and a decreasing availability of conventional fuel supplies. Therefore, engineers and scientists have an important role to play in the development of fusion energy --a long-term, inexhaustible energy source. The principles of nuclear fusion are essentially understood, but many of the experimental devices needed to demonstrate these principles are large and expensive. Cooperation of laboratories and nations will be necessary to prevent duplication of efforts and to be able to demonstrate fusion power by the end of the century.

The fusion activities of the International Atomic Energy Agency and the International Energy Agency demonstrate the multinational commitment to effective, coordinated fusion research. The major programs are those of the United States, the Soviet Union, the European community, and Japan; each emphasizes the Tokamak, a toroidal confinement machine. The United States' major Tokamak experiment, the Tokamak Fusion Test Reactor (TFTR), is planned for fusion of deuterium in 1982, and then tritium will be added in 1983. The Soviet T-1OM facility, which is about the size of the TFTR, will be the first to utilize large superconducting magnets to

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***Research sponsored by the Office of Fusion Energy, U.S. Department of Energy under contract W-740S-eng-26 with the Union Carbide Corporation.

extend its pulse length capability.The European Tokamak, the JET, has a plasma volume several times the size of TFTR with a capability for limited deuterium-tritium operation. The Japanese JT-60 will not use tritium fuel, but will include a divertor for removing impurities.These four large Tokamak facilities are representative of the cooperative efforts of the international fusion research and development programs in order to obtain maximum progress at a minimum cost to anyone nation.

Although the technological problems of fusion development appear staggering [2], the advantages of an unlimited supply of fuel and relatively slight environmental effects of fusion justify its consideration as an ultimate energy source. However, the feasibility of commercial fusion power reactors depends on the development of effective methods for containing and recovering tritium. Difficult problems are expected to be encountered in the handling, recovery, and containment of the fuel inventory of a fusion reactor fueled with tritium and deuterium. Deuterium can be obtained from natural waters; however, tritium (which does not exist in useful concentrations in nature) must be generated by neutron bombardment of lithium-containing material in a blanket surrounding the reactor plasma.It is necessary to recycle tritium from its blanket system for subsequent use as fuel.Stringent limitations must be imposed on the use of tritium concentrations in the system because of the direct effect on the tritium inventory, the tritium release rate to the environment, and the embrittlement of structural materials by helium resulting from tritium decay.

Most fusion concepts resemble the system shown in Fig 1. The thermonuclear reactions which occur in the plasma that release energy are:

$$ {}_1^2D + {}_1^3T \longrightarrow {}^4_2He + {}_0^1\eta + 17.6\ MeV, $$

$$ {}_1^2D + {}_1^2D \longrightarrow {}^3_1T + {}^1_1He + 4.03\ MeV, $$

$$ {}_1^2D + {}_1^2D \longrightarrow {}^3_2He + {}_0^1\eta + 3.27\ MeV $$

$$ {}_1^2D + {}^3_2He \longrightarrow {}^4_2He + {}^1_1He + 18.3\ MeV $$

$$ {}^1_1H + {}^6_3Li \longrightarrow {}^3_2He + {}^4_2He + 4.0\ MeV $$

For the first generation of fusion reactors, the deuterium-tritium (D-T) reactor is favored because it releases one of the largest quantities of energy and its probability of occurrence (cross section) is the highest of the above reactions.[3] In a D-T reactor, a small percentage of the D-T mixture fuses during its residence in the plasma region. This fusion generates high-energy neutrons which deposit heat in the surrounding blanket fluid. The energy is then transferred to a secondary coolant fluid connected to a conventional steam cycle.

Tritium must be bred to fuel the reactor at a rate equal to, or greater than, the rate at which it is consumed in the plasma. The neutron bombardment of lithium produces tritium by the following reactions:

$$ {}^6_3li + {}^1_0\eta \ \ldots\ {}^4_2He + {}^3_1T + 4.78\ MeV, $$

7 1 ., 1 3
3li + oq... 2He + OT! + IT - 2.47 MeV .

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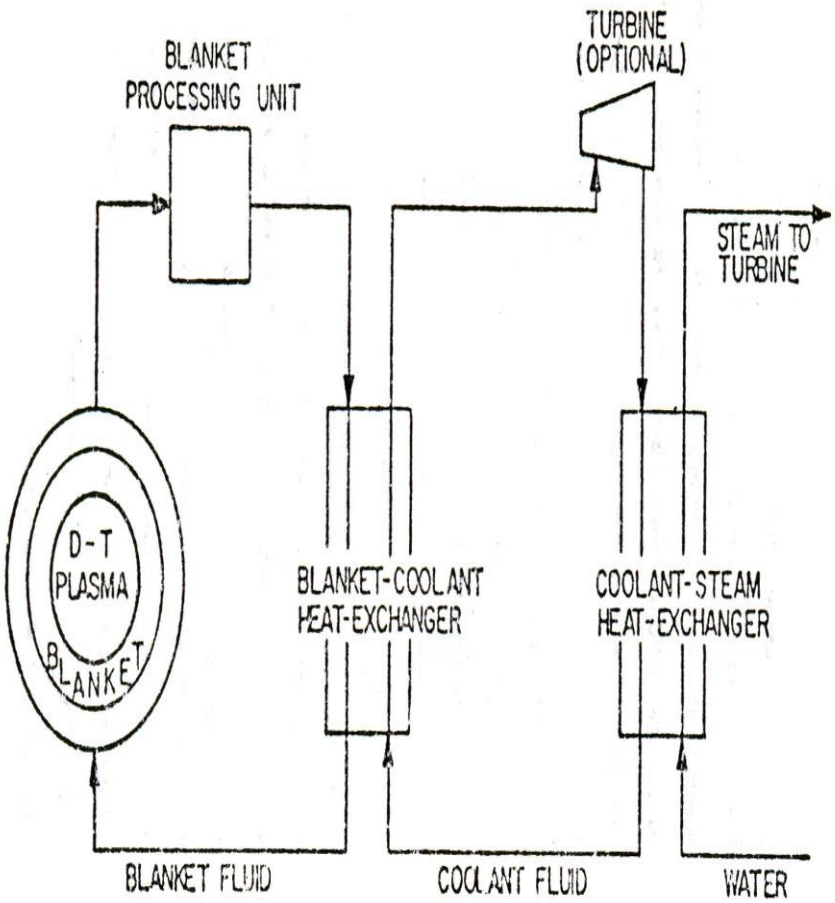

Fig. 1. Simplified schematic of a fusion reactor system.

Lithium must be included in the blanket material for breeding purposes. subsequently, tritium-handling systems are needed to recover tritium from the blanket for recycling to the plasma. Although tritium breeding is not necessary for the deuterium-deuterium (D-D) and deuterium-helium fuel cycles, tritium will be produced by D-D reactions and handling systems will still be required, but the problems will probably be less severe.

Two tritium-handling systems are needed, one to handle the tritium that is recycled from the plasma and the other to recover tritium that is bred in the blanket. The deuterium-tritium mixture, which is to be recycled to the plasma, must be processed to remove helium, hydrogen, and other impurities. The easiest strategy for purification of the recycle gas is to use cryogenic fractional distillation[4] for isotope separation and a chemical separation technique (metal adsorption or cryosorption) to remove helium and impurities.[5] The objective in this isotope separation technique will be to produce a hydrogen stream with a low tritium concentration for discharge or storage.

The second tritium-handling problem involves recovery of the tritium that has been bred in the blanket. In a fusion reactor system, the blanket has a number of important roles. The blanket materia1 must ensure a favorable breeding ratio for tritium, shield the magnets from neutrons and radiation, and act as a heat transfer medium. Low tritium concentrations must be maintained in the blanket material by a tritium recovery system. These low limits for the tritium concentrations are influenced by

(1) inventory costs,
(2) embrittlement of structural materials, and
(3) leakage rates to the environment.[6] For first-generation fusion

reactors, tritium fuel wil1 be produced in fission reactors which wil1 severely increase inventory costs. Tritium is a low-energy beta emitter with a half-life of 12.3 years and an average beta energy of 0.006 MeV. The half-life results in a specific activity of ~ 10,000 Ci/gram. The current guidelines on radioactivity in eff1uents[7] imply that for a 1000-MW(e) fusion reactor: (1) the release of tritium into coolant water should be limited to ~ 10 Ci/day and (2) the amount discharged through a stack (~ 30 m high) should be limited to ~ 10 to 100 Ci/day. However, the current designs of fusion reactors attempt to limit tritium release rates to a range of 1 to 10 Ci/day. This limitation constrains the concentration of tritium in the blanket material. Tritium, which is extremely mobile, will diffuse through all heat transfer surfaces and metal structures. Large concentrations of tritium in the blanket could lead to high release rates; therefore, the blanket must be processed to achieve the lowest possible concentration of tritium.

The choice of the blanket and coolant materials wi11 have an important effect in the tritium recovery scheme.[6] The most promising blanket fluid under consideration is liquid lithium metal. Other candidate blanket materials are molten fluoride salts of lithium and beryllium and solid lithium alloys, such as lithium-aluminum and lithium oxide. These materials have breeding ratios inferior to that of lithium. Solid blanket materials would use he1ium as the coolant fluid.

The fundamental chemical and engineering research conducted at the Oak Ridge National Laboratory seeks (1) information needed to evaluate and develop processes for recovering tritium from fusion reactor blankets;

(2) techniques for removing, purifying, and recycling fusion reactor plasmas; and (3) data on methods for containing tritium to prevent release to the environment. A specific technological problem that has been studied by the authors [8] is the recovery of tritium from solid lithium alloy blankets.

Several fusion reactor designs have been proposed which suggest that solid lithium alloy blankets offer certain advantages over blankets of liquid lithium or molten lithium salts.[9, 10] The major advantage of a solid lithium alloy blanket is that structural materials can be used that do not acquire long-lived radioactivity under reactor operative conditions. Minimum activation results from the selection of blanket structural materials such as aluminum, sintered-aluminum product (SAP), and graphite. but these materials are not compatible with liquid lithium metal or salts. Residual activations of < 1 Ci/10^6 Mw(e) are possible using aluminum as a structural material compared to $\sim 10^6$ Ci/MW(e) with structural materials like stainless steel or niobium. A second advantage is the elimination of the corrosion of structural materials by blanket coolants. This results from using solid lithium alloys with gaseous coolants, such as helium, instead of liquid lithium or molten lithium salts, which can seriously corrode structural metals. Third, the possibility also exists of achieving a system with an attractively low tritium inventory. Perhaps a reduction of tritium inventory in the blanket by an order of magnitude or more could
be achieved, as compared to using a liquid lithium or molten salt blanket. However, the validity of solid blankets is contingent upon the ability of the material to breed and release tritium rapidly into a flush gas, such as helium, which can then be processed to recover the tritium for use as

fuel. Two serious disadvantages of solid blanket materirals are the need for a neutron multiplier, such as beryl1ium, to attain adequate tritium breeding ratios and the heat transfer problems associated with cooling the blanket with high-pressure helium.

The tritium release rates from irradiated samples of lithium-containing aluminum (Li-Al) and sintered-aluminum product (Li-SAP) were investigated to evaluate the potential application of both materials in fusion reactors. This study differs from previous studies[ll] of solid aluminum alloy blanket materials at other laboratories such as Brookhaven National Laboratory in a lower (ppm) lithium and tritium content, the incorporation of oxygen (17.7 wt % $A1_20_3$) within the SAP samples, and the use of large solid samples rather than powders.

To study the tritium release rates, an irradiated sample was heated to a desired temperature between 300 and 500°C using the system shown in Fig. 2. Tritium was produced in the samples by irradiating the lithium doped alloys at ~ 55°C in a thermal neutron flux to achieve the desired burnup. While the sample was held at temperature, preheated argon flushed the released tritium to a tritium monitor. Then, the tritium-bearing argon flowed through a water bubbler to exchange tritiated water from the gas. Next, the elemental tritium gas from the first bubbler was oxidized in a hot (600°C) copper oxide bed. Cooled, and passed through another bubbler. Finally, the stream was routed through a molecular sieve trap and then to the radioactive off-gas stack.

