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**TRAINING PROGRAMME ON QUALITY MANAGEMENT IN  
THE FOOD INDUSTRY IN ASIAN LDCs  
Bangkok, Thailand, 14 August to 1 September 1995**

XP/RAS/94/125

REGIONAL ASIA

**Terminal report\***

*Prepared by*

*the United Nations Industrial Development Organization  
in cooperation with the Asian Institute of Technology*

Backstopping Officer: A. Ouaouich  
Agro-based Industries Branch

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\* This document has not been edited.

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## 1. Host Organization

### ASIAN INSTITUTE OF TECHNOLOGY

*Bangkok , Thailand*

The *Asian Institute of Technology (AIT)* is an autonomous international post-graduate technological institute in Bangkok, Thailand. The Institute, situated on a 400 -acre campus, is located 42 km. north of Bangkok.

AIT plays a leadership role in the promotion of technological change and its management for sustainable development in the Asia and Pacific Region, through high-level education, research and outreach activities which integrate technology, planning and management.

Successful candidates for admission to AIT come from among the best graduates of universities in Asia. Around one thousand students, mostly from Asia, and almost two hundred faculty members and international staff foster the exchange and dissemination of advanced technological knowledge at AIT to satisfy the need for more and better trained technologists. All students live on campus where, through study and extracurricular activities , they become aware of a common Asian identity, despite differences of nationality and culture.

## 2. Background of the Project

The role of Agro-related food processing industries in the economic development of LDCs has been increasingly emphasized in the planning programs of these countries. The reasons being, their role in the transformation of agricultural products into finished products for consumption, their contribution to value addition in the manufacturing sector, and for contribution to exports.

Enhancing the role of Agro-related food industries to enable them play their role, calls for an emphasis to be laid on building the '*Quality*' aspect into the varied operations and process of Agro industries. But unfortunately, the LDCs in the Asia Pacific region are rather weak in Quality Control aspects which is a key ingredient for success in the agro industry and to become competitive both in the domestic and foreign markets. Quality and its value added to the products, has become increasingly important in the food business.

In the past, *Quality Control (QC)* was often interpreted as inspection or testing. Quality was limited to reducing the number of defective food products on the production line. With the recent industry developments, the concepts of quality has been expanded into *Total Quality Control (TQC)* including design, planning, development and marketing. Inspection does not make quality. Quality has to be built into the original design and emerge in the manufacturing process.

In today's era of fast-paced product and process innovation, a more global concept of *Total Quality Management (TQM)* arises, with TQC being only one of its domains. Quality Management has become one core component of a firm's overall business strategy. It is therefore important for capable managers in the food industry and any other industry, to proactively acquire, assimilate, and adapt knowledge about quality management and technologies, their technical and economic impacts and the competitive advantages of quality. In managing for the long term, it is important for these leaders to enhance their relevant skills and capabilities in managing quality business.

Recognizing these needs, the training course on Quality Management in the Food Industry aims at training personnel from LDCs in the Asia -Pacific region for creating an awareness of the structure and problems of food industry in various LDCs, to make them realise the necessity for producing quality products and to impart them the principles and techniques of improving product quality. This three week program addresses the various issues cited and also impart the necessary skills for introducing and managing quality programs in the food processing industry.

### 3. Objectives of the Training Course

In general, the training course is aimed to enhance the participants' expertise and skills in formulating and implementing quality control and management plans and activities in their respective organizations. After the courses, the participants will be able to :

- Better identify the quality management related problems in their organizations ;
- Propose strategies on how to solve them;
- Assist management in formulating quality control policies and procedures;
- Develop implementation plans for these;
- Coordinate quality control and management activities in their organizations;
- Estimate roughly the costs and benefits of quality control programs;
- Advocate modern quality control concepts to the management;
- Promote quality control and management programs more effectively; and
- Use statistical tools in the quality control more efficiently.

### 4. Target Group

The course was designed for a group of 20 participants belong to the agro and food industry and coming from Asian and Pacific LDCs namely Bangladesh, Bhutan, Cambodia, Laos, Maldives, Nepal and Niue Island. Most of the participants were senior officers and some were middle level officers. They are involved in planning and implementing quality improvement programs in their respective organizations and are responsible for testing and quality control of food and processed food. Some are also responsible for developing national standardization and quality control systems. The list of participants is given in appendix A

### 5. Course Methodology

The course objective was achieved through a variety of teaching methods such as lectures, case studies, panel discussion, computer and problem -solving exercises, field visits, and most importantly, the project work emphasis was on learning by doing, mostly in problem oriented activities.

We invite all to participate actively by sharing their experience and exchanging ideas with other participants, resource persons and experts. The idea was for them to relate the training course to their current work and to encourage them to apply new concepts, techniques, and skills in their current work.

In this way, we hope that the training course will be a meaningful professional experience for all. While following course activities we continuously seek solutions to their problem. They also have ample opportunity to discuss it with their colleagues and resource persons.

## 6. Course Organization and Execution

The course duration was three weeks from 14 August to 1 September 1995.

### 6.1 Opening Ceremony

The opening ceremony was attended by the chief guest, president A.M. North of the Asian Institute of Technology, Mr. Ari Huhtala of UNIDO Country Director, Dr. Nicanor Austriaco CEC Director, Prof. K. Harigopal and Dr. N. Nagarur the course directors, the AIT resource persons and the participants.

Dr. Austriaco welcomed the participants and UNIDO officers. He thanked UNIDO for entrusting the training task to the Asian Institute of technology. He described the various infrastructure facilities available at the institute.

President A. North in his address wished the participants a very fruitful and enjoyable training program. He urged the participants to initiate all the knowledge and information available and to use them effectively in the administration of quality control activities in their jobs.

Mr. Ari Huhtala traced the origin of the current training program and the various stages involved in bringing the project to the current state. He also explained relevance of the course in promotion of production and marketing of food products in LDCs.

Prof. Harigopal, in his closing remarks mentioned the importance of the quality consciousness permeating an organization for sustainable development. He briefly described the course, explaining the relevance of studying practical problems through field trips.

### 6.2 Technical Sessions

The three weeks training period consisted of lectures, discussions, exercises and project work. It covered the various aspects of quality control in food industries. At the same time emphasis was given to implement the gained knowledge into practice. For this purpose the trainees were assigned project works.

The course was conducted in collaboration with various faculty members of AIT and Kasetsart University. Apart from this, national experts from Thailand as well as experts from UNIDO contributed to the program. In total, 15 resource persons participated in the training sessions. The names positions, affiliations and addresses of the resource persons are given in appendix B. The course module and schedule are also given in appendix C appendix D respectively.

### 6.3 Class Room Lectures

Dr. Athapol Noomhorm, Associate Professor, Agriculture and Food Engineering Program, AIT started the first session with the presentation of individual country report. Each participant was

given 10-15 minutes time for their presentation, followed by a discussion of about 10 minutes. After country report presentation a video presentation related to quality control, "Journey to Excellence" was presented and discussed.

Dr. Sudip Kumar Rakshit, Assistant Professor, Agriculture Food and Engineering Program, AIT discussed the typical problems in food processing in developing countries. Dr. Suphsorn Chayovan, Vice president of the Food Industry Club, Thailand, gave a brief talk on the food industry in Thailand.

Dr. Boonjit Titapiwatanakun, Assistant Professor, Department of Agriculture and Resource Economics, Kasetsart University spoke about the export opportunities, scope and problems in food industries.

Dr. Athapol gave an overview of food processing and discussed post-harvest technology. He also focused on the selection of appropriate technology with related case studies.

Dr. Vinod Kumar Jindal, Professor, Agriculture and Food Engineering Program, AIT conducted a session on food processing and quality assessment.

Mrs. Suwalee Chandkrachang, Associated Faculty, Bioprocess Technology Program, AIT spoke about the food processing techniques and equipment. She also gave insight knowledge on gender issues in food industries.

Dr. Nagendra N. Nagarur, Associate Professor, Industrial System Engineering, School of Advance Technologies, AIT highlighted statistical tools of quality control and establishment of monitoring specifications with regard to total quality control. He explained the various components of total quality management.

Mr. Satis Sayamnet, Director, Quality Assurance AMD Thailand spoke about ISO 9000. His lecture was guided towards factory establishment and ISO 9000 Certification. He covered cost factors as well as other factors to obtain certification. In addition, he presented a successful case through video presentation.

Dr. Preeya Vibulsresth, Deputy Dean and Associate Professor, Department of Food Science and Technology, Faculty of Agro-Industry, Kasetsart University dealt with the HAACP approach in the food industries. She presented the development and implementation of HAACP approach. She organized a workshop on hazards and controls of canned food, frozen seafood and dairy products. The other topics covered were critical limits on food industry, monitoring procedures, corrective actions, record keeping and verification. Towards the end of her session, she urged the participants to implement the gained knowledge through group work session.

In addition, computer-aided quality control software was demonstrated with several hands-on sessions.

From UNIDO side three resource persons were provided as facilitators. They were Dr. K. W. Boegl, Dr. M. H. Yousif and Dr. P. Molnar.



In the morning sessions, Dr. Boegl highlighted the importance of food standards and discussed the prevailing legislation regarding food and food products at national and international markets. During the afternoon session, he organized a panel discussion among the different interest groups e.g. government, private sector, consumer etc.

Dr. Yousif gave a brief idea of international markets and discussed the various marketing techniques used in the international trade. His lectures concentrated on market share and market competition.

Dr. Molnar outlined the quality requirements with respect to international markets. He stressed on the causes and consequences of violating the norms and standards in two perspectives: social and governmental rules and regulations.

#### **6.4 Study Tour**

A three day field trip was planned and executed starting from Friday 25 August - Monday 28 August 1995. A total of six sites was planned. The itinerary is provided in appendix E. Due to the heavy rains and floods, the first trip to Food Processing Plant at Chonburi was cancelled. The rest were as per schedule.

Mr. Mircea Dauthy, UNIDO (evaluation expert) and Mr. Klaus-Werner Boegl, UNIDO resource person also joined the last day of the field trip. At the end of the field trip the field coordinator Dr. Napasri Maneewong, Director, Social and Human Resource Development Institute warmed-up the session with discussions and most participants shared their views and had useful exchange of thoughts.

All participants remarked that the field visit was very useful and interesting. They made the field trip more interesting by putting questions about quality related areas.

#### **6.5 Project Work**

The project work was conceived to integrate the theoretical knowledge with practical problems. A total of five sessions was planned. Prof. Jindal, Dr. Nagarur and Dr. Rakshit were the facilitators. The first session was held on 16 August 1995, where the facilitators gave a brief outline about the project work. Then, all participants were asked to suggest problems and prospects of their individual interest and listed. A total of 36 areas was identified. Then the most common areas were selected. Four groups, each with five members, were formed. The teams prepared four separate reports. The last day of the training was reserved for the presentation of the project report prepared by the participants. Mr. Dauthy, UNIDO evaluation expert, Mr. Ari Huhtala, UNIDO Country Director and Ms. Marion Hinte, Programme Officer, UNIDO were also present at the project presentation. Group reports are provided in appendix F.

## 6.6 Closing Ceremony

The participants were all given certificates for successfully completing the three week course. The award ceremony was held in the hotel Rama Gardens in Bangkok, on 1 September 1995, from 6:00 pm to 9:00 pm hours.

For the award ceremony, the Vice President for Academic Affairs of the Asian Institute of Technology, Prof. Ricardo P. Pama was invited as the chief guest. The director of the continuing Education Center, Dr. Nicanor Austriaco, along with the program director, Prof. K. Harigopal, course director, Dr. Nagendra Nagarur, the resource persons Prof. Vinod Jindal, Dr. Napasri and Mr. Perera attended the function.

For the UNIDO, Mr. Ari Huhtala, Ms. Marion Hinte representing the local UNIDO office and Mr. M. Dauthy, the course evaluation expert were present. All the participants(excluding Ms. Gaylene Mitikulena) came to function. Mr. Mukunda Pandeya the course coordinator, functioned as the master of ceremonies. The program commenced with cocktails and dinner.

In the opening address Dr. Austriaco welcomed the chief guest, the UNIDO representatives and other guests.

Mr. Dauthy explained the importance of quality management in food industry. He discussed the importance of critical points in process quality.

The chief guest Prof. Pama congratulated the participants for successfully completing the short course. He briefly explained the mission of AIT as the regional development through higher technical education. He described the various facilities at AIT, such as the graduate level programs, the short courses, and the laboratory facilities and implored the participants to use these facilities in future whenever required. Prof. Pama then distributed the certificates to the participants. He once again congratulated them for successfully carrying out their tasks.

Responding on behalf of the participants, Mr. Ahmed, a participant from Bangladesh acknowledged the efforts of AIT, and resource persons for conducting a very useful short course. He thanked UNIDO for financing the project. He asserted that the knowledge and information gained from the short course would be certainly helpful to the participants in their work. Mr. Ahmed also thanked the CEC staff for making their stay a pleasant one. On behalf of the participants, he presented a plaque to the CEC Director, Dr. Austriaco, as a token of appreciation.

Prof. Harigopal traced the origins of this short course from the conception at UNIDO, to its successful completion at AIT. He also explained the possibilities of further joint ventures between AIT, UNIDO and Least Developed Countries.

Dr. N. Nagarur, in his vote of thanks speech mentioned the relevance of each module in the short course for quality management. He thanked UNIDO, the resource persons, and the participants for their help and cooperation in making the course a success.

The opening and closing ceremony program and certification of attendance are provided in appendix G, H and I respectively.

## **7. Course Evaluation**

The course evaluation was carried out in three different modes. One was the weekly evaluation carried out by the CEC. The second was evaluation by the UNIDO Evaluation Expert, Mr. M. Dauthy. The last was the general discussion conducted by one of the course directors, Dr. Nagarur.

In the first mode, the participants were requested to evaluate the course on weekly intervals during the training period and also a final overall assessment of the course before the official closing of the training program.

The weekly evaluations were designed to solicit feedback on two major points of interest:

1. usefulness of the individual topics presented
2. performance of the resource persons in terms of subject content and presentation

The final evaluation, on the other hand, was concerned with obtaining participants' overall assessment of the:

1. global course content
2. study visits
3. course organization and execution

A copy of the weekly evaluation form and final evaluation questionnaire are provided in appendix J and appendix K, respectively.

Results of the evaluations are summarized in the following sections.

### **7.1.1 Course Lectures and Resource Persons**

The course lectures and resource persons were evaluated by the participants on the basis of topic coverage and their presentation skills. All the resource persons were evaluated as very good.

### **7.1.2 Course Content Evaluation**

The course content evaluation result reveals the following points:

Fifty-three percent participants rated the course content as excellent in satisfying their professional need, whereas 33 percent claimed it as very good. The same result was recorded for the "course organization" and "execution".

In regard to the course book and other printed material used in the training course, 40 percent of participant responses was "excellent" and 53 percent was "very good".

Eighty percent (40 percent excellent and 40 percent very good) participants claimed that the printed course material would be useful for their reference in their future professional practice.

More than two-third of the participants reported that the techniques and procedures presented in the training course has strong applicability to problems in their jobs.

Three-fourth of the participants claimed that the training course is useful and about 90 percent of the participants rated the course as beneficial. The majority of the participants emphasized the necessity for refresher training programs .

### **7.1.3 Field Trip**

The participants considered all field visits as very useful. The visits included:

1. Jing Huad Co. Ltd. : Quality Approved by Department of Science Service, Thailand
2. Sam Mai Kur Sausage Factory, Chonburi
3. Boi Thong Food Processing
4. Nag Poo Milk Product, Ratburi

Apart from the above mentioned field trip, one day city tour and one day shopping tour at Bangkok were organized in the first week end.

## **7.2 UNIDO Evaluation**

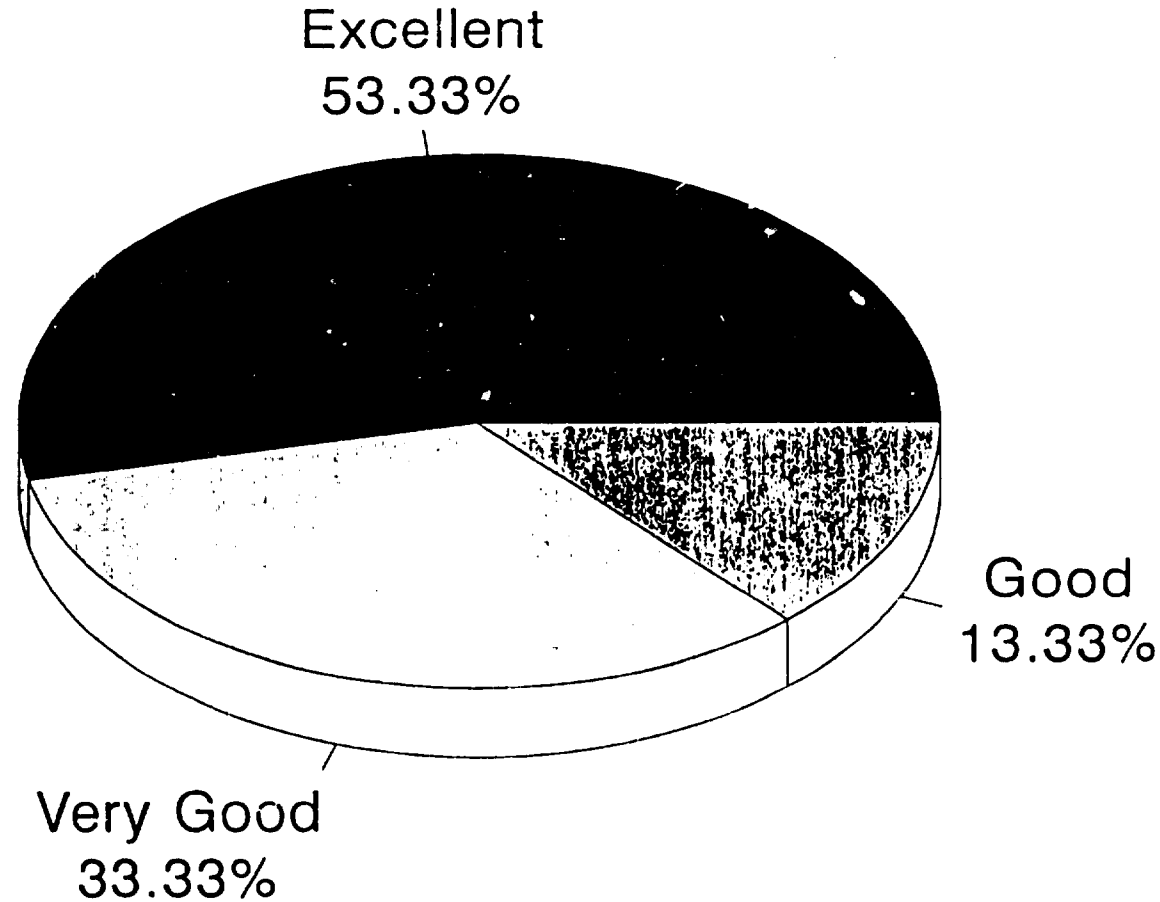
The second mode of evaluation was carried out by UNIDO. The participants filled in the questionnaire prepared by the UNIDO evaluation expert.

## **7.3 Evaluation by Group Discussion**

The final mode of evaluation was by group discussion. at which the UNIDO evaluation member Mr. Dauthy, the local UNIDO officials Mr. Ari Huhtala and Ms. M.Hinti were also present. The participants comments were in general, very good about the quality and contents of the course. There were suggestion about country specific and industry specific short courses in future along similar lines as the present one.

# A1

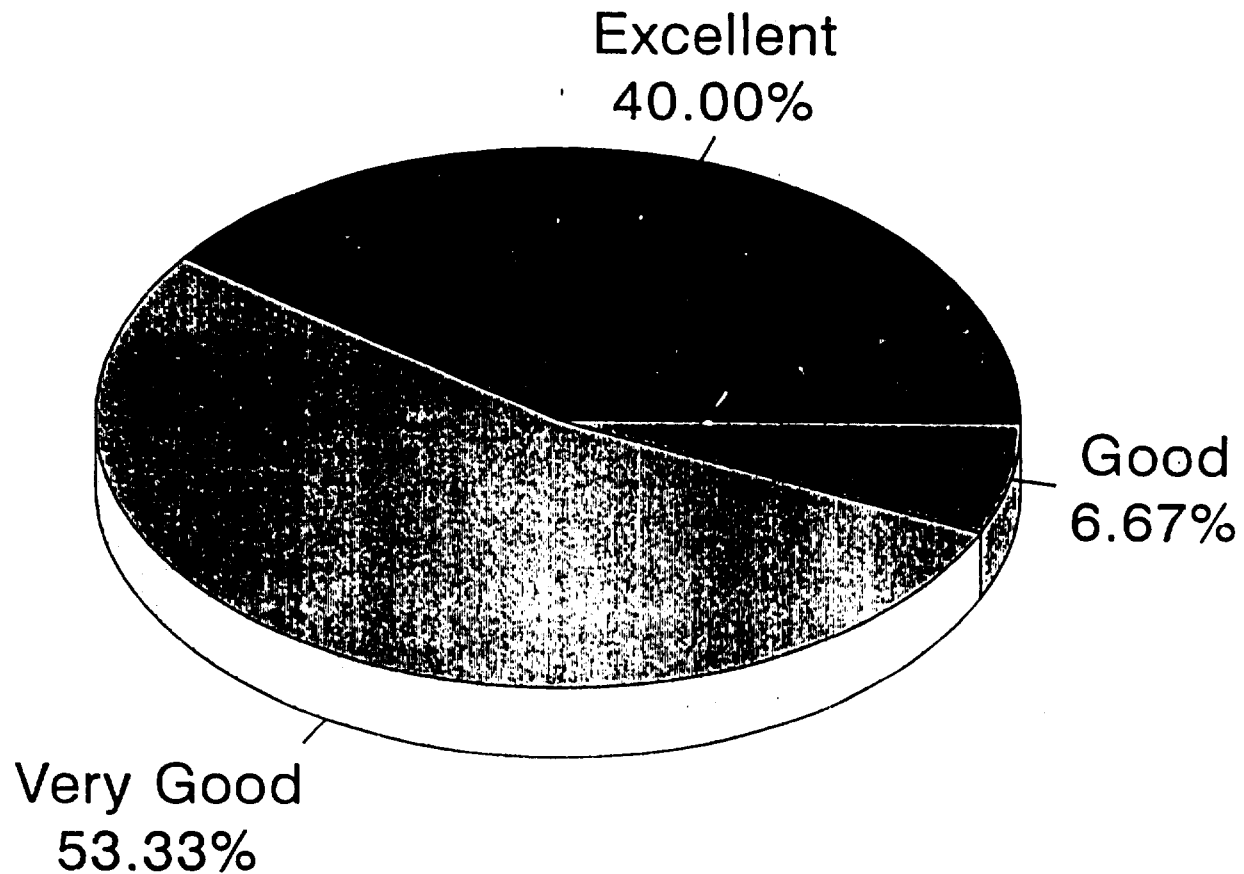
## Graphic Presentation of Course Evaluation



A.1 Were the subjects dealt with in this course appropriate in satisfying your need for your professional practice ?

# A2

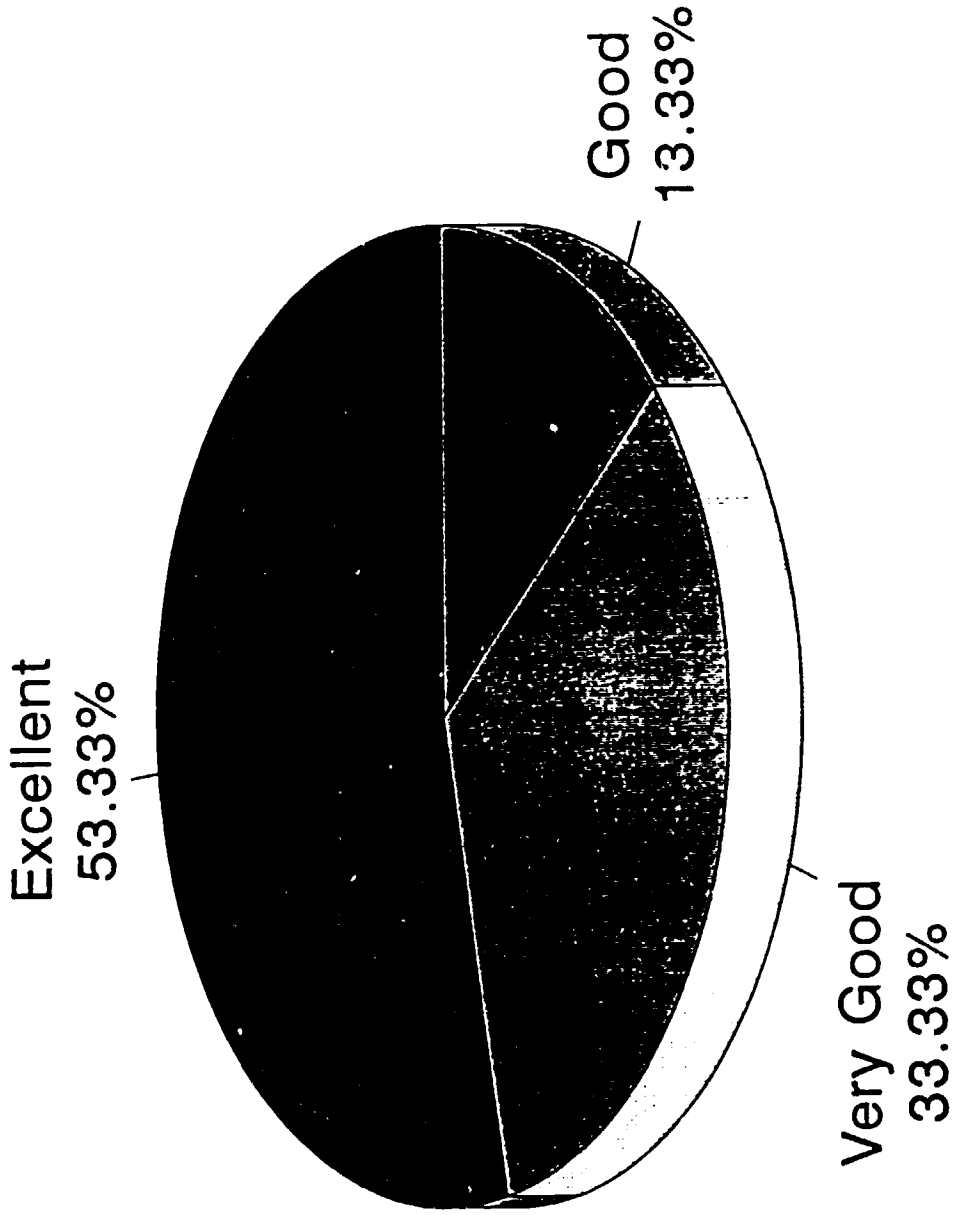
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A.2 Please rate the course book and other printed materials used in the course.

# A3

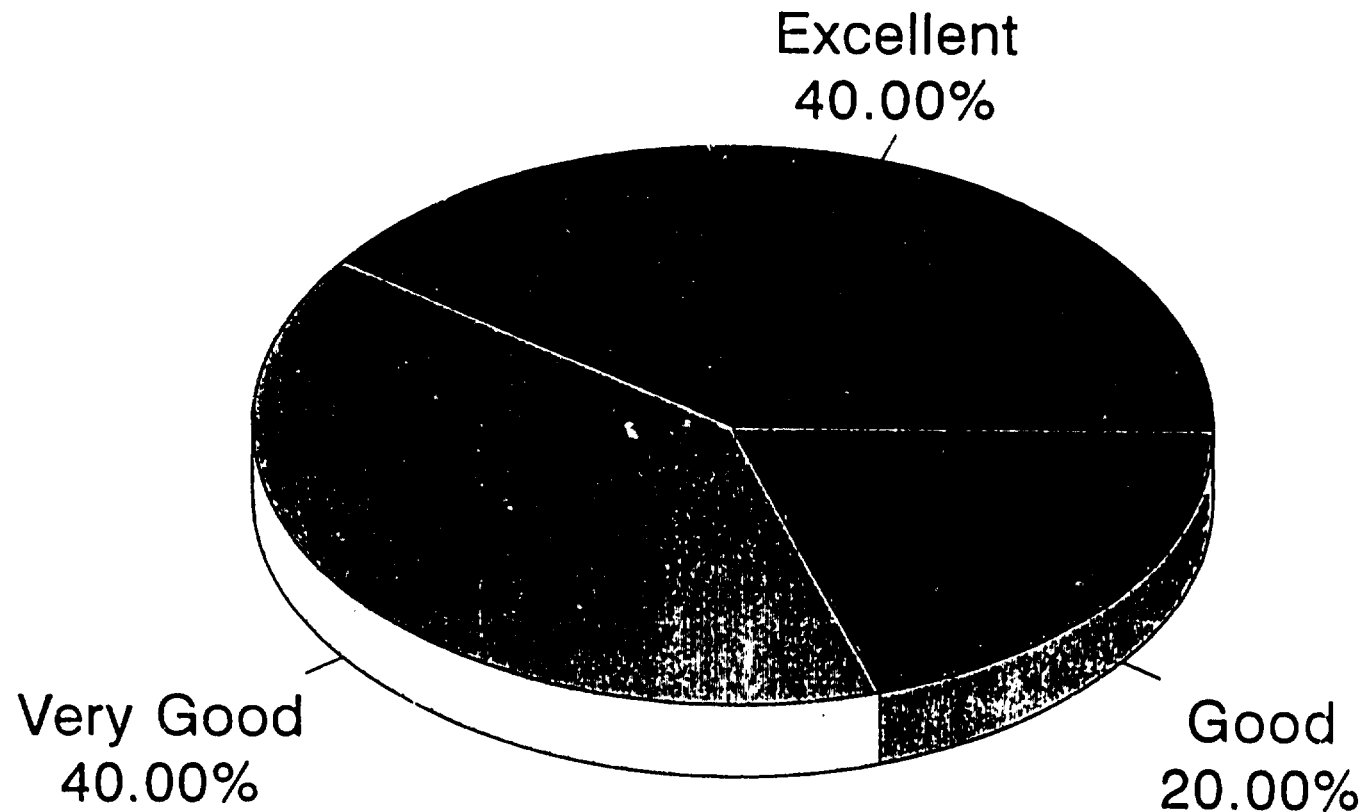
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A.3 Course organization and execution.