After an average run of 30 hr. the residual tritium in the sample was determined. The metal sample was dissolved in dilute hydrofluoric

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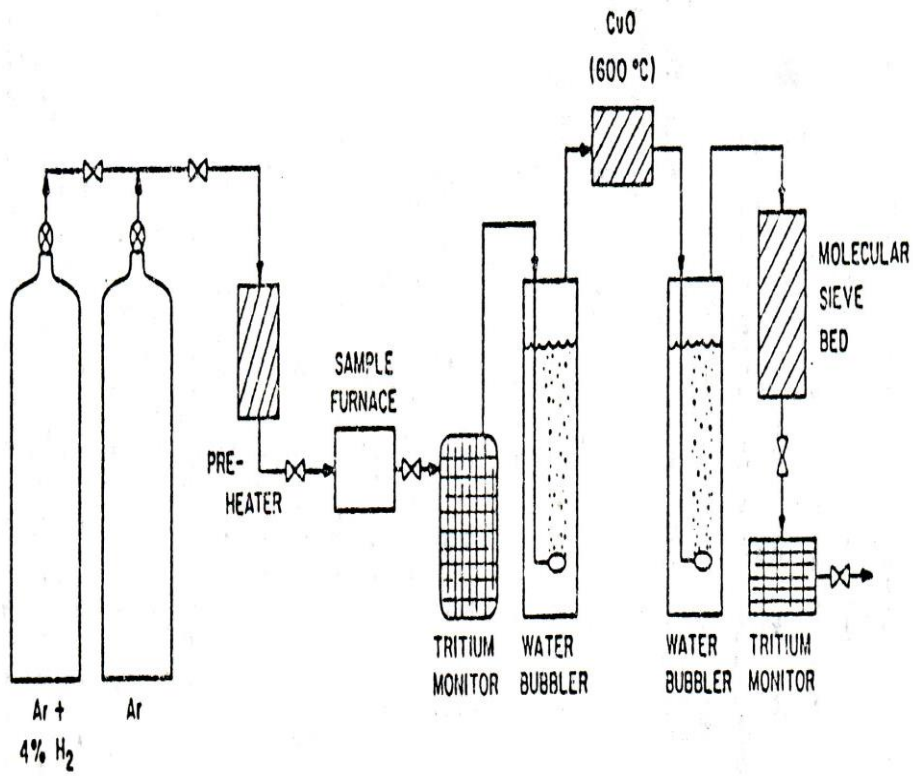

Fig. 2. The system for studying tritium release rates from solid blanket materials.

acid while a stream of argon (containing 4% hydrogen) was flushed over the dissolution solution through a hot (600 ^{0} C) copper oxide bed, and finally through a series of 100-ml bubblers. Any evolved tritium was thereby converted to tritiated water and trapped in the water bubblers. Dissolver and bubbler solutions were analyzed for tritium by liquid scintillation counting. The fraction of tritium released was determined from the integral of the signal from the tritium monitor and the tritium remaining in the sample.

Tritium release rates were measured for eight Li-SAP samples and one Li-Al sample. The percentage of tritium released from each sample and the total tritium concentration determined for each sample are shown in Table 1. The fraction of tritium released from Li-SAP varied from 1.8 to 62.0%, depending on sample temperature, sample thickness, and the length of the run. The total concentration of tritium in the Li - SAP samples ranged from 20 to 126 at. ppm. Almost complete tritium release from the Li-A1 sample (99.7%) was observed during the 22-hr run at 450.C. The tritium concentration in this sample was determined as 94.8 at. ppm.

Analyses of the data show that the release rates are controlled by bulk diffusion in the solid.[12] Figure 3 compares the tritium release rate data for three of the Li-SAP samples and the Li-Al sample, and diffusion-controlled release is indicated by a slope of one-half. Diffusion coefficients were determined for each sample by using the solution for transient diffusion in a plane sheet assuming a uniform initial tritium concentration distribution. The resulting values of the diffusion coefficients for Li-SAP are plotted in Arrheniu. form in Fig. 4.

Table I. Tritium release from solid blanket materials

	Li- SAP samples								Li-AI sample
	1	2	3	4	5	6	7	13	11
Temperature of samples ('C)	340-420	450	400	415	450	500	26-450	425	450
Weight of sample (9)	0.4870	0.1312	0.1690	0.1440	0.2550	0.1928	0.342	1. 0480	0.8695
Sample thickness (cm)	0.1143	0.0503	0.0609	0.0584	0.0609	0.0533	0.0813	0.5689	0.3124
Sample surface area (cm^2)	4.3273	2.7406	3.0012	3.4681	3.1100	3.3520	3.8971	2.8942	4.5182
length of run (hr)	30	30	26.5	25	121	47	32	29	22
Tritium released *from* sample Into sweep gas (mCi)	3.042	4.704	0.626	2.236	2.193	17.88	4.581	1.337	91.79
Tritium from sample dissolution (mCi)	35.24	11.43	3.358	9.142	5.639	10.94	39.13	71.93	0.326
Percent tritium released from sample	7.95	29.2	15.7	19.7	28.0	62.0	10.5	1.9	99.1
Total amount of tritium in sample (appm)	66.51	104.1	19.91	66.65	25.98	126.1	108.3	52.1.5	94.8

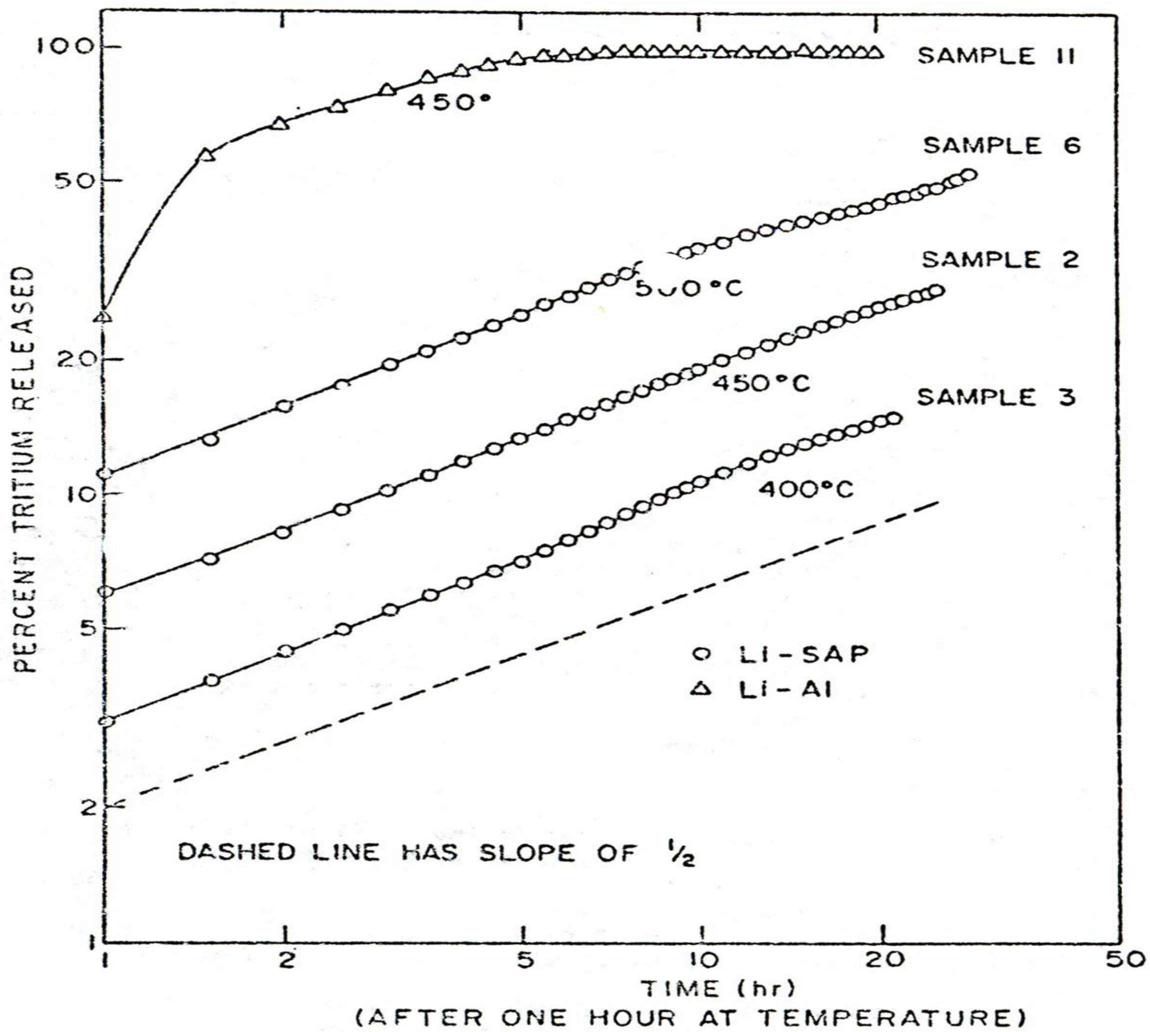

Fig. 3. Tritium release from solid Li-SAP and Li-Al alloy samples at constant temperature.

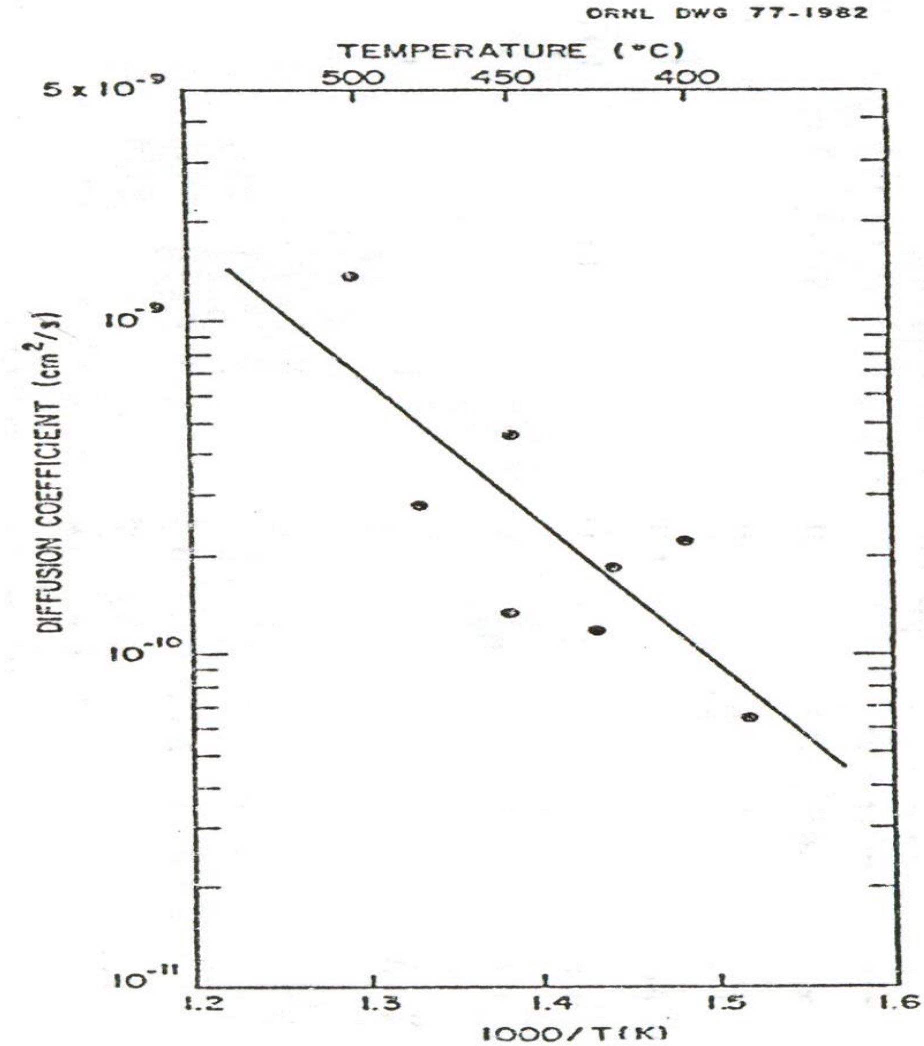

Fig. 4. Diffusion coefficients for tritium in solid Li-SAP alloy.

The dependence of the diffusion coefficient on temperature for Li-SAP from a least-squares analysis was found to be:

$$D = 2.275 \times 10^{-4} \exp \left(\frac{-19{,}580 \text{ cal /g .mole}}{RT} \right)$$

where

D = diffusion coefficient, cm^2 /sec;

R = gas constant , 1.987 cal /Kg-mole;

T = temperature of sample, K.

The diffusion coefficients of Li-SAP and Li-Al are 2.988×10^{-10} and 1.462×10^{-6} cm^2 sec^{-1} at 450°C, respectively. A possible explanation for the more rapid tritium release from aluminum than from Li-SAP is that tritium accumulates at the internal interfaces between aluminum and $A1_20_3$ particles in the Li-SAP. Hence, these effective traps retard the tritium release to the external surface of the SAP sample. Comparison of the diffusion coefficients in Fig. 3 indicates that Li-Al would be preferable to Li-SAP for a fusion reactor tritium-breeding blanket if tritium release rates were the determining consideration. Continuous extraction of tritium from Li-SAP or Li-Al at appropriate temperatures should maintain a low tritium inventory in fusion reactor blankets of these materials; the inventory, of course, would be lower in the Li-Al blankets. The residual tritium inventory in a fusion reactor also would not prohibit the use of SAP or other aluminum alloys as structural material in tritium-containing circuits.

First-generation fusion power plants based on the D-T fuel cycle must breed tritium to be economically feasible. Recovery of tritium from the blanket of fusion reactors will present difficulties, but there appears to be a workable recovery system for the proposed blanket or coolant systems.A viable tritium recovery system, determined by the ongoing research and development tot the Oak Ridge National Laboratory and other national and international fusion technology programs, is necessary for fusion power reactors to retain the advantage of being a clean, inherently safe,inexhaustible fuel supply.

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Commission 5 (C5)

DÉVELOPPEMENT TECHNIQUE DES MOYENS D’INFORMATION

Responsable : Antoinette DAVID

Dans quelle mesure les moyens techniques d'information ainsi que la technique d’information contribuent-ils à la liberté de choix des techniques? Comment l'ingénieur peut-il les maitriser ? Recommandations aux femmes ingénieurs.