# A4

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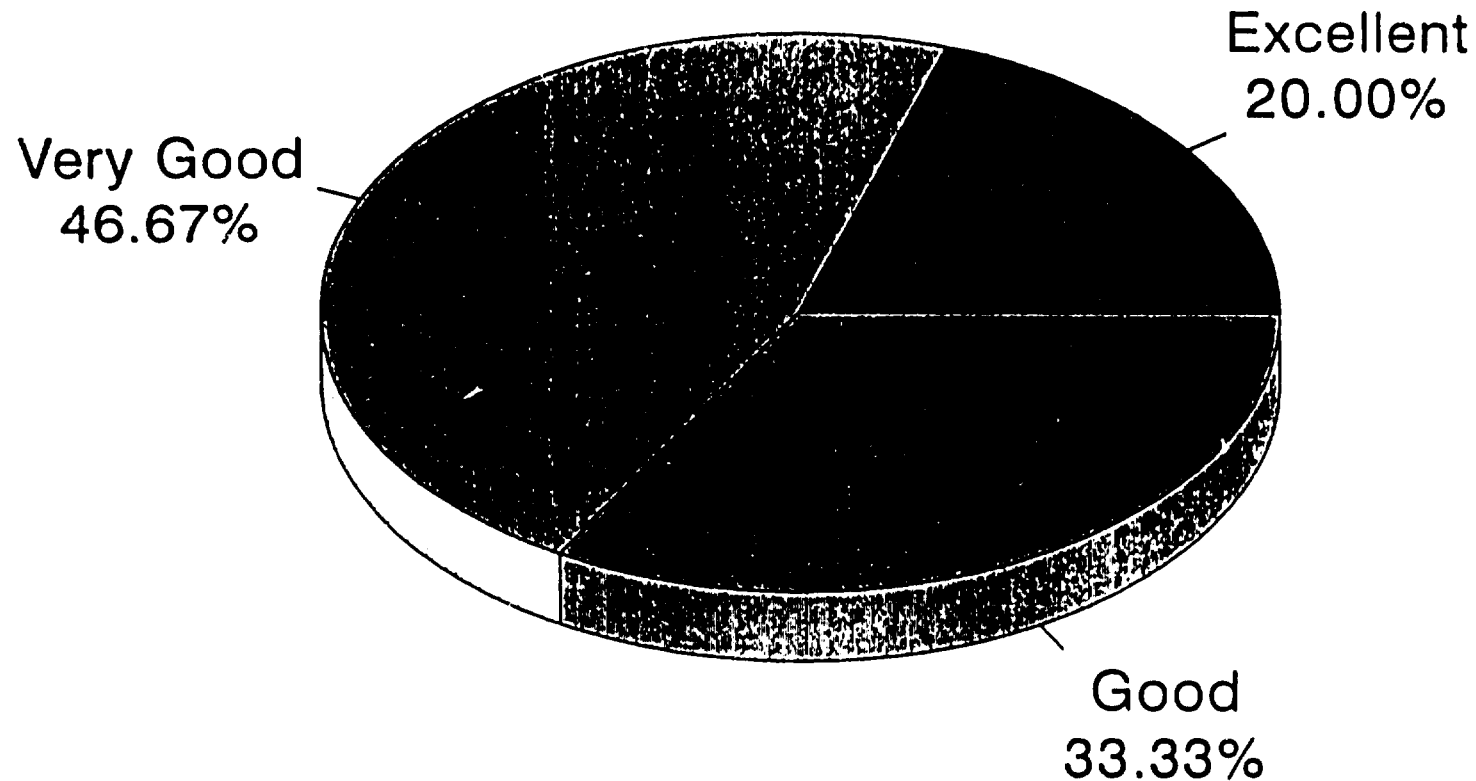
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A.4 Please evaluate the likely usefulness of the printed course materials for your reference in future professional practice.



# A5

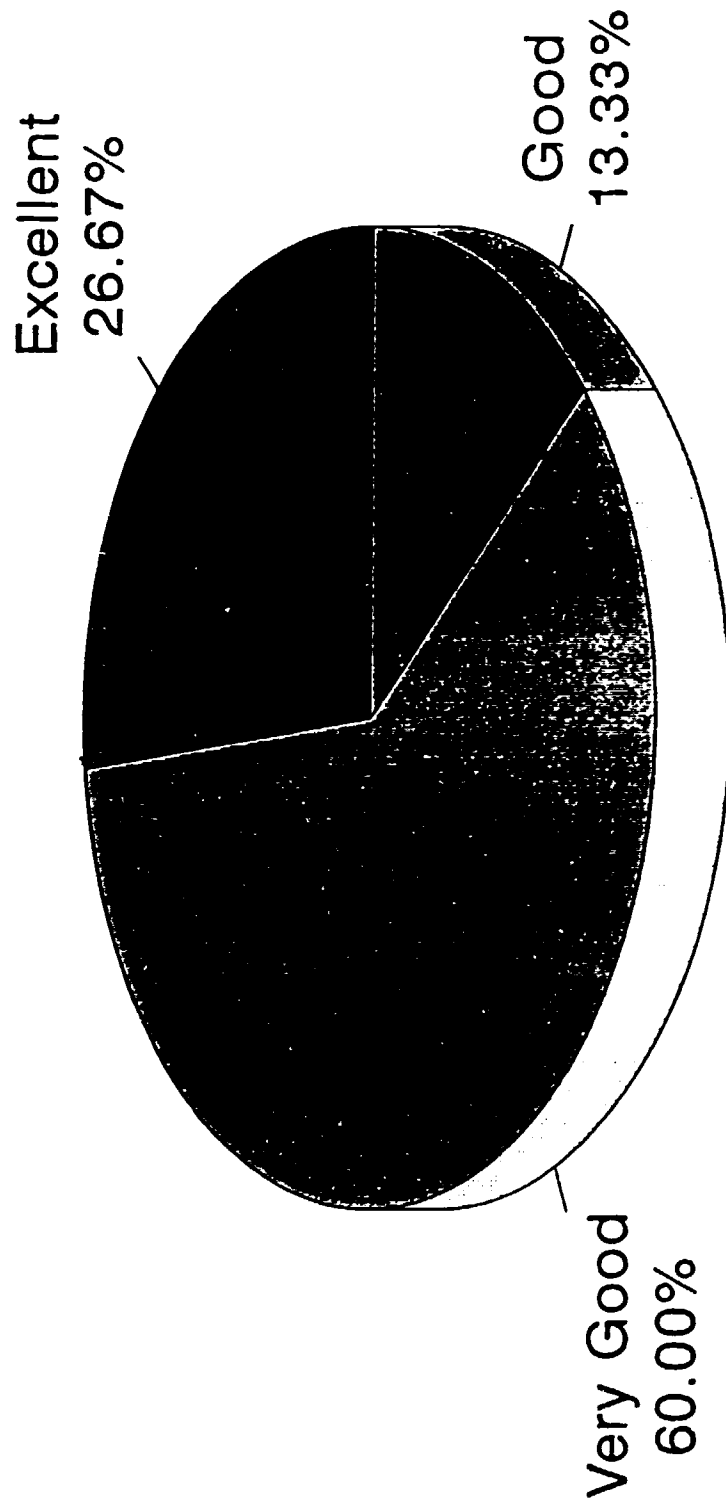
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A.5 Please rate the usefulness of the new techniques and procedures presented in this course in relation to their applicability to problems in your country

# A6

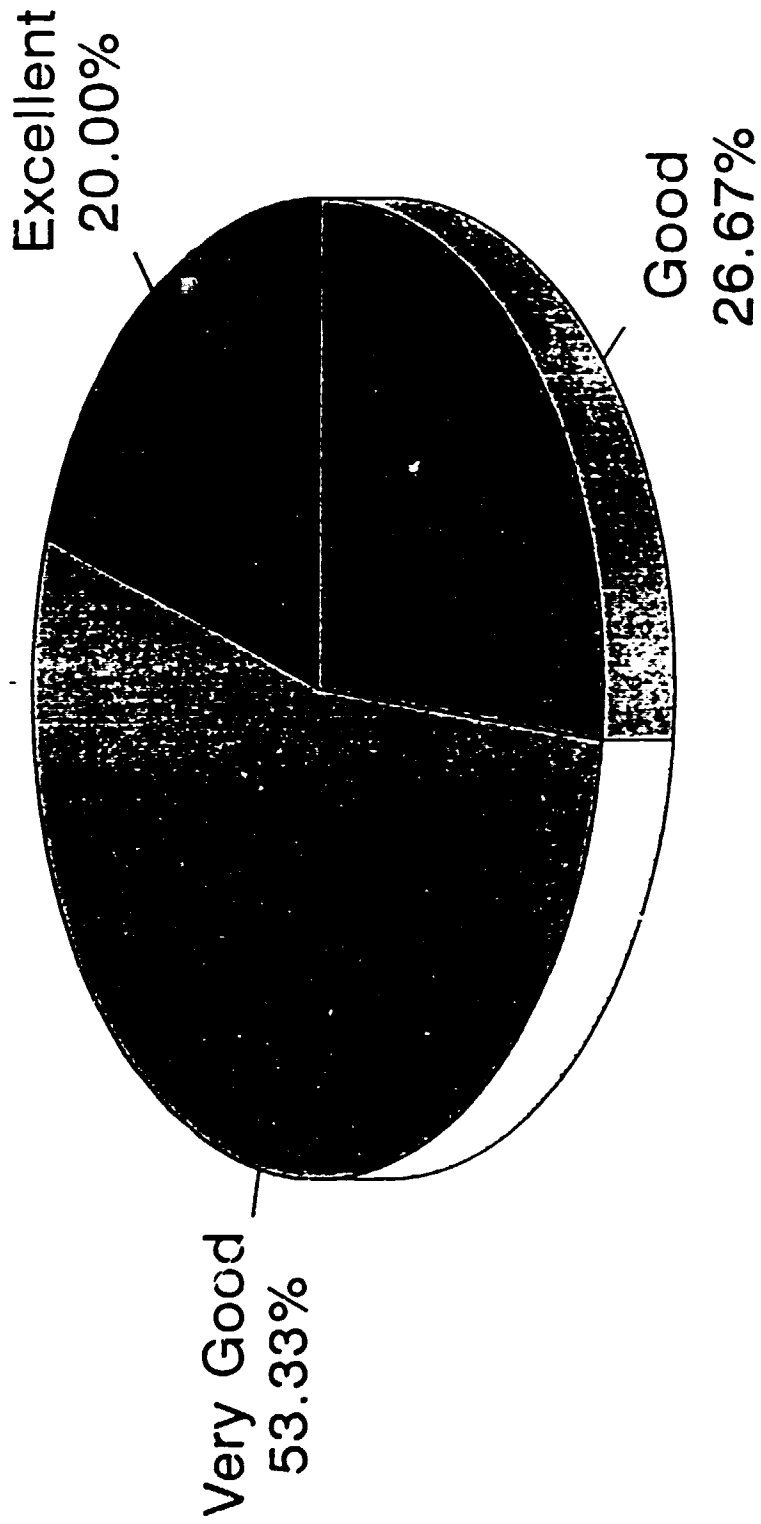
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A.6 Overall view and evaluation of the course.

# A7

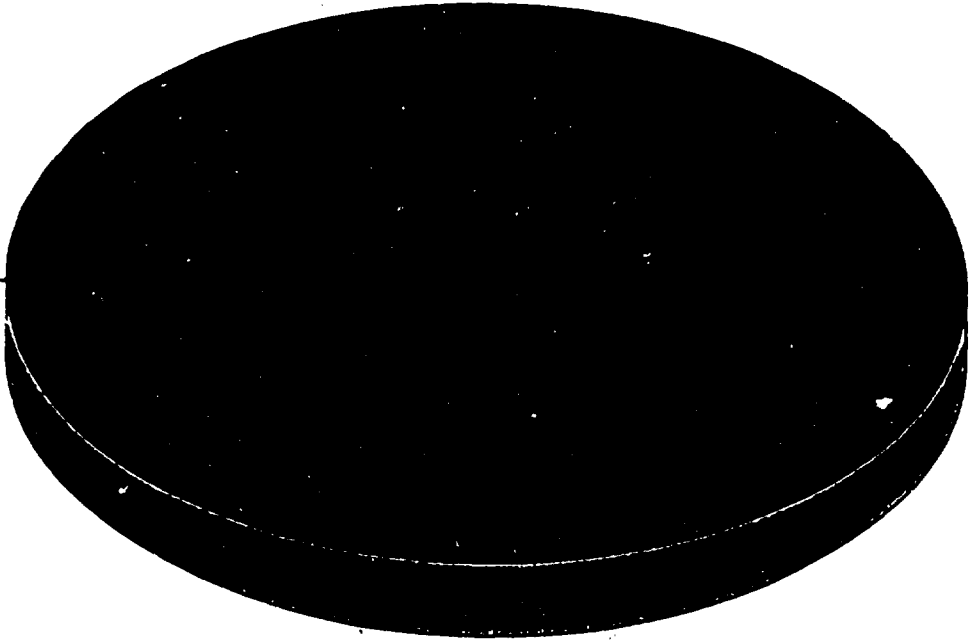
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A.7 Please rate the usefulness of the course.

C

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Yes  
100.00%

A 3D pie chart with a single black slice representing 100% of the data. A thin white line separates the top and bottom surfaces of the slice. A small white line extends from the left edge of the slice to the text label.

Response	Percentage
Yes	100.00%

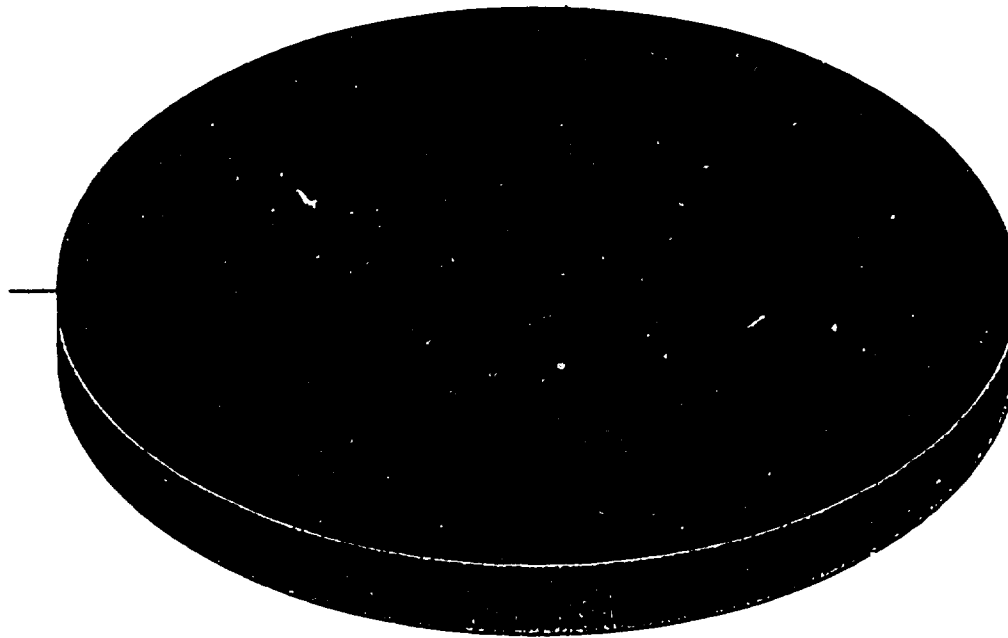
19

C. Would you consider participating in a follow-up short course on any aspects related or associated with the current course ?

# D

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Yes  
100.00%

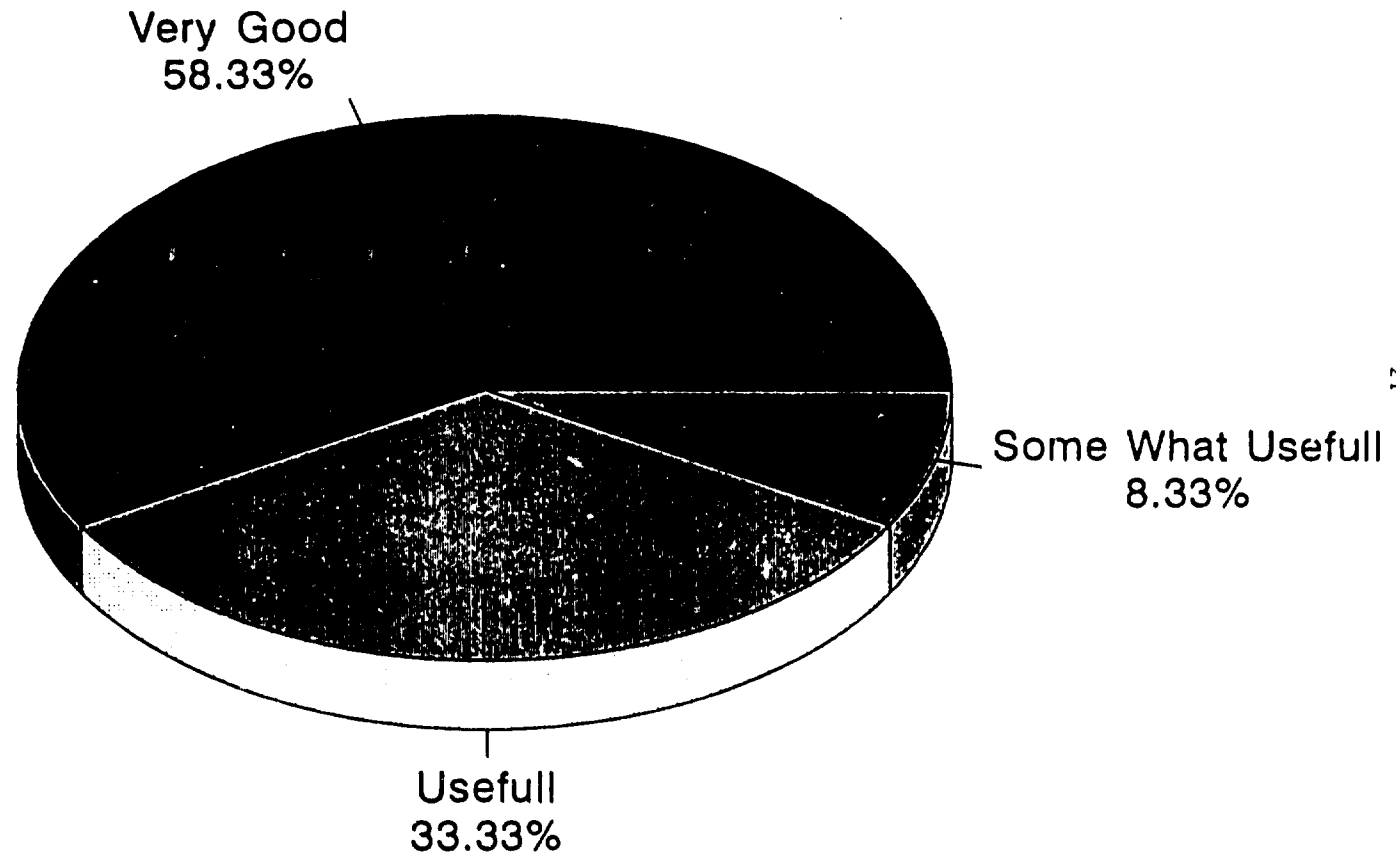


20

D. Do you think the subject mater of the current course would be beneficial to other individuals in your agency, ministry or firms in your country ?

# F

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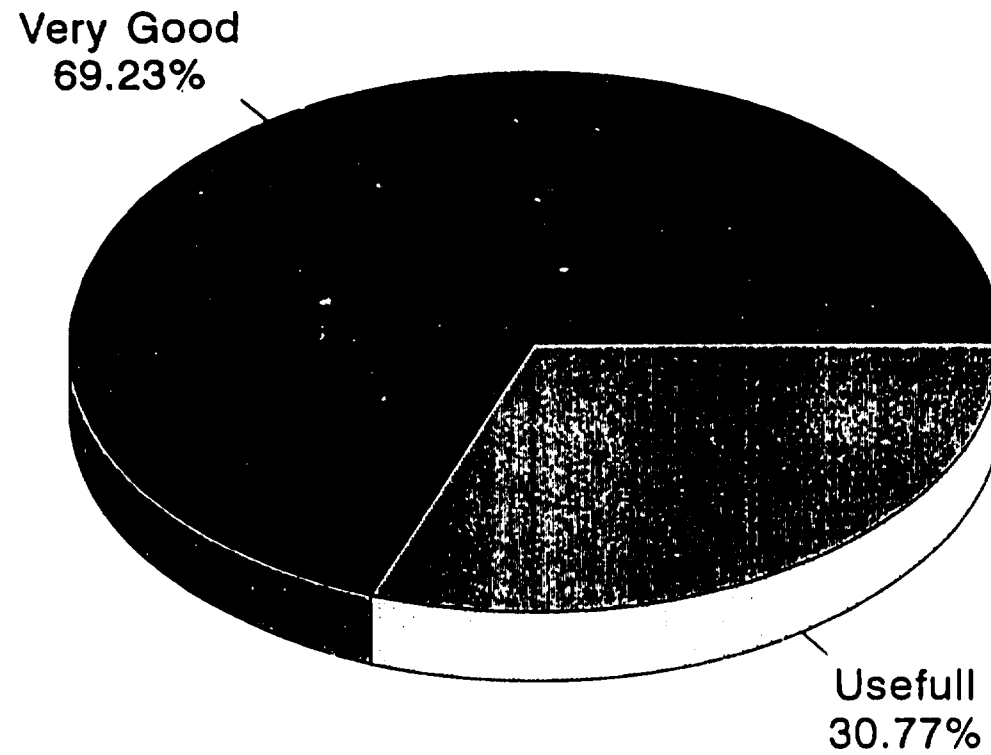
21

1. Jing Muad Co., Ltd.

F. How useful was the field trip.

# F

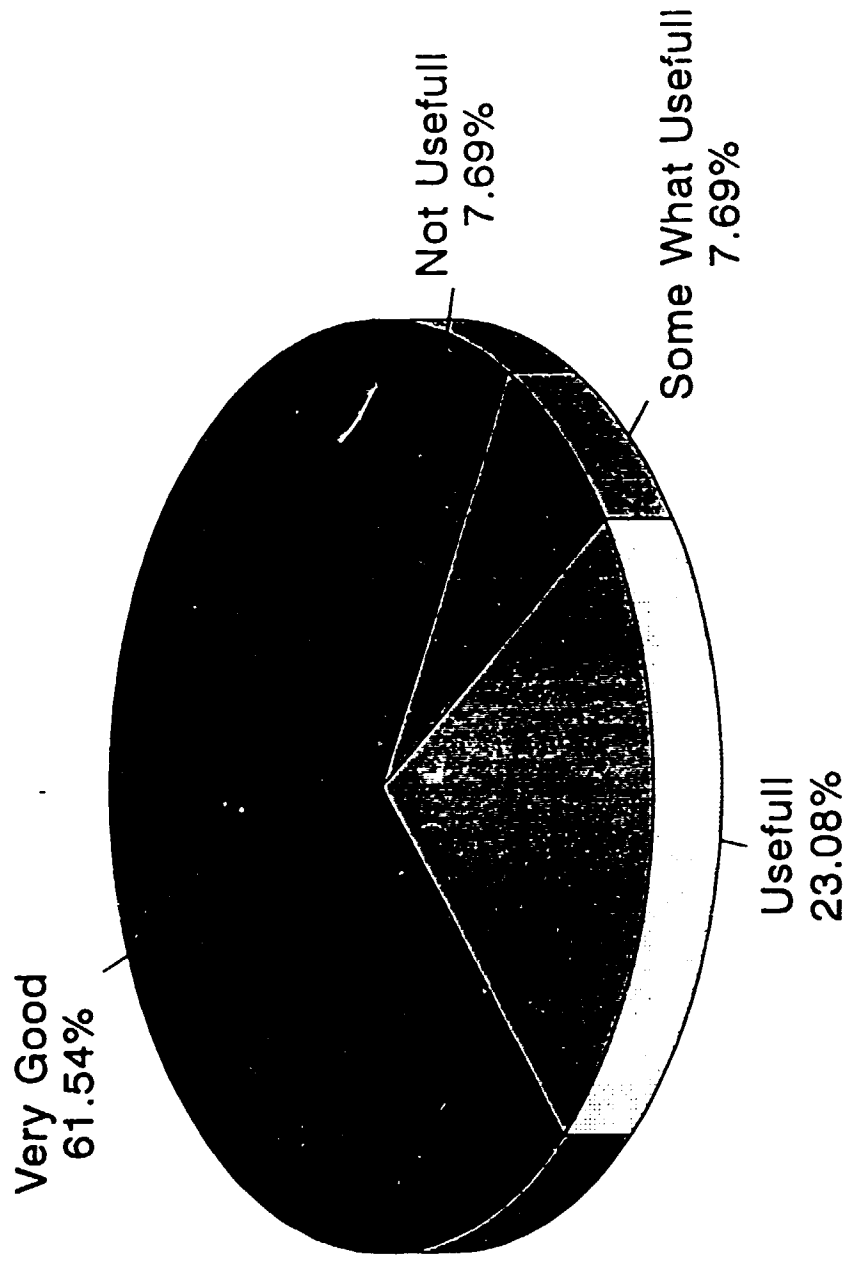
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2. Sam Mai Kur Sausage Factory, Chonburi