C5 – 1 **Quels sont les moyens techniques d’information qui se développent ?** (Transmission, enregistrement, diffusion).

Nature. Caractéristiques de ces moyens, consequences sur Ie transfert d'informations. .

C5 – 2 **Quelles sont les techniques d'information qui se développent?** (Pour l'informa- tion du public, la collecte d'information, la recherche des informations existantes).

Nature. Caractéristiques. Conséquences sur le transfert d'informations.

C5 – 3 **Conséquence sur le progrès technique du développement des moyens et des techniques d'information.**

Informer clairement Ie public des conséquences du progrès.
Effectuer des choix technologiques en toute connaissance des conséquences économiques et sociales.

C5 – 4 **Dans quelle mesure l'ingénieur a-t-il la responsabilité et la possibilité de .«maitriser» le développement de ces moyens techniques pour sauvegarder la liberté de choix ?**

Les pays ont -ils tous, du fait des conditions et de l'état de leur développement technologique, la méme possibilité d'étre informés et par suite la méme liberté dans le choix de leur industrialisation ?

C5 – 5 **Conclusions quant à la manière dont les femmes ingénieurs et scientifiques peuvent :**

- informer le public des conséquences du progrès,
- s'informer dans l'exercice de leur métier,
- apprendre aux autres à choisir et à utiliser les moyens d'information en toute connaissance de leurs caractéristiques techniques.

Commission 5 (C 5)

TECHNIQUES OF DEVELOPMENT OF INFORMATION SYSTEMS

Convener: Antoinette DAVID

To what extent do the technical means of handling information together with the techniques of information presentation contribute to the freedom of choice between technologies? How can the engineer effectively influence them? Recommendations to women engineers.

C5-1 What are the currently developing technical means of handling information?
(Transmission, recording, broadcasting).
Nature - characteristics of these means - consequences on the transfer of data.

C5-2 What are the currently developing techniques of information presentation?
(For information of the public, collection of data, research with existing data).
Nature - characteristics - consequences on the transfer of data.

C5-3 . Influence on technological progress of the development of information systems.
Educating the public on the consequences of new developments.
Making choices between technologies in the full knowledge of the economic and social consequences.

C5-4 To what extent is the engineer responsible for and able to influence effectively the development of information systems, thereby safeguarding the freedom of choice ?
Countries differ in the extent of their technological development. Can each country therefore be equally well informed on this matter and, in consequence, does each country have the same freedom of choice in its industrialisation ?

C5-5 Conclusions as to the way in which women engineers and scientists are able:
- to inform the public on the consequences of new developments,
- to keep up-to-date in the practice of their professions,
- to teach others how to choose and utilize information systems in the full knowledge to their characteristics.

SYNTHESE DE LA COMMISSION N° 5
SUR LE DEVELOPPEMENT DES MOYENS D' INFORMATION

Elle observe que la communauté des ingénieurs et des scientifiques a 1a responsabilité de rendre 1es progrés en matiére de technologie accessibles aux uti1isateurs des différents niveaux: des gens trés bien formés et trés avertis en matière de technologie à 1a foule de gens qui n'ont reçu qu'une foimation rudimentaire.

La Commission affirme sa conviction
que des femmes ingénieurs et scientifiques, se rencontrant dans des congrès qui leur sont propres, ont, du fait qu'e11es sont moins nombreuses, une occasion particulièrement favorable d'échanger leurs vues entre spécialistes des différentes disciplines.

Il importe d'exiger de l 'ensemble des ingénieurs et des scientifiques qu'ils fournissent un effort accru pour coordonner les multiples technologies dans l'intérėt du travail de chacjn.

La Commission recommande d'attacher une attention particulière à la manière dont l'information technique est transmise à des non-techniciens et aux risques d'erreur d'interprétation, Il faut, de nos jours, une formation pour savoir choisir et utiliser les moyens d 'information.

Nous devons prendre conscience du fait que l 'information s' est accumulée à un rythme plus rapide que ne pouvait croitre notre aptitude à utiliser cette information. Il en résulte que nous devons contribuer à faire comprendre l 'importance de la formation et de l 'entrainement tant aux methods de classification et de diffusion de l 'information qu 'aux technologies de stockage, accumulation et diffusion à travers les banques de données.

On a exprimé l 'espoir que celles qui ont participé à nos réunions internationales aient la volonté de faire connaitre ces activités d'importance capitale et en particulier qu'elles fassent des efforts tout particuliers pour appeler l'attention dans leur pays et dans leur environnement professionnel sur le résultat des travaux de cette Commission, de notre Congrès en général.

LISTE DES COMMUNICATIONS

MASS MEMORIES FOR ENVIRONMENTAL DATA

by

Rose Mary Thompson

Abstract

Millions of bits of data are being transmitted every second by meteorological and earth resources satellites. Mankind can use this data to predict the weather, study the climate, and manage the natural resources at its command. But the data must be stored - sometimes for a short period, sometimes for archival purposes - and accessible by computer to he useful. This paper discusses mass memories (capacity $\geq 10^{12}$ bits) that are available today and those predicted for the future. Both short term and archival memories are surveyed. Storage capacity, access time, and transfer rate are the prime performance characteristics to be addressed.

Introduction

The paper will cover the challenge to our technology of providing computer accessible storage for the massive amounts of sensor data which are generated by environmental (meteorological and earth resources) satellites. Statistics for established programs such as LANDSAT and GOES will be presented - how much data has been generated since the beginning of the program, how is it stored, how much has been processed, and how much data is received every day. Then, with this sizing in mind. existing mass memories ($\geq 10^{12}$ bits) will be surveyed:

1. Cal Comp Autolibrary 7110
2. CDC Mass Storage Facility CDC 38500
3. IBM Mass Memory System IBM 3850
4. Ampex Terabit Memory
5. Harris HR/MR
6. Holofile

Special technology problems of archiving this data will be discussed and cabability of each system for long term storage will be reviewed. Future storage technologies and capabilities will be projected.

MASSIVE DATA GENERATION

Earth observation experiments are characterized by general purpose sensors which generate data that are used by hundreds of investigators for many different purposes. Such a variety of users precludes the possibility of extensive processing on-board the satellite with the transmission of only a few "answers". The data itself (perhaps compressed) must be transmitted to the users.

By surveying the almost continuous studies of user needs for earth resources data, it is possible to judge trends in data requirements. One recent survey (referenced in (1)) of these studies related data types, such as ocean survey, meteorology, agriculture, forestry, geology, and mineral resources to user community uses ranging from sea surface effects (temperature, roughness, etc.) to terrain mapping, atmospheric pollutions and severe storm warning. Additional factors such as data uses, data destination, data perishability, frequency of observation, and resolution, can then be used to form candidate missions and sensor groupings to meet emerging needs. Figure 1 presents a summary of typical sensor / mission groupings.

The sensors listed are typical of the major classes of earth resources sensors being used in the post 1975 time frame. Among these, the highest data rates are achieved by the imaging sensors (often multispectral) and the synthetic aperture radar. Figure 2 shows the relationship between data rates for images and selected user requirements. When projected into the 1980's these sensors lead to spacecraft missions with instantaneous composite data rates in excess of 700 Mbps and data volumes approaching 10^{12} bits per orbit.

Several factors determine the data rate required of a Landsat type high altitude earth resources multispectral sensor: observational frequency (hours to months), field of view (1 mile to 1500 miles) ground resolution (50 feet to 20 miles), spectral, resolution *(*0.2 m to .5 m), spectral coverage (.1 m to 2.2 m), and radiometric resolution. The resulting data rate of a single sensor can be between 20 to 300 megabits per second. (1)

SENSORS → / MISSION ↓	IMAGING SENSORS	SPECTROMETERS	VISIBLE AND INFRARED RADIOMETERS	PASSIVE MICROWAVE RADIOMETERS	SYNTHETIC APERTURE RADAR
TERRESTRIAL SURVEY ENVIRONMENTAL QUALITY 1	X	X			
OCEAN SURVEY METEOROLOGICAL 1	X	X	X		
TERRESTRIAL SURVEY/ ENVIRONMENTAL QUALITY 2	X	X			X
OCEAN SURVEY/ METEOROLOGICAL 2			X	X	
TRANSIENT ENVIRONMENT PHENOMENA MONITORING			X		
TERRESTRIAL SURVEY ENVIRONMENTAL QUALITY 3	X	X			X
OCEAN SURVEY/ METEOROLOGICAL 3		X		X	
METEOROLOGICAL			X	X	X

Figure 1. Mission/Sensor Grouping

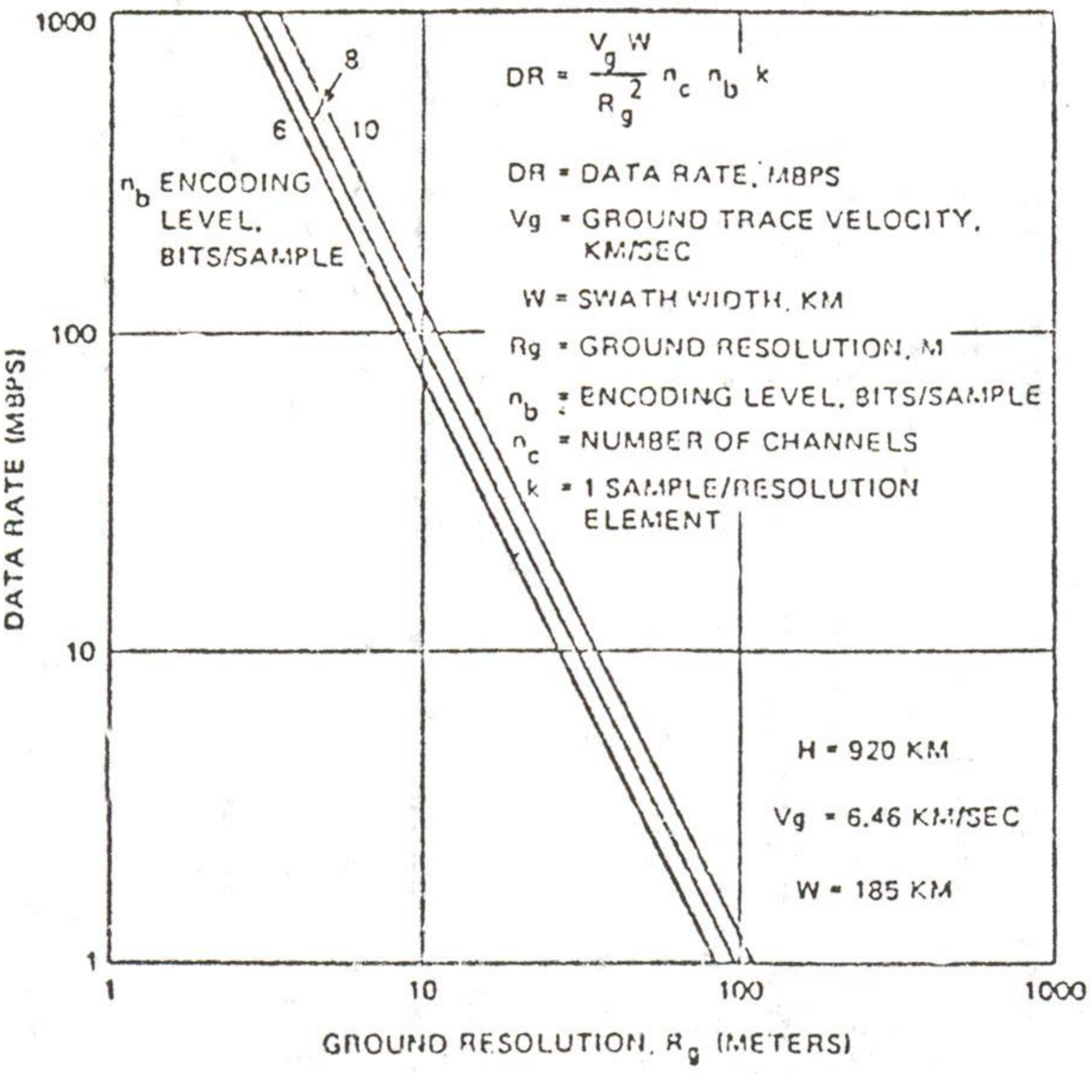


Figure 2 Data Rate vs Ground Resolution for Imaging Sensors

The Geosynchronous Orbital Earth Satellites (GOES) transmit over 60 x 10^{9} bits of data each day per satellite.In this data were to be recorded using a conventional magnetic tape memory system (the primary mode of starage today), 32 tapes would be recorded per day. Three years of data from two satellites would require 70,080 tapes.In addition, because of the limited capabilities of magnetic systems to archive data (bleedthrough, etc.). these tapes would be of1imited use for data analysis at the end of three years of storage. (2)

It has been estimated (3) that NASA earth satellites and other space probes are transmitting to earili 10^{15} bits of raw data each year. Of this data, 10^{13} bits will be retained, or archived, for fifty years or longer.