F. How useful was the field trip.

# F



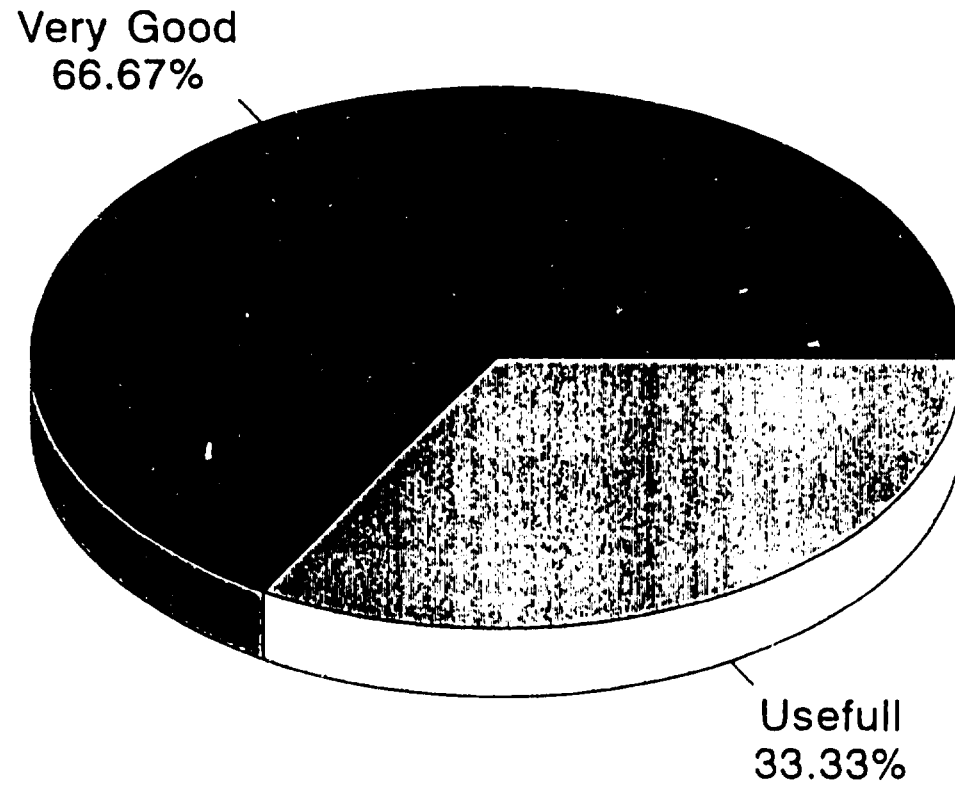
### 3. Bio-Thong Food Processing

F. How useful was the field trip.



# F

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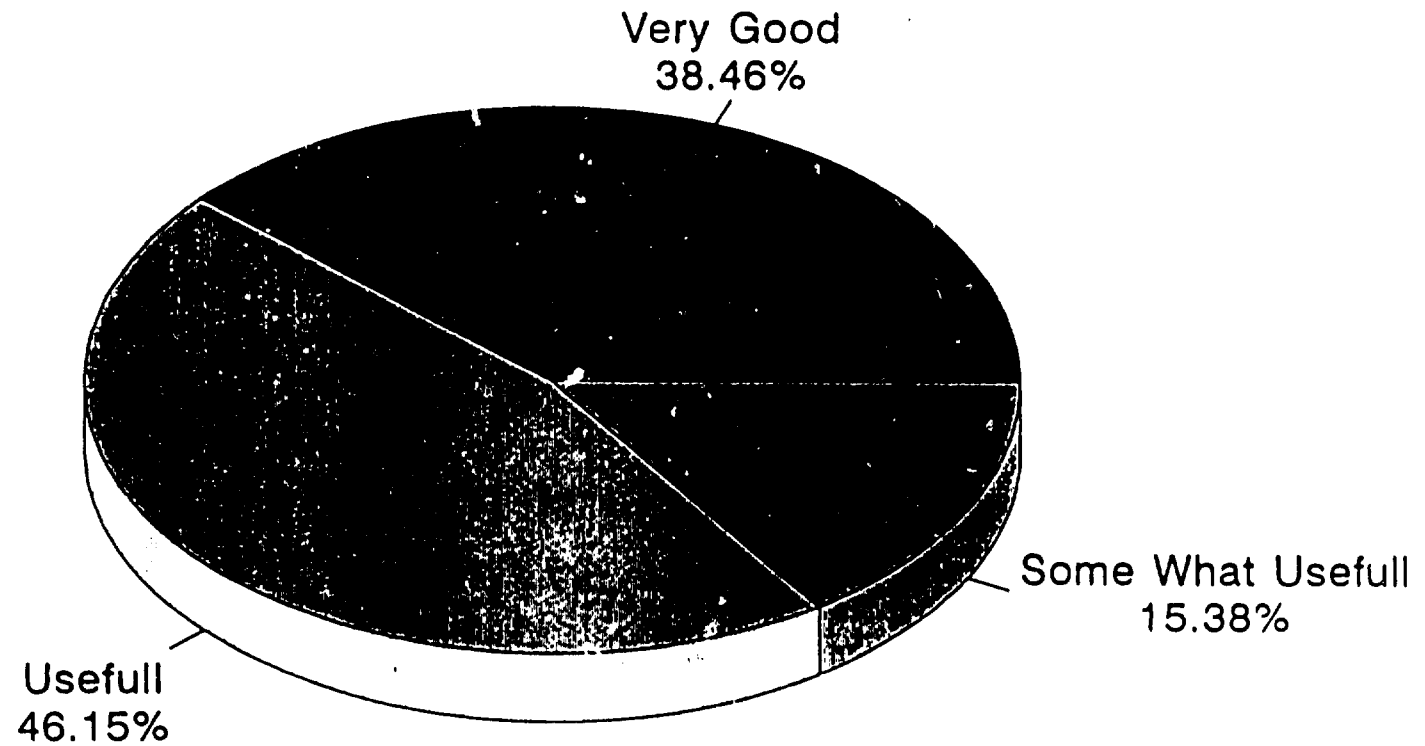
24

4. Nong Poo Milk Product

F. How useful was the field trip.

# F

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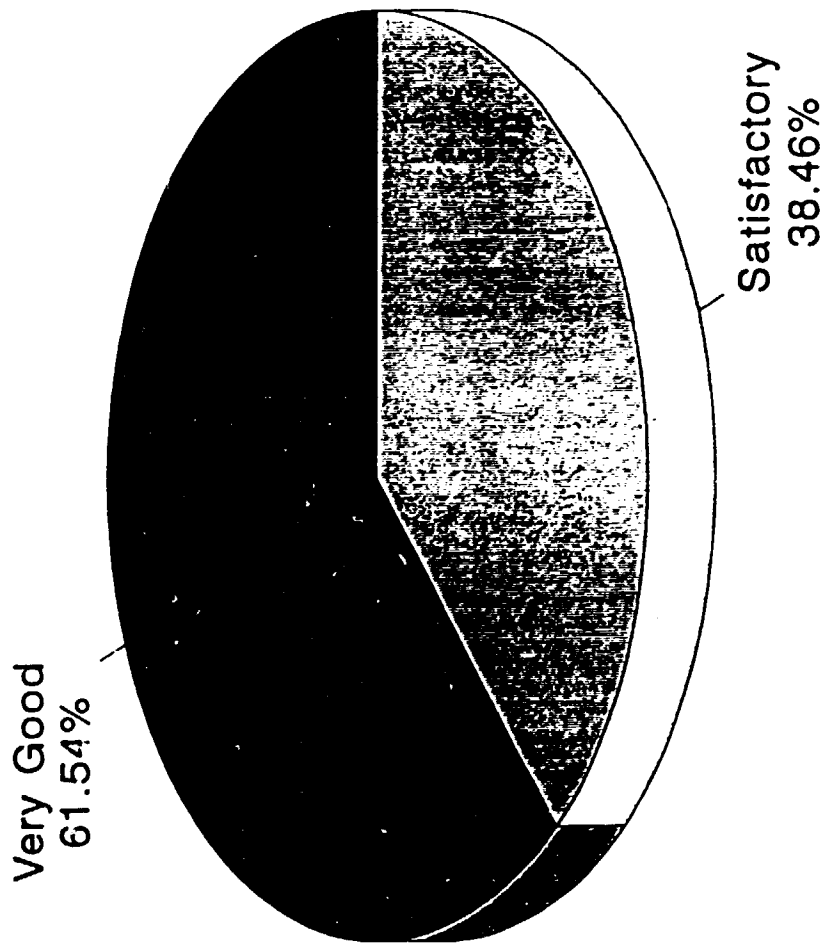
25

## 5. Villages Acctivities on Dairy Cooperative

F. How useful was the field trip.

# G

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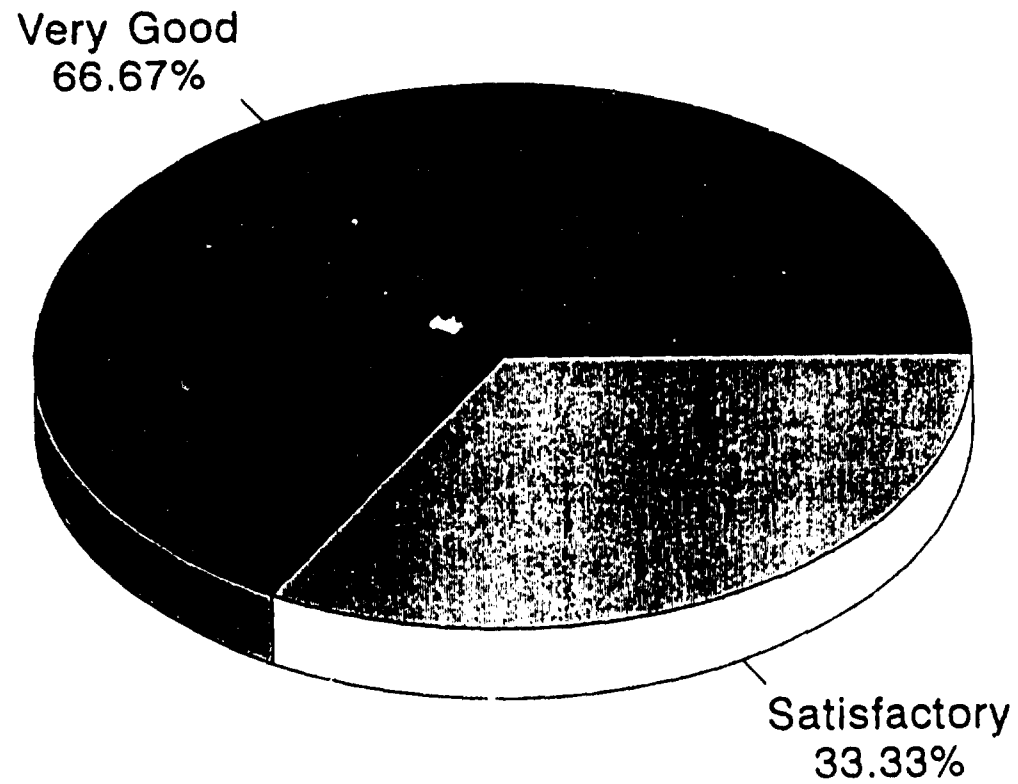


1. Welcome from airport/departure service

## G. Services and Facilities.

# G

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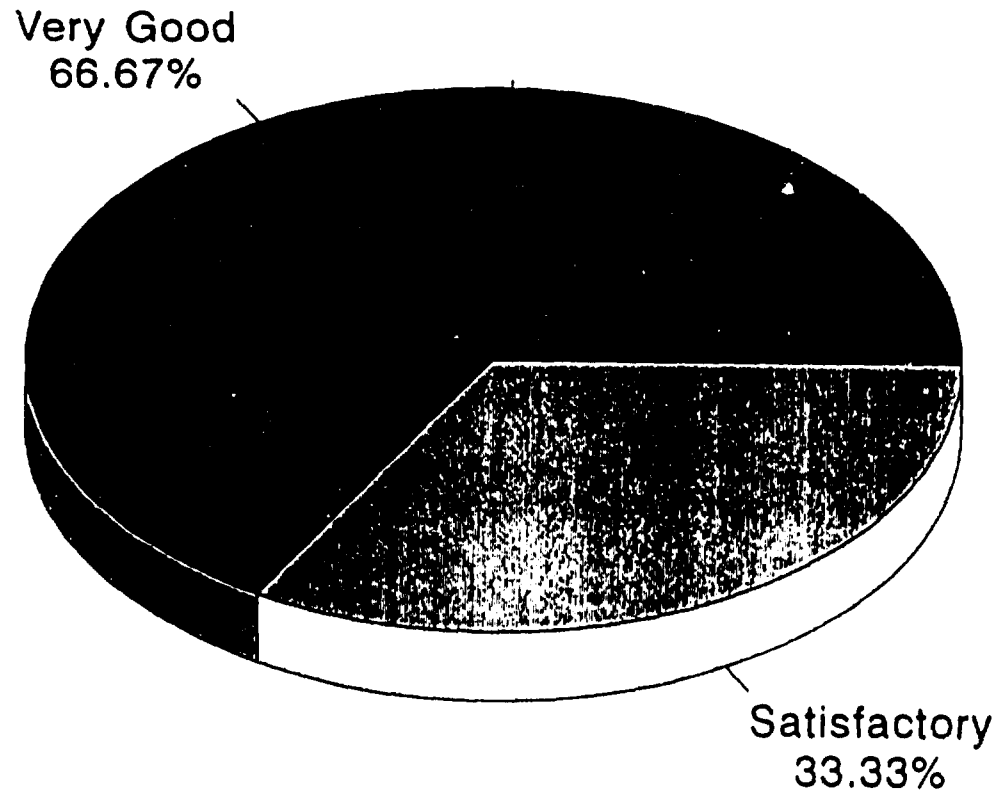
27

2. Accomodation

G. Services and Facilities.

# G

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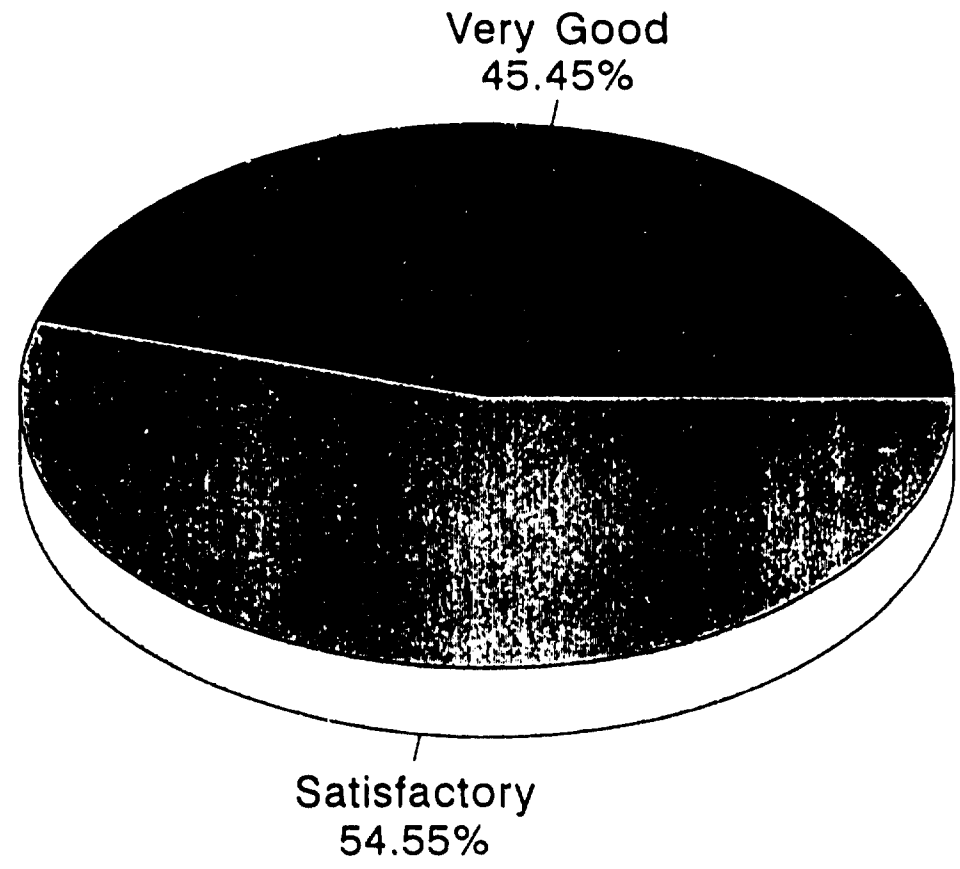


3. Lecture Facilities

G. Services and Facilities.

# G

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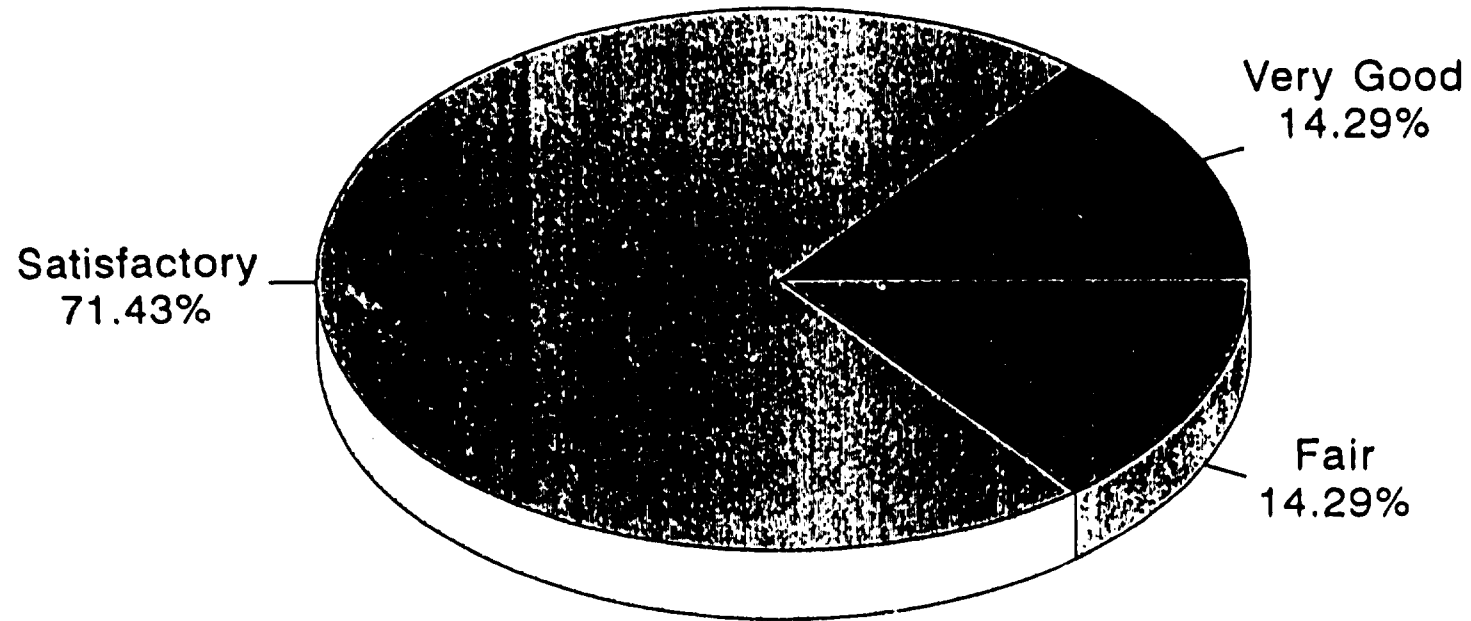


4. Field Work / Labs Facilities

## G. Services and Facilities.

# G

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30

5. Quality of food at cafeteria

G. Services and Facilities.

# G

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6. Assistance given by Continuing Education Center for general needs

G. Services and Facilities.



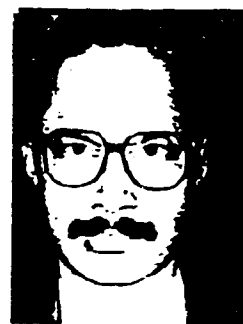
**Training Course on  
Quality Management in the Food Industry  
in Asian and Pacific LDCs  
14 August - 1 September 1995**

**List of Participants**

\*\*\*\*\*

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## **Appendix C**

### **Course Module**

#### **Module 1: Food Industry : A Perspective**

- Structure of the food industry
- Problems of the food processing enterprises in developing countries
- Country reports: situation and experience of the food industry

#### **Module 2 : Appropriate Processing Technology**

- Post-harvest processing operations
- scientific rationale for food spoilage and preservation
- Techniques of processing and preservation of food
- Approaches for selection of technology and equipment
- Gender issues

#### **Module 3 : The path to Quality Management**

- Introduction to Quality Management
- HACCP and sanitation
- Quality assurance systems
- Criteria for certification and implementation of ISO 9000
- Legislation : National and International food Standards
- Monitoring systems for products specifications
- Meeting customer specifications through right technology

## Quality Management in the Food Industry in Asian and Pacific LDCs

14 August – 1 September 1995

### Course Schedule

WM	TIME	MONDAY 14 Aug	TUESDAY 15 Aug	WEDNESDAY 16 Aug	THURSDAY 17 Aug	FRIDAY 18 Aug
1	0830-1000	Registration Opening Ceremony AIT Video Presentation	Problems of Food Processing In Developing Countries <i>Dr. S.K. Rakshit</i>	Overview of Food Processing	Processing Techniques and Equipments	Selection of Appropriate Technologies
	1000-1030	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
	1030-1200	Presentation by participants  <i>Dr. Athapol N.</i>	Food Industry in Thailand  <i>Dr. S. Chayovan</i>	Post Harvest Technology  <i>Dr. Athapol N.</i>	Contd.  <i>Mrs. Suwalee C.</i>	Contd.  <i>Dr. Athapol N.</i>
	1330-1500	Presentation of Individual Country Scenarios <i>Dr. Athapol N.</i>	Structure of Food Industry	Food Processing & Quality Assessment  <i>Prof. V.K. Jindal</i>	Gender Issues In Food Industry  <i>Mrs. Suwalee C.</i>	Case Study
	1500-1530	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
	1530-1700	Video Presentation Journey to Excellence	Export Opportunities Scopes & Problems  <i>Dr. Boonjit T.</i>	Participant's Project work I Introduction  <i>Prof Jindal Dr. Rakshit/Dr. Nagarur</i>	Computer-aided Quality Control (software demonstration)  <i>Mr. C. Perera</i>	Case Study  <i>Dr. S.K. Rakshit</i>
	1800		Cocktail Reception		Contd.  <i>Mr. C. Perera</i>	

**Quality management in the food industry  
in Asian and Pacific LDCs**

14 August – 1 September 1995

Course Schedule

	TIME	MONDAY 21 Aug	TUESDAY 22 Aug	WEDNESDAY 23 Aug	THURSDAY 24 Aug	FRIDAY 25 Aug
2	0830-1000	Quality/TQM	Establishment/ Monitoring of Specifications	HACCP Approach In the Food Industry	Critical Limits, Monitoring Procedures and Corrective Actions	Study Tour
	1000-1030	Coffee Break	Coffee Break	Coffee Break	Coffee Break	
	1030-1200	Contd. <i>Dr. N.N. Nagarur</i>	Contd. <i>Dr. N.N. Nagarur</i>	Development and Implementation of HAACP <i>Dr. Preeya V.</i>	Workshop <i>Dr. Preeya V.</i>	
	1330-1500	Participant's Project Work II	ISO 9000	Hazards Material in Food and CCP	Record Keeping and Verification Procedures	Study Tour
	1500-1530	Coffee Break	Coffee Break	Coffee Break Workshop on: Hazards & Controls	Coffee Break	
	1530-1700	Contd. <i>Prof. Jindal/ Dr. Rakshit/Dr. Nagarur</i>	Contd. <i>Mr. Satish S.</i>	- Canned Food - Frozen Seafood - Dairy Product <i>Dr. Preeya V.</i>	HACCP Group Work <i>Dr. Preeya V.</i>	
1800	Computer Hands-on <i>Mr. C. Perera</i>	Video Presentation	Computer Hands-on <i>Dr. Preeya V.</i>	Participant's Project Work III <i>Prof. Jin./Dr. Rak./Dr. Nagarur</i>		

**Quality Management in the Food Industry  
in Asian and Pacific LDCs**

14 August – 1 September 1995

Course Schedule

TIME	MONDAY 28 Aug	TUESDAY 29 Aug	WEDNESDAY 30 Aug	THURSDAY 31 Aug	FRIDAY 1 Sept
0830 – 1000	Study Tour	Food Standards/ Legislation	Introduction to Marketing	Quality Requirements for Processed Food	Participants' Project Work V Final Presentation
1000 – 1030		Coffee Break	Coffee Break	Coffee Break	Coffee Break
1030 – 1200		Contd.	Contd.	Contd.	Contd.
3		<i>Mr. K.W. Boegl</i>	<i>Mr. M.H. Yousef</i>	<i>Mr. P. Molnar</i>	<i>UNDIO/Prof. Jindal Dr. Rakshi/Dr. Nagarur</i>
1330 – 1500	Study Tour	Panel Discussion	Contd.	Contd.	Course Evaluation
1500 – 1530		Coffee Break	Coffee Break	Coffee Break	Coffee Break
1530 – 1700		Contd.	Contd.	Contd.	
	<i>Dr. Napaari M.</i>	<i>Mr. K.W. Boegl</i>	<i>Mr. M.H. Yousef</i>	<i>Mr. P. Molnar</i>	
1800		Participant's Project Work IV <i>Prof. Jindal/ Dr. Rakshi/Dr. Nagarur</i>			Closing Ceremony

## Appendix E

### FIELD TRIP Quality Management in the Food Industry in Asian and Pacific LDCs

(14 August - 1 September 1995)

Friday 25 September 1995

8:00 : Leave AIT  
 10:30 - 12:00 : Food Processing Chanbure  
 12:00 - 13:30 : Lunch  
 14:00 - 16:00 : Jing Huad Co. Ltd: Quality Approved by  
 Department of Science Service, Thailand  
 13:30 : Check in at Hotel  
 : Evening Free

Saturday 26 September 1995

7:00 - 8:00 : Breakfast  
 : Check out from Hotel  
 09:30 - 11:30 : Sam Mai Kur Sausage Factory, Chonbure  
 12:00 - 13:30 : Lunch  
 14:00 - 15:00 : Boi Thong Food Processing  
 18:00 : Return to AIT

Monday 28 September 1995

7:30 : Leave AIT for Ratchaburee Province  
 10:00 - 12:00 : Nong Poo Milk Product  
 12:00 - 13:30 : Lunch  
 13:30 - 15:30 : Activities of Villagers on Dairy Cooperative  
 18:00 : Return to AIT

**APPENDIX - F**

**TRAINING COURSE ON QUALITY MANAGEMENT  
IN THE FOOD INDUSTRY IN ASIA AND PACIFIC LDCs**

from  
14 August to 1 September 1995  
at  
AIT, Bangkok, Thailand

**PROJECT WORK ON PRODUCTION OF SUGAR  
IN  
BANGLADESH**

Prepared by

A.S. Salahuddin Ahmed (Bangladesh)  
Shahadat Hussain (Bangladesh)  
Lhatu (Bhutan)  
Prak Boreth (Cambodia)

## A. INTRODUCTION

Sugar is one of the basic commodities needed in our day-to-day lives. One of the major raw materials for the production of sugar is sugarcane, which is grown in tropical countries like Bangladesh and Nepal among the LDCs, apart from the other developed and developing countries of the world. This project will consider sugar production in Bangladesh.

Bangladesh is an agrarian country which produces rice, jute, tea, wheat, fruits and vegetables. Sugarcane is abundantly grown in the country. It is a seasonal crop and is generally harvested between November to April. The period may fluctuate depending on the climatic conditions, and maturity and quantity of the cane.

The total sugar requirement of the country is approximately 350 thousand metric tons, of which 225 thousand metric tons are met by the production of white plantation sugar by sixteen sugar mills run by Bangladesh Sugar and Food Industries Cooperation under the Ministry of Industries. The rest of the demand is filled by imports. The per capita consumption of sugar is 2.8 kilograms.

## B. OBJECTIVE

The objective of this project is to produce white plantation sugar with the following specifications:

- |    |                                   |   |                                |
|----|-----------------------------------|---|--------------------------------|
| 1. | Polarization                      | : | not less than 99.5°C           |
| 2. | Invert sugar                      | : | not more than 0.1% m/m         |
| 3. | Conductivity ash                  | : | not more than 0.1% m/m         |
| 4. | Loss on drying<br>(3 hrs., 105°C) | : | not more than 0.1% m/m         |
| 5. | Color (3 hrs., 105°C):            |   | not more than 105 icumsa units |

## C. SCOPE

This paper has been prepared as a part of project work on quality management in the food industry at the Continuing Education Center, Asian Institute of Technology Organized by UNIDO.

## D. RAW MATERIAL: SUGAR CANE

The problems encountered in the availability of adequate and quality raw materials are:

- less production of cane
- shifting from cane cultivation to other crops due to less income from cane
- crop failure



- insect and pest attacks
- improper interculture operation
- low yield due to varietal deterioration
- old method of cultivation
- improper use of fertilizers and other inputs
- low quality seed

To overcome the above-mentioned problems and to ensure adequate supply of quality raw material, the following measures are to be taken:

- undertake scheme named "Intensive Care Cultivation"
- provide training to growers on modern techniques of cane cultivation
- supply growers with inputs such as fertilizers and pesticides
- supply growers with clean seed
- mechanize cultivation where required
- inspect field (done by trained extension workers)
- ensure credit facilities to farmers or growers

## E. HARVESTING

After harvesting, sugarcane cannot be stored or kept for a long time. It should be crushed within twenty-four hours after harvest; otherwise, it starts decaying, causing low recovery of sugar. Hence, this is a very important factor for a sugar factory specially in I.D.C.s where the number of growers in sugar mills varies from twenty to twenty-five thousand.

To avoid dislocation of procurement of sugarcane from fields to mills, a harvesting schedule should be framed and the growers should be given a permit to harvest and supply a certain quantity of cane to the mills on a particular date. The mills can procure the cane from distant places through the mill's transport while some growers who stay nearby can supply the cane directly to the mills.

This is an important element and proper care should be taken through strict supervision. If there is any dislocation, the mills incur heavy monetary losses. If there is inadequate supply of cane, the mills will have to undertake intermittent crushing.

If the cane harvested is more than mills' capacity, the mills will not be able to crush the entire lot. This causes damage and decay of cane, thus recovery of sugar from these canes will be very low.