MASS STORAGE SYSTEMS

Mass storage systems are characterized by large storage capacity (10^{12}. bits) at (hopefully) low cost per bit. As shown in Figures 3 and 4, they are usually at the slow end of the memory hierarchy and must be staged on to faster memories before being fed into *computer*. The complexity of the staging and the vast quantity of data involved require higher sophisticated data base management systems to control these mass storage systems. This paper will not go deeply into the subject of data base management, but the reader should be aware that the devices described below will require such control.

Bit error rate (Ber) is a parameter which should also be of concern to the reader. It is a function of the recording method, condition of the recording media, coding of the data (is EDAC used?) and to some extent the data base management system. Although this paper does not compare actual Ber's for the hardware under discussion, Ber should be a consideration in the design of mass memory systems.

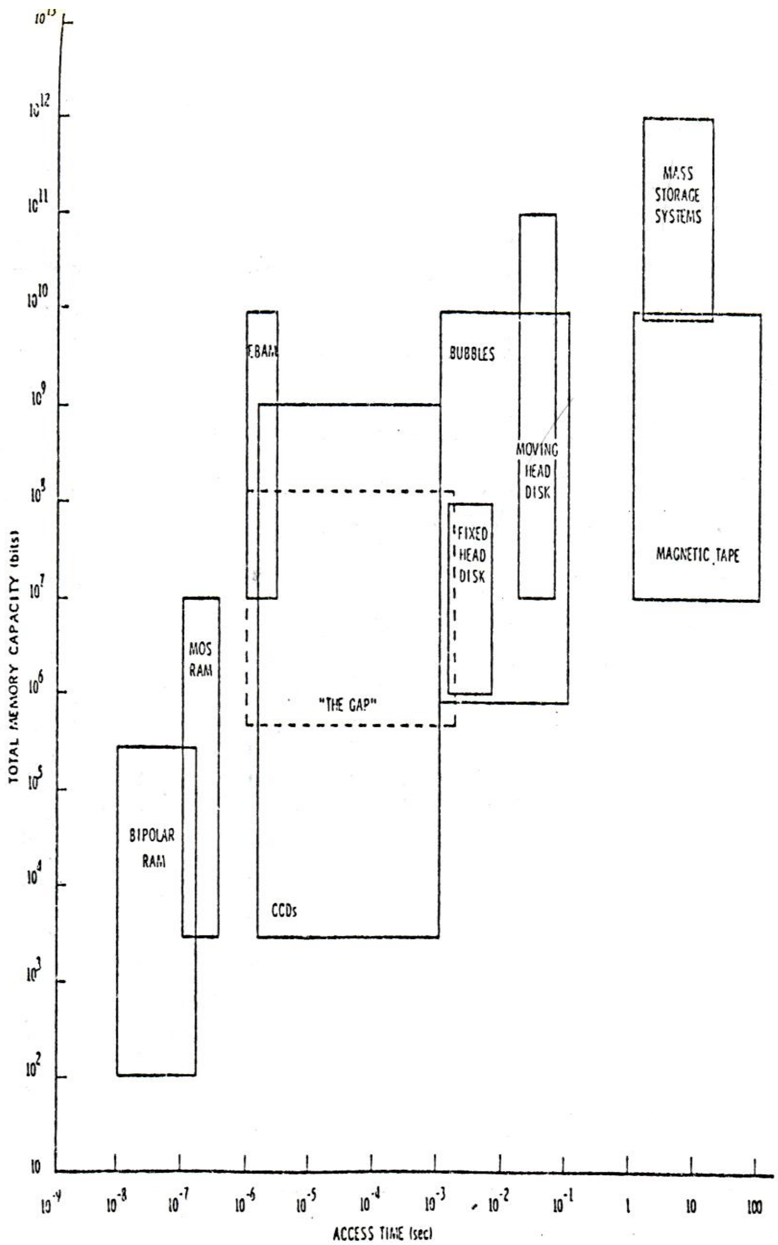
Mass storage systems will be divided here into archival and non-archival systems. Archival systems are generally defined as being read only devices & capable of preserving data for 100 years under ambient environmental conditions. Non-archival systems preserve data for shorter periods. The magnetic tape technology, which dominates the non-archival systems, can generally preserve data for about three years. Most of the systems which are fully developed, on the market, and in the field are non-archival systems.

<u>Non-Archival Systems</u>

In different ways, non- archival units combine the inexpensive cost of magnetic tape as a storage medium with the operating advantages of on-line access. Table 1 compares the characteristics of the Calcomp 7110, the GDC 38500, IBM 3850 and Systems Development Corporation /Ampex TBM.

The Calcomp 7110 is a fully automated on-line tape library for standard 1/2 inch magnetic tapes. Under computer control, the 7110 equipment automatically brings the tapes from storage, mounts them on tape drives, dismounts them when the job is completed, and returns them to storage. Accessing up to 150 reels per hour, the 7110 can store up to 7000 standard tapes or 8000 thin line reels in a lockable self-contained library. This system is particularly advantageous where the data already exists on standard computer tape. No conversion to other media is required. The 7110 can service up to 32 tape drives (although 2-4 is more typical) and can interface with up to 4 CPUs. The 7110 has the lowest cost per bit of the four systems and can interface with almost any brand of computer system (although the supplied software is designed for IBM machines), Calcomp's software, which resides in the IBM mainframe, provides data base management below the specific tape number to the data set. There are over 30 Calcornp systems currently delivered and in operation.

The IBM 3850 mass storage system uses a new storage component called a data cartridge. Housed in honeycomb storage compartments, these 2 by 4 inch plastic cartridges can each hold up to 50 million bytes of information. Whenever information from a cartridge is needed by the computer, a mechanism selects the desired cartridge and transports it to one of up to eight reading stations. There the data is read out and transfered to the staging disk drives.


TOTAL MEMORY CAPACITY (bits)
ACCESS TIME (sec)
MASS STORAGE SYSTEMS
BUBBLES
MOVING HEAD DISK
FIXED HEAD DISK
MAGNETIC TAPE
MOS RAM
"THE GAP"
BIPOLAR RAM
CCDs
10
10^2
10^3
10^4
10^5
10^6
10^7
10^8
10^9
10^{10}
10^{11}
10^{12}
10^{13}
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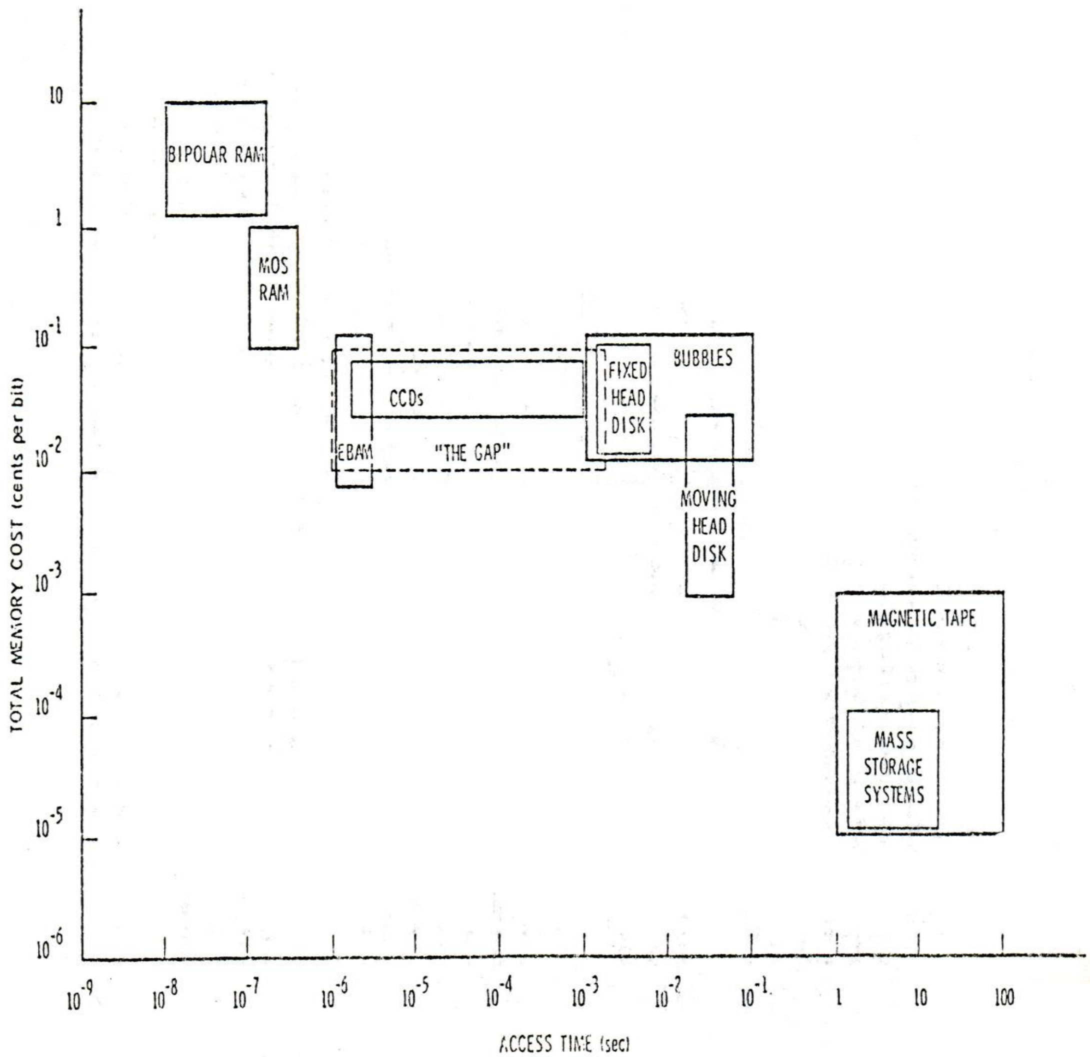
100

Reference 4

Figure 4 Cost Versus Access Time



Reference 4

TABLE 1. Comparison of Non-Archival Mass Storage System Characteristics

Mass Memory Storage Characteristics	Cal Comp 7110	CDC Mass Storage Facility CDC 38500	IBM Mass Memory System IBM 3850	System Development Corporation/Ampex TBM
Maximum Capacity	8 * 1012 bits(8000 tapes at 1012 bits/ 1000 tapes, at 6250 bpi)	2.4 * 1011 bits (2000 cartridges in library Magazine)	38.1 * 1011 bits (Maximum Mass Storage System – Model B4)	2.94 * 1012 bits (Maximum 32 transports, typical system 4)
Media	0.5 inch wide magnetic tape on 10.5 inch reels (standard computer tape). Density flexible: 556, 800, 1600, 6250 bpi	8 megabyte cartridges containing 770 inch of 3 inch wide magenetic tape	50 megabyte cartridges containing 770 inch of 3 inch wide magnetic tape	Two inch video tape, 10.5 inch reel, 3800 ft/ reel, 4.5*1010 bits per reel
Maximum Transfer Rate	1.2 * 106 bytes/ sec	Nominal 806 k bytes/ sec Peak 983 k bytes/ sec	806 k bytes/ sec	700 k bytes/ sec
Access Time	10 sec (max 20.5 sec)	7 sec	15 sec	15 sec (max 47sec)
Throughput	150 reels/ hour	200 files/ hour	100 files/ hour	150 files/ hour
Operation System Support	MFT, MVT, SVS, MVS (LBM 370)	MFT, MVT, SVS, MVS (IBM 370)	VSI,SVS,MVS (IBM 370)	MVT (IBM 370)
System cost (Capacity) Low Cost Medium	$111,276 (7.6 * 1011 bits) without tape storage/ drives	$626,200(2.4 8 1011 bits) without staging disks	$496,050 (Model A-1 2.8 * 1011 bits) without staging disks	$1,154,000 (22.4 B bytes) without staging disks
Cost Per bit (on-line system)	0.0000175$/ bit	0.00026$ / bit	0.00017$/ bit	0.000644$/ bit
No. of Installations	Over 30	4	Over 100	4

Table 2. Comparison of Archival Mass Storage System Characteristics

Mass Memory Storage Characteristics	Harris HR/ MR	Holofile
Maximum Capacity	2 X l0^{11} bits # of fiche: 6750 (30M bits / fiche)	I. 4 X 10^{11}bits #of fiche: 720 in carrosell (200M bits/fiche)
Media	4" x 6" microfiche	4" x 6" microfiche
Maximum Transfer Rate	500 K bps	5 M bps
Access Time	15 seconds	3 seconds
Hologram	1D	2D
Throughput	120 sec/ Fiche	40 sec / Fiche
System Cost	$ IM (prototype)	$ 300,00

The CDC 38500 system uses similar cylindrical data cartridges which can each hold up to 8 megabytes of data. The CDC 38500 has a faster access time and a faster data transfer rate than the IBM. 3850 (CDC's longitudinal recording requires less data correction than IBM's helical recording). CDC has the option of using either a staging disk or reading directly from the read station to the CPU and thus can mix staging data files and others on one common disk unit.