## F. PROCESSING

The manufacturing process of sugar from sugarcane comprises of over a dozen operations. These are:

1. crushing and grinding

2. fluid flow
3. mixing and agitation
4. settling
5. filtration
6. heat transfer
7. evaporation
8. crystallization
9. centrifuging
10. drying
11. size separation
12. material handling and conveying

In general, the process can be divided into the following sections:

1. milling
2. clarification
3. evaporation
4. pan boiling
5. centrifuging, etc.

### 1. Milling

The cane stock consists of juice cells and fibers. The juice which lies in storage cells, enclosed by fibers, is of high purity and high solid content. For this reason, the cane is shredded in order to disrupt or open up the cells so that during crushing maximum sugar is extracted. After shredding, the cane is passed through a number of squeezes under high pressure. The squeezes are applied by a series of rolling pressure mills containing grooved walls. In each unit mill, there are three rollers arranged in an assembled cast steel or mild steel fabricated housing in a triangular pitch, so that two squeezes are obtained in each unit. Extraction is maximized by leaching the disintegrated exposed cane with weak juice and make up water in a counter current system. In the sugar industry, this leaching system is named "imbibition".

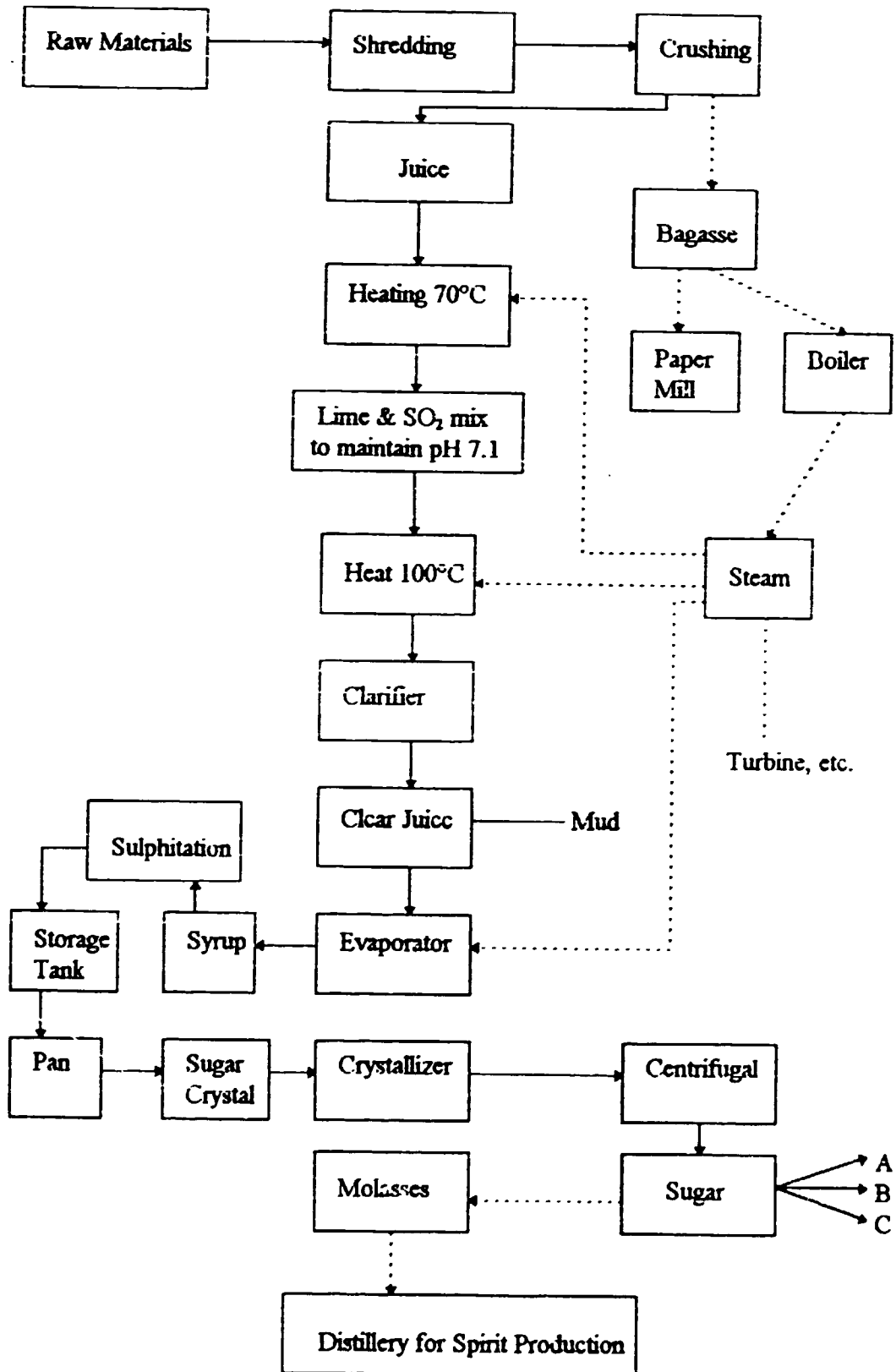
### 2. Clarification

The mixed juice contains a lot of impurities. It is opaque and grayish in color. Sugar cannot be extracted from it by crystallization unless the juice is sparkling clear and is of neutral pH. The juice is first heated to a temperature of 70°C, then it is passed through a tank where milk of lime and Sulfur dioxide gas are mixed with it for clarification. Here, the pH of the juice is maintained at 7.0 to 7.1. Then it is again heated to a temperature of 100°C and kept in a tank called "classifier" so that mud will settle down.

### 3. Evaporation

Clear juice from the clarifier is passed through a quadruple effect evaporator to make a syrup of 60 Bx. Here, the evaporation is done in a vacuum to avoid "caramelization".

**SUGAR FACTORY**  
(in Bangladesh)



#### 4. Crystallization

This is an important unit operation in the manufacturing process of sugar from the sugarcane. In the sugar industry, it is known as "pan-boiling". The syrup produced by evaporation is boiled in the pan and brought to a particular concentration when "seed" is introduced into the pan. The crystallization of mother liquor and crystals known as "massecuite" is then transferred to crystallizers where the process is completed by cooling the mass under stirred conditions.

#### 5. Centrifuging

The "massecuite" produced is centrifuged and sugar is separated from the mother liquor.

The sugar crystals in the centrifuge contain 15 to 20% surface moisture. These are passed through a conveyor through which hot air is passed and then dry sugar is produced. This sugar is bagged in one hundred kilograms gunny bags.

The "molasses" that come out from the first boiling is called "A" molasses. These are subjected to second and third boiling. After the separation of sugar from these molasses, the final molasses, from which economic recovery of sugar is not possible, are obtained. Therefore, these molasses are ultimately utilized in distillery, cattle-feed, and others.

### G. QUALITY CONTROL MANAGEMENT

In sugar production, the efficient operation of the recovery process is of very critical economic importance. As such, rigorous quality control measures are required from the beginning to the end and samples of such syrup, bagasse, molasses, and other products should be analyzed in the laboratory at regular intervals so as to minimize chemical or physical losses. Shredding to open up the sucrose-containing cells and crushing of the shredded cane should be done efficiently to maximize the optimal extraction of juice. At subsequent operations, utmost care should be taken to keep the temperature, pH, time and other parameters within the prescribed ranges. Crystal formation should also be checked and done by skilled and experienced hands. In case of lapses in any of the above processing stages, losses in both quality and quantity are likely to occur.

Apart from the above, there are also microbial losses. Dilute sugar solutions are liable to be attacked by a variety of microorganisms and are easily fermented by airborne osmiophilic yeast, leucono stock mesenteroids. The only remedy is to avoid the creation of light, sweet waters and unscrupulous cleanliness and plant hygiene. This is done by using steam and disinfectants.

Every sugar factory has a well-equipped chemical laboratory. The analytical data is computed and fed back to the processing personnel to control the lapses that may happen at any point.

## H. CONCLUSION

The sugar industry is one of the agro-based industries in Bangladesh contributing to the import substitution to a great extent and generating employment for the local and urban population. Nowhere else is the interaction between the raw material growers and the industry so complete as in sugar production. A large cross-section of the rural society is benefiting from the sugar industry directly or indirectly. Bagasse and molasses – two important by-products – are also used considerably for production of paper, hard board and alcohol, respectively. However, in order to make the sugar sector more viable and profitable, better sugarcane quality is required. This means having better cane breeding, better cane farming, better cane management in getting cane of proper and early maturity and high sugar content, and avoiding attack of pests till harvesting.

During crushing and the processing steps that follow, maximum extraction of sugar should be ensured and energy consumption and sugar losses in bagasse, press-mud, molasses and others should be minimized.

It should be kept in mind that the world has reached the stage where consumer preference and quality consciousness play more significant and vital roles than ever before, whether the commodity is meant for local or overseas market.

The various aspects of the quality management training course attended by the project group during the three-weeks stay in the Asian Institute of Technology will go a long way in solving the existing problems with respect to quality not only in the sugar industry, but also in other food processing industries in their respective countries.

**QUALITY MANAGEMENT IN THE FOOD INDUSTRY  
IN ASIAN AND PACIFIC LDCs**

14 August – 01 September 1995

**PROJECT REPORT:**

**“QUALITY IMPROVEMENT OF CANNED TUNA”**

**Submitted to:**

**Prof. V. K. Jindal  
Dr. N. N. Nagarur  
Dr. S. K. Rakshit**

**Submitted by:**

**Ms. Bounsong Manolin (Lao P.D.R.)  
Ms. Seema Ali (Maldives)  
Ms. Gayline Mitikulena (Niue Island)  
Mr. Suon Sothoeun (Cambodia)  
Mr. Subba Chandra (Nepal)**

## 1.0 INTRODUCTION

### "ASPAC CANNING CO., LTD."

This company was established as a result of a surplus catch of tuna fish during peak seasons. It started operations on 01 September, 1990. It is a privately owned company which runs at a current production capacity of thirty (30) tons per day and which employs two hundred fifty (250) workers, including management.

The plant produces only one product "Canned Tuna in Soy Bean Oil". It is located in the mainland of a small group of islands where the main income generating activity is fishing.

The fishermen employ traditional practices to preserve their catch (e.g., salting and drying) but these methods are not adequate and result in high losses.

#### INCOME GENERATING ACTIVITIES

•	Agriculture	8%
•	Fisheries	72%
•	Tourism	15%
•	Industry	5%

(Ref: Govt. of ASPAC: Bureau of Statistics)

The domestic market is sufficiently catered for by 9% of total production. Export markets such as Nepal, Cambodia, Bangladesh, Bhutan and Laos receive the balance of production.

## 2.0 PROJECT BACKGROUND

Throughout the past two years, the company has experienced an increase in production losses due to high rejection of low quality fish, improper handling of fish and other process problems (e.g., plant equipment).

These problems have become of great concern to management as these adversely affect the product and its market potential.

After a series of managerial discussions, it had been decided that the best and most effective way to improve the situation was through the establishment of an "advisory team". This team would consist of representatives from the five main sectors or sections of the organization.

### "ADVISORY TEAM" COMPOSITION

Quality Control Section:	Ms. Manolin
Production Section:	Ms. Ali
Engineering Section:	Mr. Sothocun
Accounts Section:	Mr. Chandra
Administration Section:	Ms. Mitikulena

The team was then asked to evaluate the present situation and to devise the most feasible and appropriate solution which may be implemented to reduce, if not eliminate, the current problems.

### PROJECT OBJECTIVE

To improve the quality of the canned tuna through the establishment of a sound quality system

## 3.0 METHODOLOGY

3.1 FLOW PROCESS CHART (FPC)  
See Appendix 1.

3.2 IDENTIFICATION OF PRODUCTION PROBLEMS

- Receipt of raw fish
  - receipt of low quality fish from fishermen
  - irregular supply of fish
  - storage problem of excess fish
- Thawing of fish
  - present thawing system does not thaw fish uniformly
- Racking
  - labor intensive and time consuming due to unsorted fish
- Pre-cooking
  - uneven cooking due to insufficient thawing and unsorted fish
- Cooling
  - no proper cooling system
  - reliance on air cooling causes the skin surface to become dry



- Pre cleaning and cleaning  
high possibility of cleaned loins picking up blood meat, and other foreign substances due to several operations done on the same conveyer belt
- Final inspection
  - visual inspection for foreign matter on surface of product, done by one person, is inadequate
- Seaming
  - seam defective cans usually go undetected
- Commercial sterilization  
some operators are inadequately skilled/trained
- Cooling
  - inadequate cooling due to lack of cool air circulation

### 3.3 IDENTIFICATION OF GENERAL PROBLEMS

- untreated waste water is released into the environment
- lack in quality awareness
- employees' lack of awareness in the importance of personal hygiene
- no training programs conducted within the organization

### 3.4 SOLUTION TO PRODUCTION PROBLEMS:

- Receipt of raw fish
  - a. increase the price of frozen or chilled fish  
provide ice to fishermen directly after harvest (for chilling purposes)
  - b. increase or add storage facilities to cope with excess fish
- Thawing of fish
  - a. design and install proper thawing facility.(e.g., one that circulates or agitates water)
  - b. sort fish according to weight (< 1 kg, 1 – 3 kg, 3 – 6 kg and > 6 kg) upon receipt and prior to thawing
- Racking and Pre-cooking
  - problems can be eliminated via sorting
- Cooling

- design and install a mechanical cooling system (e.g., tunnel cooler with fine mist spray)
- Pre-cleaning and Cleaning
  - design and install a separate conveyor system for pre-cleaning and cleaning operations
- Final inspection
  - have more than one person to do inspection for final checking
- Seaming
  - install a deadhead trap directly after seaming (reject any cans which do not meet specified can dimensions)
- Commercial Sterilization
  - make sure that operators are certified
  - institute a training program for retort operators
- Cooling
  - design and install a water circulation system for secondary cooling and then air dry

### 3.5 SOLUTIONS TO GENERAL PROBLEMS

- a. The waste water from this operation may be treated before its release into the environment. However, the establishment of such a treatment facility will depend on the organization's finances and capabilities.
- b. The remaining problems can be tackled through training programs.

#### "INCREASE QUALITY AWARENESS"

- Managerial level
  - gain managerial support for the development and implementation of quality systems (e.g., HACCP)
- Supervisory level
  - run training programs to introduce their role(s) and importance to the success of such systems
- Subordinate level
  - conduct training programs emphasizing the need and importance of good hygiene

- design picture boards or other aids for instructing employees on hygiene practices (e.g., washing of hands before work)
- have adequate orientation programs for all new employees

### 3.6 QUALITY CONTROL SYSTEM (HACCP)

Refer to Appendix 1 - FPC.