The Systems Development Corporation / Ampex TBM takes advantage of video tape technology Ampex's expertise in this field. In development since 1966, the first system was installed in 1972. Four systems are now in operation. The TBM is very similar to the magnetic tape systems discussed earlier, except that data is written onto and read from video tape, which can store many more bits per inch than traditional computer compatible tape systems, partially because the tape is wider. For example, the floor space for the Systems Development Corporation / Ampex Terabit Mass Memory takes 112 square feet versus 220 Model l IBM 3330' s with the equivalent bit capacity taking 2100 square feet. TBM records digital data on 2 inch wide tape, 3800 feet long. Data is encoded with frequency modulation of a 6.25 MHz carrier and recorded on magnetic tracks which are transverse to the 1ongitudinal tape movement by transducers mounted on a rotating drum. During read/write operations,the longitudinal tape speed is 5.17 inches/see, and during search mode, the speed is 1000 inches/ sec. TBM has a minimum capacity of 9 x 10^{10} bits and a maximum capacity of 2. 94 x 10^{12} bits. Its, output can be staged onto disk storage.

Archival Systems

Archival memories currently under development are based on optical/ film techniques which give a longer life (up to 100 years) than magnetic media technology (<3 years). Holographic recording of digital data permits extremely high packing densities without the requirements of close alignment tolerances, or the intolerance of dust, scratches and recording media imperfections inherent in conventional digital recording techniques.

Two holographic memories currently under development, the Harris HR / MR and the Holofile are compared in Table 2. Two prototypes of the Harris machine have been delivered to a government agency and the Holofile (which is a more advanced design) is currently being marketed commercially. Both are currently read only (a film technique is used) but research is underway at Kodak to develop a medium which can be used for read/write. The Harris machine uses a ID holograph, while the Holofile uses a 2D. Holofile is researching a 3D holograph which could add up to 5 levels of storage in a third dimension. Holofile projects a potential storage capability of *multiterabytes* per fiche.

Holographic memories have tremendous potential as archival mass memories. Further development should being costs down drastically, and the low cost (see Table 3) and volume of the storage media should make storage and processing of environmental data a feasible undertaking.

Conclusion

Mass memories are needed to capture the massive amounts of data generated by sophisticated environmental sensors. Magnetic & holographic technology is beginning to become available that will meet these needs. Future developments are expected to improve these technologies further and being down costs.

Table 3. Media Cost For 10^{12} Bits

Holographic:	Fiche @ $. 10	$500
Mag Tape:	IBM 3850 @ $20	$99,000
Cal Camp 7110 @ $10		$30,000

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Session: 5. **Technical growth of means of information. Its consequences.**

Title: Informatique in the service of the mankind

/Abstract/

1. The basic means in informatique: the computing techniques:
   - some aspects of its advance
   - newest means, systems and methods in the computing

2. The significance of informatique and computing in the developement of the backwarded regions of the world and in the struggle against bunger, famines and epidemies:
   - forecastings by extrapolation and model-building
   - databanks, danger-signalling and resource-distributing systems.

3. The impact and consequences of the overall application of informatique /computing/ in a society in respect to the social and private life:
   - computer-assisted state-, industry- and service-control
   - the impact of computing/means and methods/ on learning, education and structure of manpower

4. Possibilities of women by computing:
   - new professions, new job-possibilities
   - home/remote/education for young mothers
   - some data on the state of the Thlngarian woman professionals in the computing field

January, 1978.

ZSuzsa / Susan / Szentgyërgyi
Hungary

INFORMATICS AT THE SERVICE OF MANKIND

Zs. Szentgyorgyi, Hungary

Informatics is a broad concept containing all forms, methods and applications of sensing, collecting, storing, transforming, processing and distributing information in technical, human, social, economical and/or natural environment.In the latest 2-3 decades computer techniques became the basis for the processing /transforming/storing/distributing functions of informatics. That is why these two notions are used alternately. As a matter of fact, however, informatics in a stricter sense is not totally identical with computing as the earlier may have some divergent features: spread and processing of information by purely human resources /e.g. gossip/, or in semi human/semi technical modes /e.g. press, radio, tv, etc./. Being, however, computing the ablest and most powerful support for processing, storing and distribution information and having an ever growing role in it, in the following I'll refer only to informatics using computers and deal first of all with the impact as such on human individuals and societies.

Advance in computing

Since the appearance of serially manufactured machines computing techniques has developed in a "permanent revolution". Second-generation machines were introduced as late as the fifties, end - not more then twenty years later - the fourth-generation tools and systems are already at the threshold.

For the coming years of the century two main tendencies can be predicted in the development of computers:

/i/ the exploding spread of autonomously working microcomputers, and
/ii/ the emergence of large, interconnected, highly integrated Multiprocessor system./networks/.

No doubt that the above mentioned trends are essentially related to the advance in computing, nevertheless some other lines will have importance as well, such as minicomputers working in stand-alone or in terminal modes , or medium-size computer systems used in various / process control, production control, accounting, etc./ applications.

Microprocessors μp / and mierocomputers μc / built from them represent a special fecture in the development of semiconductor technology. Along with the growing density *of* components on the IC's chips the relative price / related to a bit, or to the maintenance/ of the logic and storage elements has been dramatically falling. In the course of the letest twenty years component density has roughly doubled in each year and price cuttings show a nearly logarithmic trend. This process involved the idea to create complete subunits or units of a computer on a single chip. The first μp's appeared about five years ago as off-the-shelves products, and a made revoluticn on the electronic market.

μp's can provide a great variety of functions and change the facet both of every-day devices and industrial means .The so-called "smart" or "intelligent" devices indirectly can serve their human masters without the necessity, to exert big effort to learn their handling and control. As exemples we can mention here only a few types of them.

Pocket calculators provide aid to compute not only taxes or statistics but even householding calculations, too. Electronic units can control and program all the electrically driven and fed domestic machines and devices such as e.g.Washing machines, cookers, etc. Hypochonders - and sometimes really ill people, too - can self-control their health-parameters: blood-pressure, dextrose-level, etc., and the more advanced health-control devices can make evalutions on a longer period and send alarm signals in case of danger. In a rapidly growing number and various types here are the electronic games played on tv- screens or autonomously /e.g. chess-automation /, the self-instructing machines and so on, which may /not certainly / raise the quality of life onto a higher niveau.

On the other hand, μp's are not only Smart little toys but hove more earnest roles, too: as built-in intelligence in industrial applications /process-control, wheighing machines, measuring instruments, etc./, in public services /desk-top, programable calculators/, in planning and projecting works /personal computers/.

The second basic trend, the formation of interconnected systems is quite analogous in its main characteristics to the former story of other public servicing and supporting systems, such as electric networks, transporting systems, etc. The hardware basis of the computer systems is systematically and continuously improving in respect of its technical /memory capacities, reliability, processing speed/ and economical /relative costs/ parameters. These are, however, only necessary conditions, while the sufficient conditions must be provided by the software support and by the system-theory and by the system engineering as background. These are at present the weakest points in creating integrated systems in spite of the great efforts made in this field. Stability of highly interrelated processors, methods for optimal access to common resources and for solving, queuing problems ,dumping and redumping strategies, problems of physical, logical and privacy security are /and will be in the future, too/ in the focus of theoretical and applied research in respect to integrated multiprocessor computer systems.

What can informatics be used for?

Man always had the desire to know the future. Up to now, however, the means to gather, store and process necessary information – and very frequently the information itself - were not available. That is why the early forecasts belonged rather to the realm of tales, supertitions or apocalyptic legends than to that of reality. Only in our days technology, drew the possibilities of scientifically well established predicitions nearer.

Having in *mind* the definition of informatics given in the first passage of this paper we can state the huge significance of its means and methods in the extrapolation and model-building. Informatics can be used in processing collected statistical data and so the required information / or at least, parts of it / becomes available. In memory systems with enormous capacity incredible amounts of information can be stored and accessed for very long periods /practically for ever/. By means of computers, and especially that of large computing systems and networks economic and social models requiring immense computing resources can be compi1ed, computed, evaluated and so used for medium- and long-range planning purposes.

A well –Known example among the future-searching attempts was the famous world-model initiated by the Club of Rome and accomplished by a team of the Massachusetts Institute of Technology in the USA. Based on the system-theoretical results of J. Forrestor, the compiled world-model used five relevant quantities: growth of the population, food production, industrial production, exploitation of natural resources and growth of pollution. In spite of the vehement critics against the model itself, its mistaken presumptions and mathematical procedures in principle and especially its conclusions, the effort to create and even quantitatively evaluate such an immense object as the world was a great challenge and gave impact to the scientific world to follow this way in clarifying -the dangers threatening our globe. They newer models partly avoided the mistakes made by the pioneers. They aimed less ambitious purposes, made predictions on trends standing nearer to reality, realized the restrictions of the computing means available at present. For example, these newer predictions based on models which divided the world into more or less homogenous regions, or which emphasized only one or two of the most significant characteristics. Last of all, in spite of all critics and confrontations these models are extremely useful, because they reveal trends and relations which earlier could not be scientifically established, only conjured or progmatically compiled. In other words, the recent powerful computing systems by their superhigh processing speed, mighty storing capacity and last but not least by the mathematical methods having been brought to life by them are the prerequisites for modelling huge objects.

World models give an overall view on general quantities. Ferhaps, more important are the special information-masses stored in databanks on the basis of which continuous forecasts and signal1ing can be made. Of this type are the meteorological /Weather-forecasting, hurrican-signalling /systems, the systems following and signa1ling the move of fishes in oceans, or the migration of locust swarms medical databanks, epidemy-signa11ing systems, etc. Informatics can effectively contribute to dispensation of aids to famine - or other catostrope-striken areas.

The applications listed above touched only a port of the use of machine-supported informatics and referred to the most general aspects of human life. In the following I'd like to give a short account on its more special and narrower employments in the society.

Informatics can be widely used in organizing the life of society and in accomplishing works in science, industry, agriculture and services. Basically computing techniques can provide twofold aid:

/ i / ordering and storing data /*or*, more exactly, information/, and
/ ii / problem- / task -/solving / i.e. computing abilities /.

In the various applications now the first, now the second side comes into the foreground. In state-administration, clerical, statistical tasks, in medical, criminal, traffic databanks for example the first one **/i/** is the more important side. In these fields computing supports collecting and ordering according to various aspects of the very large amounts of raw data. The ordered data in most cases should be rapidly accessed by a great number of users via terminals located remotely from the, datacentres. Computing work in the above cases is generally primitive: first of all, it consists of data-moving, ordering and simple arithmetical and logical functions.

Service controls and managements, such as reservations / hotel, transport /, being and credit tasks require similar features.

Scientific, engineering problems and some industrial controls require basically the second side /ii / services of informatics, very complicated mathematical functions and procedures are to be computed and solved on a relatively small number of data. Among these are to be mentioned the control of flying objects /space vehicles, planes/, solving thermodynamic, nuclear etc. problem optimizing large industrial and energy plants, projecting complicated technical objects /machine tools, IC's, buildings, ships/.

It is highly probable that the means and methods of informatics cause big changes in learning and education, as well . While the early –mechanized and passive - means rather alienated the pupils with their tormenting question-answer methods than helped them imacquiring knowledge, the new Computer- assisted and managed methods and systems can bring them the joy and pleasure of active participating in learning and competing. A good example is the CDC’s PLATO TV education system in which the student can solve problems given by the computer on his own but in case of mistakes or difficulties he can consult interactively with the "machine-tutor". The system evaluated the results, gives advices and new tasks as well, similarly to a good, tolerant and well-honoured teacher. On the other hand, machine-aided learning systems are extremely useful for those who are not able to attend the lessons /e.g. ill, hindered people, young mothers, corresponding students /. They can learn at home via a terminal, which can be hired for the required learning period.

Some conclusions

A11 the above mentioned applications and possibilities of informatics show only its advantageous features. Here I don't want to deal with its negative effects, since this could be the subject of another paper. Nevertheless, without any exaggeration we can state that computer-supported informatics will change the quality and forms of life of societies not only in the future, but it has already made modifying effects in the more developed countries. One of these effects are the transformations in the manpower structure. While by some special and important applications / automation in industry, Some clerical, administrative works, etc./ quite a great number of workers became superfluous, on the other hand, informatics itself requires as a big number of workers / if sometimes not more / as were fired because of its use. The difference is only that "brains" have to be converted, which is very difficult, especially in the case of elderly people.

The new jobs provided by informatics gave new opportunities to Women. Work in informatics is mentally pleasant end physically easy. Indeed, a lot of women work in this field. Unfortunately, no matter that informatics is a brand new profession, the distribution of women in the job-hierarchy is essentially the same as in other branches. On the lowest levels only - or mostly - women are to be found: among operators, punchers, junior programmers while in the higher jobs / senior programmers, computing centre leaders/ men make the overwhelming majority. And what is worse: about this problem I have already written in my paper for the 4. ICWES held 3 years ago in Craccow and instead the situation has improved, it is perhaps worsening. Time has come to do something against this process if we want to use the advantages of informatics for the working women, too!

SESSION 5 - TECHNICAL GROWTH OF MEANS OF INFORMATION ITS CONSEQUENCES

Trends in the Use of computers in Manufacturing Industry

by **Sheena Inglis** MA , C Eng, MI Prod E, MIEE

Summary:

Management of production is complex, and still little understood by many people working in the manufacturing industry. If it could be improved, it would have a major impact both on companies' profitability and on their country's economy.

The computer has always had the potential to improve management control in production. However, ten years ago computers were expensive, highly specialised and remote from the user, walled-off from him by the professional world of data processing. Consequently, only a small proportion of manufacturing companies attempted to use them for management and control of production, and many attempts were unsuccessful.

In recent years, computers have improved dramatica11y in price / performance. On-line terminals have brought the computer's capabilities much closer to the user, and he can now retrieve his data, change it and manipulate it very easily. All these trends have lead to a better understanding by the user of what can be achieved, and he is eager to try new approaches to his work. The computer cannot be used to run a company - this is still the manager's function - but it can be used to give real assistance in many areas.

In the future, we can expect more companies to realise the potential to improve their manufacturing management, and more users to enjoy working with the computer.

The theme of this paper is illustrated by cartoons, and uses examples of manufacturing companies with whom the author has worked.

TRENDS IN THE USE OF COMPUTERS IN

MANUFACTURING INDUSTRY

Sheena Inglis MA CEng MIProdE MIEE CdipAF

Biography

Sheena Inglis took a degree in Engineering Science at Oxford University. She then worked for five years as a design engineer of power systems, first for the electricity supply industry in the UK, and then for a firm of consulting engineers in Canada.

For the past ten years she has worked as a systems engineer for IBM UK Ltd. specialising in the application of computers in manufacturing industry.

Summary

Management of production is complex, and still little understood by many people working in the manufacturing industry. If it could be improved, it would have major impact both on companies' profitability and on their country's economy.

The computer has always had the potential to improve management control in production. However, ten years ago computers were expensive, highly specialised and remote from the user, walled-off from him by the professional world of data processing. Consequently, only a small proportion of manufacturing companies attempted to use them for management and control of production, and many attempts were unsuccessful.

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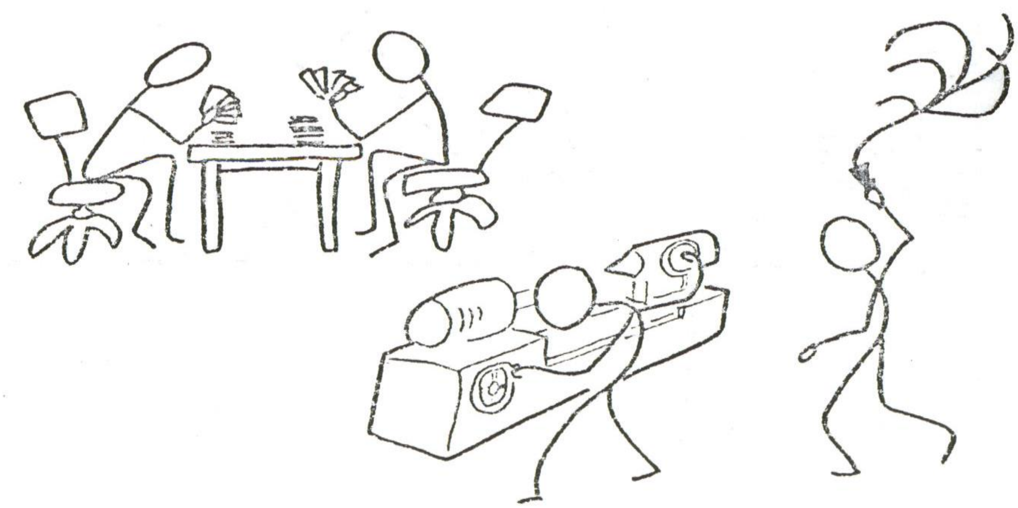
In the future, we can Expect more companies to realise the potential to improve their manufacturing management, and more users to enjoy working with the computer.

TRENDS IN THE USE OF COMPUTERS IN MANUFACTURING INDUSTRY

The Management of Production

The management of production in manufacturing industry is a complex but often underestimated problem. It consists of a number of inter-related subsystems - such as inventory planning, shop loading, purchasing and receiving - making up a total system which is both dynamic and unstable. If this were viewed as a control problem, most engineers would reach the conclusion that the system was too unstable ever to work. However, the production manager and his staff proceed in happy ignorance of the magnitude of their problems, believing that one day everything will go right and the factory will produce to plan. They are reacting to the problems on a day-to-day basis, rather than evolving a strategy which will assist them in the long-term.

Meanwhile the company suffers from high inventory coupled with shortages of key components, bottlenecks in manufacture coupled with lack of work for direct labour, and late deliveries coupled with lack of orders.



... bottlenecks in manufacture coupled with lack of work for direct labour ...

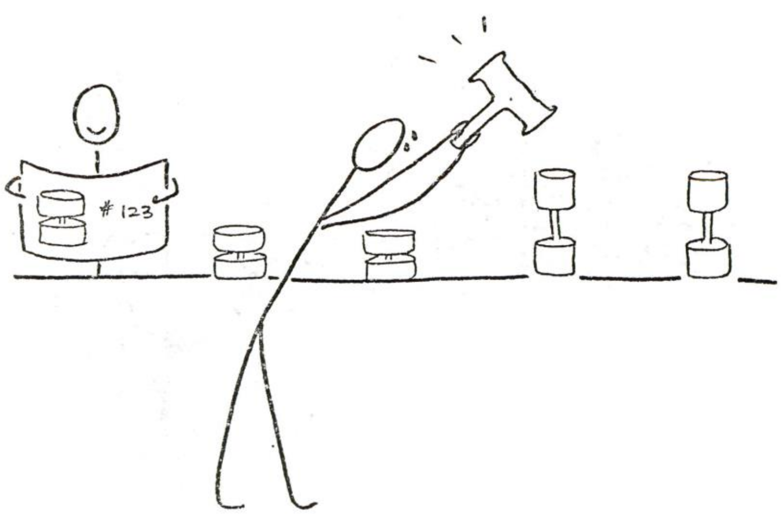
The effect of these problems on profitability can be disastrous. It is easily illustrated. Typically, a company with a turnover of £10 million pa, and a profit margin of 10%, will spend around 40% of this on bought in materials and components if production can be increased by 5%, material costs will also increase by 5% but labour and overheads will remain the same. The profit margin in this case will increase to 12.4%, and profits will increase by 30%. With an increase in output of only 16.7% profits would double. If the original profit margin was lower say 5% - the change is even more dramatic, and an increase in output of only 8% will double profits.

The problem is largely one of lack of control within the necessary timeframe. By the time production management react to a problem in one subsystem, it has already gone unstable and is affecting other subsystems.

How can production management get a grip on this problem?

The Usefulness of Computers to Production Management

A computer can be a useful tool in helping production management to reduce their reaction time to problems. Like any other tool - particularly complex and expensive ones - it has its pitfalls.

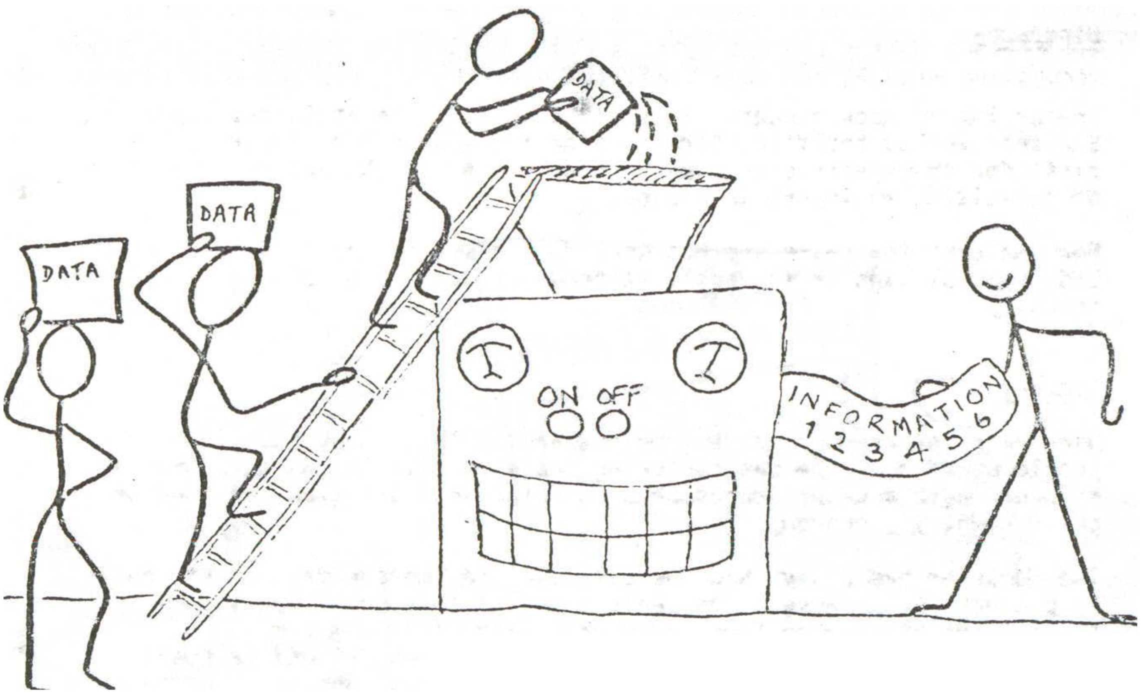


... a useful tool in helping production management ...

Its Assets

The computer's main assets are simple. It has the ability to handle large volumes of data quickly and accurately. This can be useful in a manufacturing company, where production is controlling, for example, 30,000 individual parts, 60,000 bills of material showing how the parts are used, 120,000 routing records showing how the parts are made on 200 machines and workcentres, and 400 shop floor workers. At anyone time there will be around 1000 jobs on the shop floor and 1000 purchase orders outstanding.

The computer can be used to help in planning material and component requirements, and in loading the jobs on the shop floor. Its ability to process information quickly enables production management to use new approaches to planning and controlling work, and in fact to change the way in which production is managed.



... to handle large volumes of data ...

Its Drawbacks

However, regardless of all these good things, many computer applications fail to achieve their objectives - in fact, they can be a menace to good production management rather than an asset.

The computer's main drawbacks are also simple. It is expensive, needs high1y-specia1ised technical staff who often have little understanding of production management and its problems, and it is remote from the users, who frequently do not understand it and regard it with suspicion.

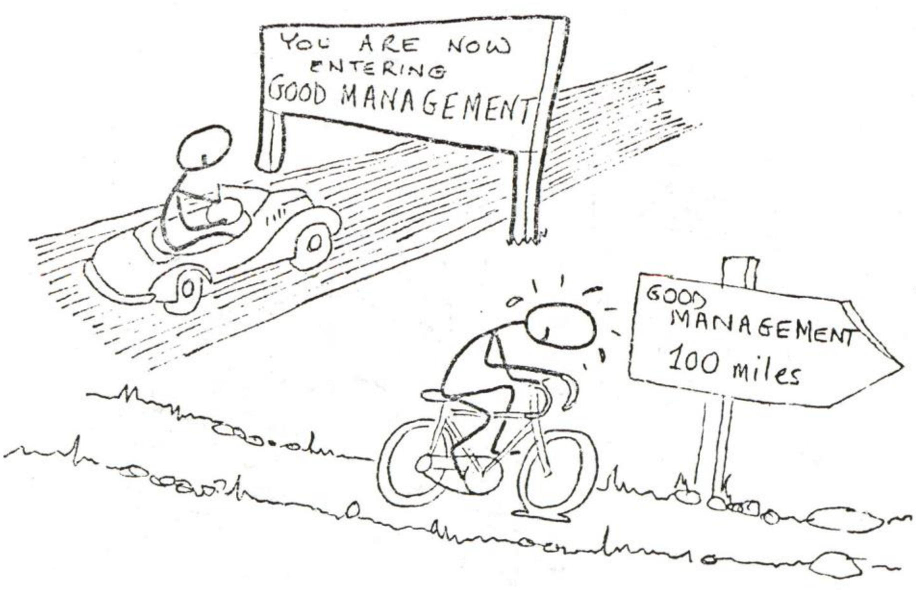
Reasons for Failure

The major reason why these applications fail is simple. It boils down to lack of communication - between the computer specialists and user management, between user management and their staff and between what the system was expected to do and what it actua11y does.

More specifically, the need for discipline in entering data into the computer is seldom appreciated or enforced. Shop floor workers are, after a11, employed to make things, not to fill in forms - and seldom if ever receive any benefit from doing so. When data is entered wrongly, it takes time to correct the errors (if indeed they are ever corrected).

The Computer's ability to produce reams of paper at the drop of a hat leads to endless reports which have very little use.

All these problems can add up to a rigid unworkable system, which, after struggling with it for some time, the user is only too thankful to drop.



... what the system was expected to do and what it actually does ...

Rewards

But a computer's success can be as dramatic as its failure. Inventory reduced by around 30%, and late deliveries reduced from about 40% to less than 5% have been achieved by the successful companies.

In the last five years, most of manufacturing industry has had to struggle with an unpredictable world economy. It has had to face shortages of cash, inflation, lack of orders, shop floor militancy and unpredictable suppliers (who were often contending with the same problems). Those companies who could use their computer systems to respond quickly to this rapidly-changing environment managed far better than those who had rigid manual systems.

... shortages of cash …..

Technological Change in Computers

The computer industry is changing more rapidly than any other industry in history. For example, in the last twenty years there have been four major changes in circuit technology. Price / performance for a complete computer system has improved by a factor of fifty, opening the possibility of using a computer to many thousands more - and sma11er -companies.

As an illustration of the speed with which computer technology is changing compared to other industries, it took 25 years to go from a standard turbo-generator design for power stations of 60 megawatts to one of 660 megawatts. It took five years to go from a computer central processing unit with a speed of 2000 instructions per second to one of 100,000 instructions per second. The same order-of-magnitude change was repeated in computers twice in the next fifteen years.

These basic changes have brought computing power within easy reach of millions more working people. In 1950 there were less than a hundred computers throughout the world and only a handful of people worked with them. There are now many thousands of computers, and by 1985 it is forecast that over 70% of the total population of a country like the UK will have direct contact with them.

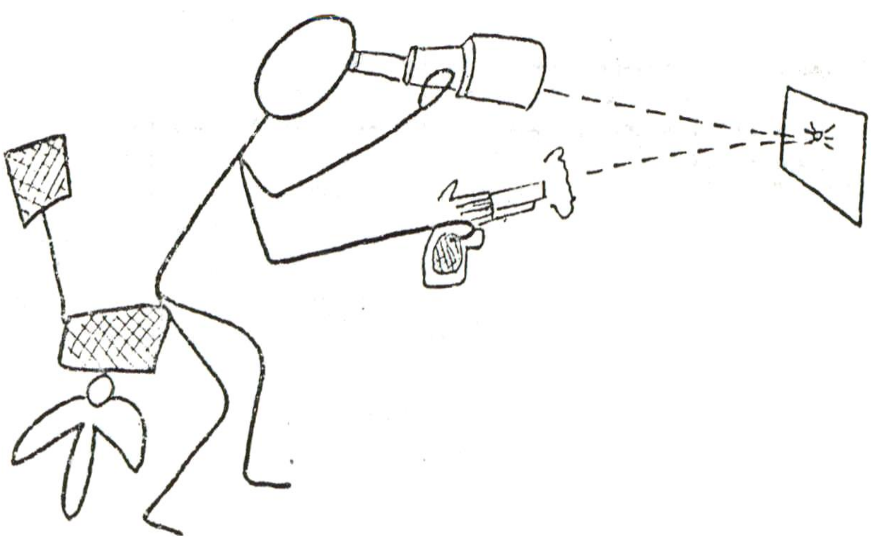
This has been brought about, not on1y by the rapidly decreasing price / performance, but also by the development of terminals communicating directly with the user, enabling him to get hold of any information held in the computer.

Impact of Change

What do all these changes mean to the production manager?

Like any tool, the use of computer must be assessed on its return on investment. Since required is now so much lower, and (due to inflation) the potential return has also risen, the ROI required to justify the use of a computer is now within the reach of many more companies.

On-line terminals can also improve the usability of the system. Information can be edited and validated when it is entered, making errors easier to spot and correct. Once the data is entered and processed, it can be retrieved as required. Only one copy of the data need now be held. Instead of stock records being held as bin cards in stores, stock cards in production control and stock records in costing, only one record need be held in the computer, with all departments able to see the accurate stock position at any time.



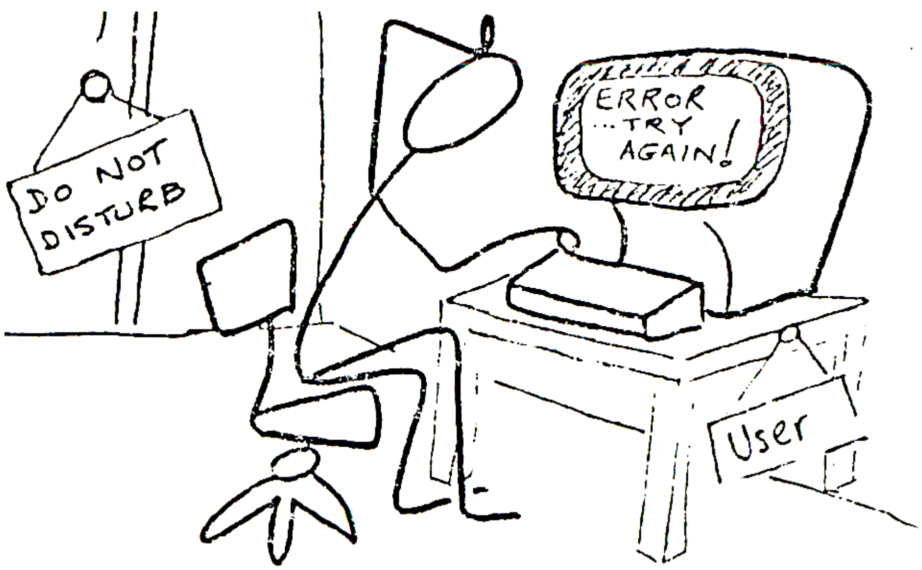
... errors easier to spot and correct ...

The user feels closer to the computer and to some extent the communication link between the computer's technical specialists and users is consequently improved. However, many of the problems mentioned previously still remain. The advances in computer hardware have not been matched by advances in software, and computer managers and specialists have not necessarily kept pace with technical developments.

Top user management has also frequently failed to appreciate the impact of computers, and the commitment required from themse1ves in terms of user resources - as well as computer specialist resources - in order to implement a successful system.

In the future, further price / performance improvements are certain, and so for the pace of technological change shows no sign of slowing - on the contrary, it is still accelerating.

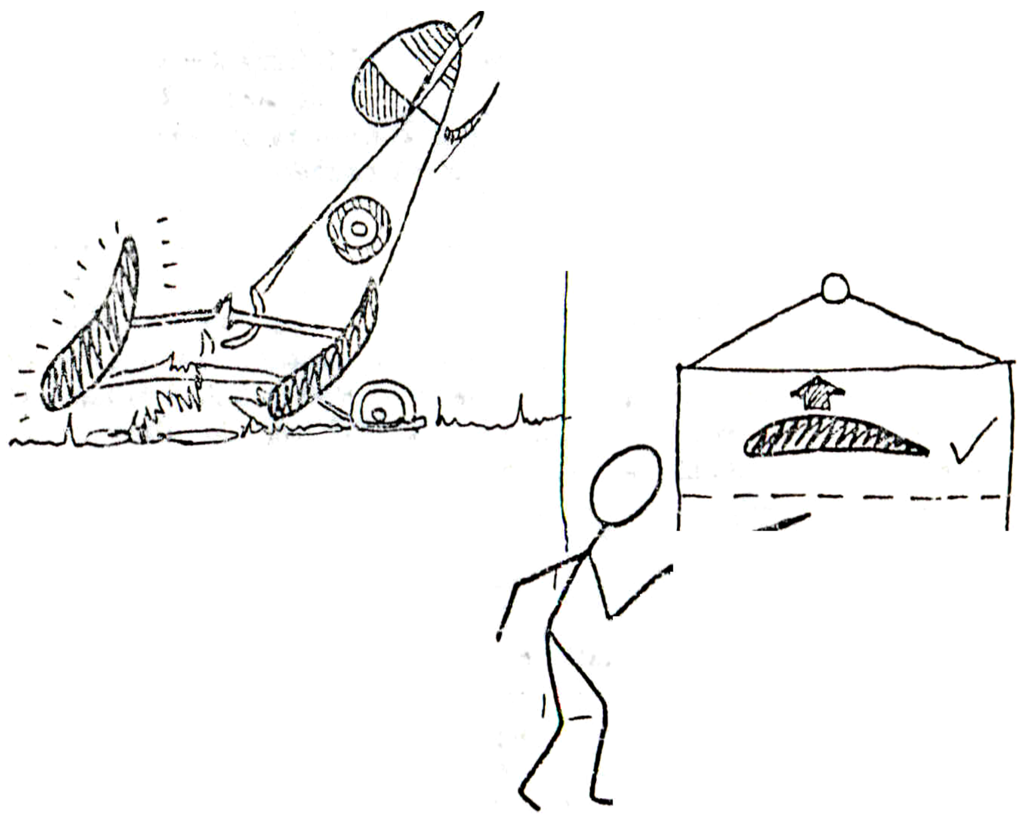
The user's attitude to the computer is gradually changing, from thinking of it as mysterious black box to realising that it is a user tool, different in degree but not in concept to that of others he uses, such as machine tools. Unfortunately this change is happening very slowly, with little assistance from computer specialists - those working either for computer manufacturers or for the user's company.



... little assistance from computer specialists ...

The modern production manager needs to learn all he can about computers and how to use them. Having done so, he must plan to use them as thoroughly and efficiently as he uses his other production facilities. The investment required is large, but for this very reason he should ensure that it is profitable.

He can achieve success; many companies have done so already - but he must be prepared to learn by other's mistakes, and to commit himself to making the computer work for him.



… prepared to learn from others' mistakes...

TECHNICAL GROWTH OF MEANS OF INFORMATION - ITS CONSEOUENCES

by

K. BALARAMAN
Library & Information Services,
Bhabha Atomic Research Centre, Bombay
lndia-400 085

Abstract

In talking of “technological revolution", One cannot but accept the fact that one of the major fields in which this has happened is the field of information: more precisely, the means of information. The tremendous advances made in this branch of activity, vital to all other disciplines of technology and research, in the last two decades are really phenomenal.

A brief outline of the history of information collection, classification. Storage and retrieval, as has been done in the last century from the simplest library services to the present modern and stunning mechanized information services, is given. The latest technological achievement in this direction, which has cluminated in the introduction of the largest computers as tools in the hands of information scientists to serve the ever increasing thirst for knowledge of mankind has been described. The usefulness and effectiveness of these innovations as well as their consequences and problems are touced upon. Th e presentation is primarily based on the personal experience of the author ,gained while working with the ‘on-line ‘ demonstration held in Bombay ,by the kind cooperation of UNESCO,when the computer at Frascati ,Romo was made available to scientists in India for a week .

A reference is also made to the progress achieved in the associated fields of Reprography, Micrography, Machine Translation and Satilite Communication which are also serving as vital means of information.

TECHNOLOGICAL ADVANCES IN THE COMMUNICATION AND DISSEMINATION OF INFORMATION COSEQUENCES

Mrs. **Kamala Balaraman**
Library & Information Services
Bhabha Atomic Research Centre
Trombay, Bombay-400 085

INTRODUCTION

In talking of “technological revolution ", one cannot but accept the fact that one of the major fields in which this has happened is the field of Information; more precisely, the means of Information; the tremendous advances made in this branch of activity, vital to all other disciplines of technology and research, in the last two decades, are really phenomenal.

We are not only living in an age of technological revolution but in one of information explosion too. May be, we could term it better as "Information Age". 'Information', to quote M. E. Williams of Illinois, U.S.A., "is a vast, dynamic and inexhaustible resource that effects all disciplines as well as the lives of all citizens". Information,. in any and every form (from time immemorial) has been recorded, collected, stored, asked for, retrieved and used not only by Individuals but groups of them and in an ever-increasing manner, It is required for confirming basic research and supporting development projects; for the production of goods and services that touch all our lives in some form or the other and it can always be used to improve the quality of life. Every nation lives in a knowledge-based society in which sophisticated and high-cost projects and Industries depend on the speedy acquisition and efficient use of information. Thus, the importance of 'Information' and the advances made and being made in its means, can never be over-emphasized.

BRIEF HISTORY

How and when did this great science take its origin? Perhaps, the answer is very simple - from the time man ever wanted 'to know'. Recording of information started with pictographic representation on papyrus rolls in ancient Egypt, then, in cuneiform script on day tablets, then on palm-leaf manuscripts and parchments, etc. Much later came the most useful (to date) technological achievement, in the form of printing. Thus came into existence books, followed by journals, reports, newspapers, etc. But in the last two decades, the technology has progressed by leaps and bounds and we have gone from batch-processing computers, microfilms to 'on-line' computers and data terminals.

A century ago, books, reports and other categories of literature in printed form, were collected and stored in small or big libraries. Different system’s of classifying and arranging the documents have been followed in different

Libraries, depending on the need of the users every location of retrieval were always the main objectives. By and large the DC & UDC have come to be accepted as the two systems of classification almost the world over.

The turn of the 20th century saw a tremendous growth in the production of all forms of literature, particularly in the fields of science and technology. The number of journals kept sky- rocketing; then there were reports being produced by individuals and organizations alike; symposia and seminars and conferences being held, which gave rise to the volumes of their proceedings being brought out in printed form. The task of a student or researcher in any field wanting to search all available literature and collect all references became more and more difficult and almost impossible. This ushered in the era of abstracting and indexing journals, cumulative Indexes and information centers.

The responsibility of the special libraries and information centres has been growing at a tremendous pace In the last 2 or 3 decades. The librarians and information scientists have been devising newer, more efficient and speedier methods of disseminating the information required by the users. New classification, cataloguing and storage systems have been introduced and used, only to find that each attempt is inadequate to meet the growing demands of the users.

The advent of computers came as a boon to these people. Gradually, information came to be stored on tapes, drums and discs and was disseminated by batch processing. Then came the 'on- line' search and off-line printing which made the system more dynamic, But now we have so many 'on-line' terminals with simultaneous printing facility, that one is stunned by the progress made in this field in such a short time.

AVAILABILITY OF DATA BASES AND ON-LINE SYSTEMS

Bibliographic data was available only in printed form till 2 decades ago and they were high-priced. Even many institutions could not afford to buy them, Also, their updating coat was high. Today, the majority of the world's currently generated research literature is accessible in the form of bibliography references through computerized on-line search services. Over 55 million references citations are reported to be appearing in 400 computer-readable commercially available bibliographic data bases. (1)

More than 75% of such records are now available through on-line vendors in the USA, Canada and Europe. Some of such major vendors include LIS, NLM, SDC, BRS, CISTI and ESRO. These service organizations use a variety of sophisticated on-line software packages such as ELHILL, DIALOG, ORBIT, STAIRS, CAN-OLE and RECON. It is reported that an estimated 1.5 million (or more) retrospective searches have been conducted by dozens of centers, libraries and brokers who are regular users of the data-bases provided by the on-line vendors.

Some of the information services that can be provided ‘on-line' to users include the conventional retrieval activities such as

Retrospective searches
Current awareness

Numerical data retrieval

Fact retrieval

Library reference service

Location of records

Referral services to data base resources & services

Referral services to people places &. Conferences

Data base transfer within networks

Personal data base maintenance, etc.

There are more than half-a-dozen aspects of technologies and trends that go to make a successful on-line system, viz, computer processors, terminals, storage, data bases, networks (which Include communication, computer and Information),soft-ware, output hardware, etc. One such successful on-line system was made available to the scientists in India for a week in Sept. 1976 by the kind courtesy of UNESCO. The on-line demonstration was held at the Tata Institute of Fundamental Research, Bombay. A Seminar on "Access to bibliographic data bases"was organized by the Department of Science & Technology, Government of India in conjunction with the on-line demonstration. The RECON on-line system at Franscati, Reme, which holds in its large computer, 15 of the most sought –after data bases in the world was made accessible to Indian scientists. (App. 1). The author had the rare opportunity of carrying out an on 1ine search on a specific topic "Singlet molecular oxygen" by searching 3 major files :ie.. CA, SCI & NSA. Over five hundred references were made available in a search which took less than 20 minutes

Some of the quick reference commands of Recon that were used are listed in App.2. An example of the bibliographical citation printed on the line-printer is reproduced in App 5. The system provided for the option or omission of abstract.

As a matter of comparison, It is worth mentioning that the bibliography on singlet molecular oxygen which was being complied manually earlier took over an year, Just to get about 200 references from the different primary and secondary sources that were available in the library of the Bhabha Atomic Research Centre, India.

An example of the selection of keywords and the logical combination of the same is reproduced in App, 3&4. It is absolutely essential that the searcher is a subject specialist and should know the topic thoroughly in order to use the computer time judiciously because every second of the terminal used costs & lot of money.

MERITS AND DEMERITS OF THE ON-LINE SYSTEMS

Where do all this technological advancements and *sophistication* lead us to?
What *are* their plus points, consequences and problems?

Talking of the positive side, the simultaneous and staggering advances made in the fields of computers, micro-electronics and tele-communication have undoubtedly reduced the distance between people and places. They have made it technically and economically possible to couple information research with high technology to help us utilize the world's information resources to solve the pressing problems of science and society.

The major point scored by on-line ever any other conventional systems is the speed with which the search for reference or fact is done and printed simultaneously. Even if the printing is done off-line, it is far easier to be able to do the job just by using a command code such as "PRINT IN -FULL 23400-28780" and get the whole lot of references in a matter of minutes; this is something worth having. Just imagine the effort and time that would be required to complete the bibliography, and then print the same, if done manually.

The other aspect of advantage with on-line systems is the flexibility of the scarch strategy. A searcher can modify and combine a number of alternative search points in the same file and then combine the results with those from other files to avoid duplication, etc. in a very short time. He can access and refine his own search capabilities which could help him even with his manual searches

The third point is the accessibility to files of peripheral interest and potential to the user and perhaps, even rarely referred files. Centres, with on-line terminals, with passwords for a few on-line systems, can easily have access to well over 100 unique files, though they cannot subscribe to all the abstracting, and indexing services that they might need at some point of time or the other.

Then there are possibilities such as Scientific Research & Development Centres requiring economic data or environmental data or political, economic or social organizations needing scientific or other data. Such searches can be made speedily and less costly by on-line systems.

There are many more advantages of the on-line system but they are quite well-known and hence not enumerated here.

Coming to the problems connected with on-line systems, the major problem is one of the cost involved. In developed countries, the cost of hardware and allied equipment is perhaps not a very big problem. But this could be and is the major problem of the developing countries; then comes the question of the cost of computer-time for on-line search. Though there does not seem to be any uniform or standard rate, the coat is quite high even for users in the USA and Europe and certainly prohibitive for others. The costs are reported to vary from around $ 30 per hour to over $ 120 per hour and communication charges vary from place to place, depending on the distance(2)

Some studies reveal that a whole set of hard copies of Abstracting & Indexing Journals could have bean bought for the amount spent on just 40 to 50 hours of on-line search on some 100 profiles, whereas the former would have an added advantage of having been available to more than a few hundred people the whole year through and later! So far, for cost problems.

Then comes the problem of retrospective search of old files. Most of the computer-readable data bases being new or of recent origin references prior to the sixties are not likely to be available. This again is due in part to the enormous cost of data storing. Where are we again? On-line searches, though fast and thorough, are never going to be exhaustive!

There are other problems like the missing human element. Which can use its common sense to choose or reject a reference even when a dumb and stupid computer is asked to do the search. The Americans term it as 'garbage-in and garbage-out', Again, certain searches on indexes such as ISI(SC could be leus cumbersome when done manually.

In conclusion, one may, perhaps say that on-line systems must be accepted and used as added tools in the hands of an intelligent and efficient searcher and not merely as an end to all his efforts in his task.

ALLIED FIELDS OF TECHNOLOGICAL ADVANCES

The contemporary developments that have taken place in the fields of reprography, micrography, machine translation and satellite communication are worth mentioning in this context.

Hard copies of published literature are heavy, cumbersome and costly to transmit or to buy. Micrography has reduced the weight (and hence the cost) and increased the else of transmitting the literature over large distances. Reprography in its various forms (photocopying, xeroxing etc.) has reduced the coat of owning hard copies of the original documents. Machine translation, in the near future, is expected to reduce the time and cost involved in translation services. Satellite communication has made communication even to long distances an easy feat. Instructional TV experiments (such as the SITE which was carried out in India for about an year) go a long way in helping to educate the rural population in many ways in countries like India.

Even in developed countries and between them, the ease of communication to the most marvellous (and useful, too) thing that the century has ever witnessed How many precious hours or days are saved by being able to sit at one's desk and dial a number on the phone and get the required urgent information from a person on the other side of the globe?

Such spectaeutar advances compled with many others, should, when used in the right way, undoubtedly, go to improve the quality of life in every country in the world.

ACKNOWLEDGEMENT

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(Presented at the Seminar on Access to Bibliographic Data Based, September 1976)

APPENDIX - 1

Data bases made available during 'Recon' on – line demonstration in Bombay, during Sept.1976

	FILE	**Number of Citations**	**NAME / SUBJECT COVERAGE**	**SINCE**
1	NASA STAR IAA	800,000	"STAR/IAA": aerospace, geophysics, electronics, earth resources, biotechnology thermodynamics	1962
2	CHEMICAL ABSTR	2,000,000	"Chemical Abstracts Condensates": pure and applied chemistry.	1969
3	METALS ABSTRAC	200,000	"Metals Abstracts": metallurgy and associated disciplines.	1969
4	ENGINEERING IN	470,000	"Engineering Index ": civil, electrical, mechanical engineering ,electronics.	1970
5	ELECTRONIC COM	16,200	"ESA Electronic Components Data Bank".	1970
6	NTIS,SINCE 70	200,000	"Government Reports Announcements": Scientific, Technical and social disciplines.	1970
7	NUCLEAR SCIENCE	485,000	"Nuclear Science Abstracts ": Nuclear science and technology.	1969
8	INSPEC SINCE I	680,000	"INPEC": Physics ,electronics,computers.	1968
9	WORLD ALUMINIUM	45,000	"World Aluminium Abstracts ": aluminium and associated technology.	1971
10	IS MEC 1975	50,000		1968
11	ENVIRONMENT SC	700,000	"Environmental Science Index": environment scinces,pollution.	1971
12	Not online			
13	Not online			
14	PASCAL TEST FI		Aerospace and related subjects.	1972
15	STAR ABSTRACTS			
16	OCEANIC ABSTRA			
17	I.S.I	600,000	"Science Citation Index":Physical, chemical,engineering science	1972

APPENDIX -2

Quick reference list of RECON commands

Command	Symbol	Natural Language Abbreviation	Natural Language Full Text	Examples
Begin Search Begin Search Bypass		BEGIN 3	BEGIN BEGIN B "'-'PASS	BEGIN 3
Expand Term, Expand Related Terms Expand Related Terms over 99 Expand after Select Error	"	E	EXPAND	ECOMPUTERS EE6 ERI/100 E
Select Term Select from Expand List (Single term) Select from Expand List in Ranges (one set) Select from Expand List in Ranges (separate sets) Select from Expand List (several terms)	#	S - 	SELECT * 	SCOMPUTERS SE6 SE6EI2 SE6:EI2 SE6, E9, EIO-Fl2. FI
Combine Intersect	$	C	COMBINE INTERSECT	CI*2. Cl and 2 INTERSECT (I. 2, 3). (4,5,6)
Display Accession Number Display Set Number Display Forward Display Back Display in Formats (1, 2, 3,4.5,6,7)	% %	D	DISPLAY	D7 4NI 2345 D6 D D- D99/6, D74NI2345/4
Page Forward Page Back		P	PAGE	P P-
Print Displayed Item Print Accession Number Print Set Number Print Certain Item out 0f Set Print Certain Range out of Set Print in Formats	&	PR	PRINT	PR PR7412345 PR6 PR7 /4/9 PR7/4/9-13 PR7/1

APPENDIX – 2 (Contd)

Command	Symbol	Natural Language Abbreviation	Natural Language Full Text	Examples
Type Displayed Item Type Accession Number Type Set Number (one item) Type Certain Item out of Set Type Certain Range out of Set Type in Formats	'	T	TYPE	T T7N12345 T6 T7/4/9 T7/4/9-13 T7/1
Display Set History Display Certain Set in History Display Certain Range in History	@	DS	DISPLAY SETS	DS DS3 DS3-10
End Search	=		END OR END SEARCH	

APPENDIX-3

Use of command codes

ESINGLET

EXPAND SINGLET

REF	INDEX-TERM	TYPE ITEMS RT
E1	SINGLECRYSTAL ………………………	2
E2	SINGLED…………………………………	2
E3	SINGLEFEED…………………………….	2
E4	SINGLER………………………………….	2
E5	SINGLES………………………………….	3
E6	SINGLET…………………………………	1786
E7	SINGLETS……………………………….	29
E8	SINGLEY………………………………..	3
E9	SINGLLY………………………………..	287
E10	SINGUEANA……………………………	
	1. 1786 SE61E7	
	EXPAND 7	
REF	INDEX-TERM	TYPE ITEMS RT
E1	098……………………………………….	4
	2 1786 SSINGLET: SSINGLETS	
	3 29 SINGLETS	

'E' SINGLET' called for a display of the entire page in which the keyword 'SINGLET' appeared as above. Out of these the combination of entries, E6 & E7 was selected and reserved as 2 & 3. Similar searches were done on 'E MOLECULAR' and 'E OXYGEN' and the references selected were stored as 4 & 5. nation used was C 5* **4***(3+2)

APPENDIX - 4

Keywords and logical combinations used in the on-line search on 'Singlet Molecular Oxygen'

SET	ITEMS	DESCRIPTION
1	1786	SINGLET
2	4786	SINGLET
3	29	SINGLETS
4	31582	E6-E7 MOLECULAR
5	36120	E6-E7 OXYGEN
6	100	5*4*(3+2)

APPENDIX -5

Examples of bibliographic citation

84163732 ACS COPYRIGHT -23- SECTION 22 JOURNALS
MOLECULAR OXYGEN ENHANCED FLUORESCENCE OF ORGANIC MOLECULES IN POLYMER MATRICLES: A SINGLET OXYGEN FEEDBACK MECHANISM
AUTHOR: NENNER, REX D. I. KHAN, AHSAN U.
LOCATION: DEP. CHEM. MICHIGAN STATE UNIV. EAST LANSING MICH.
PUBLICATION: J. CHEM. PHYS.: PAGES: 1877-82; (76) VOL: 64: NO: 5
LANG: EN: CODEN: JCPSA
KEYWORDS: CHRYSENE/DIBENZANTHRACENE/ENHANCEMENT/ MATRIX

84117050 ACS COPYRIGHT -17- SECTION 6 JOURNAL
A POSSIBLE MECHANISM OF THE GENERATION OF SINGLET MOLECULAR OXYGEN IN NADPH – DEPENDENT MICROSOMAL LIPID PEROXIDATION
AUTHOR: SUGIOKA, KATSUAKI: MAKAND, MINDRU
PUBLICATION: BIOCHIM. BIOPHYS. ACTA: PAGES: 203-13 (76) VOL: 423
NO: 21 LANG: EN: CODEN: DBACA
KEYWORDS: PEROXION