#### CCPs STEPS:

1. Fish temperature at receipt.
2.
  - a. Freezing fish not higher than - 18°C.
  - b. Refrigerated sea water cooling not higher than 1°C.
3. Uniform thawing of frozen fish.
4.
  - a. Rapid butchering operation.
  - b. Hygienic handling of fish.
5. Pre-cooking the fish with at least back borne temperature not less than 60°C.
6. Hygienic handling and good manufacturing practice.
7. Using clean empty cans.
8. Using the good quality salt and potable water for brine solution making.
9. Using good quality soy bean oil and heating it at 80° C to achieve high initial temperature.
10. Formation of sound double seam with double seam criteria (overlap, tightness rating, counter sink juncture rating and pressure ridge) thus complying with good manufacturing practice.
11.
  - a. Process temperature and time.
  - b. Pressure differentials during processing.
  - c. Thermographs of process.

Refer to attached sample sheet of HACCP for "Commercial Sterilization".

PROCESS	:	Commercial sterilization
HAZARDS	:	Survival of <i>Clostridium botulinum</i>
CCP	:	Process time and temperature
PREVENTIVE MEASURES	:	Ensure it is within tolerance levels; correct operating procedures (G.M.P).
CRITICAL LIMITS	:	Time < 75 min.; Temp. < 117°C
MONITORING PROCEDURES	:	

WHAT	:	Time and temperature control
HOW	:	Accurate control settings
WHERE	:	Retort unit
WHEN	:	During every operation
WHO	:	Retort operator
CORRECTIVE ACTION	:	If properly sterilized, then determine whether to re-sterilize by incubation tests before release/reject, on reject batch.
RECORD NAME	:	
VERIFICATION	:	M.I.G calibration once/6 monthly. Heat distribution and penetration once/annually.

#### 4.0 CONCLUSION

A quality system cannot be implemented and adhered to without the total involvement and/or commitment of people at all levels in the company.

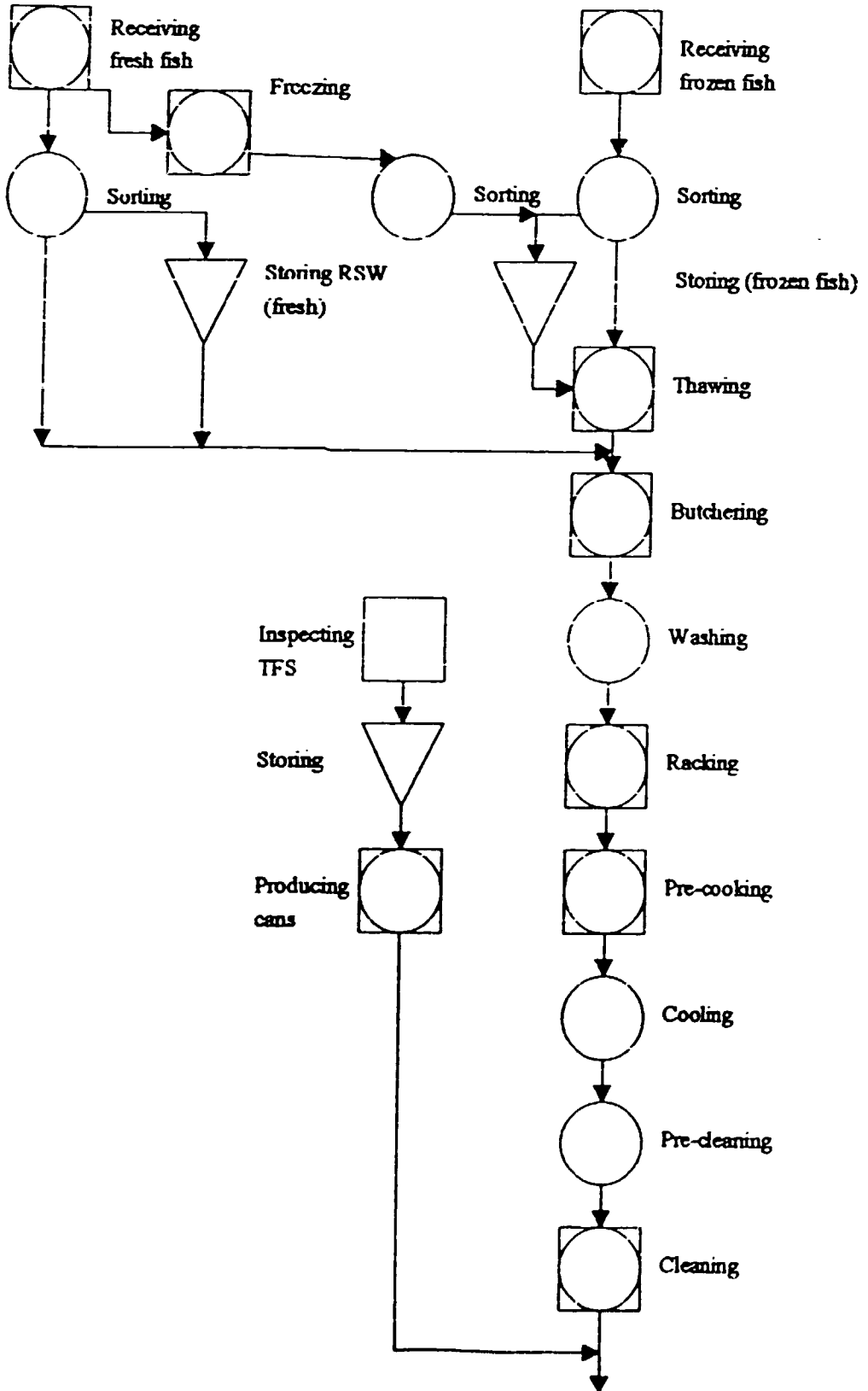
Though the initiative for quality improvement comes from top management, it would only be through the efforts of lower level employees (including subordinates) that it will be a success.

#### 5.0 RECOMMENDATION

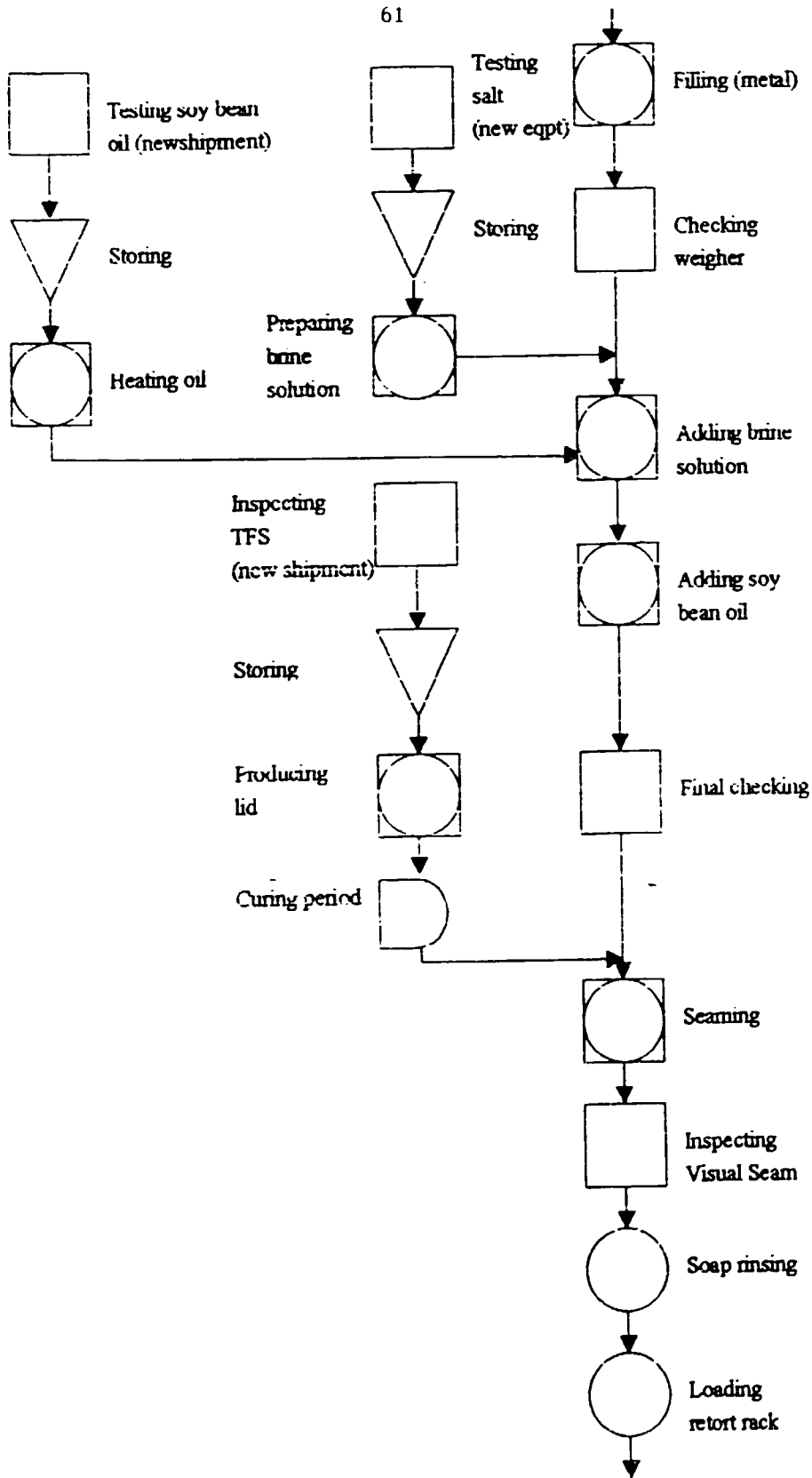
Pending the approval of this report, it is recommended that

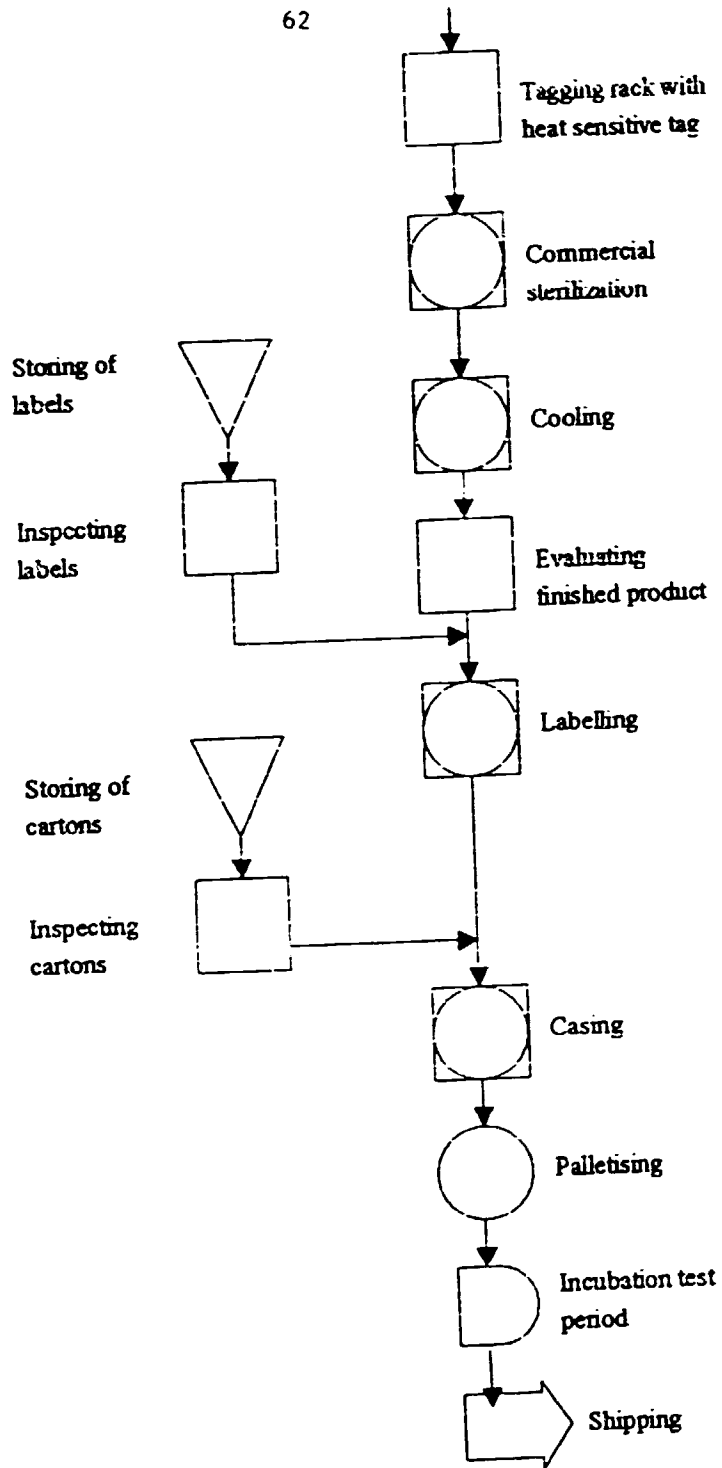
- a trial production be conducted for a period of one to two weeks.
- regular monitoring of the proposed quality management system be conducted to determine if it works effectively and efficiently.

**APPENDIX 1: FLOW PROCESS CHART FOR TUNA CANNING**








**Note:** RSW - Refrigerated Sea Water  
 TFS - Tin Free Steel





## Legend:

-  **Operation:** Operation occurs when the material deliberately changes its physical, chemical and microbiological characteristics
-  **Inspection:** Inspection occurs when the material is tested, checked, evaluated, measured, analyzed, examined, weighed, evaluated, sampled, etc.
-  **Storage:** Storage occurs when the material is stored in a known and controlled condition which does not affect its characteristics
-  **Transportation:** Transportation occurs when the material is transferred from the place to another without changing its characteristics
- D** **Delay:** Delay occurs when the material is kept in a temporary storage
-  **Combined Operation and Inspection:** Combined operation and inspection occurs where the inspection is carried out while the operation is taking place



**TRAINING COURSE ON QUALITY MANAGEMENT  
IN THE FOOD INDUSTRY IN ASIA AND PACIFIC LDCs**

from  
14 August to 1 September 1995  
at  
AIT, Bangkok, Thailand

**PROJECT WORK ON HEAD-OFF AND SHELL  
ON PROCESSING OF SHRIMP**

## INTRODUCTION

Shrimp is abundantly available in the area where the processing industry is expected to be set up. Shrimp, as raw material, is available from the natural source, i.e. adjoining sea and cultivation in the offshore areas. It is one of the important export commodities of the country.

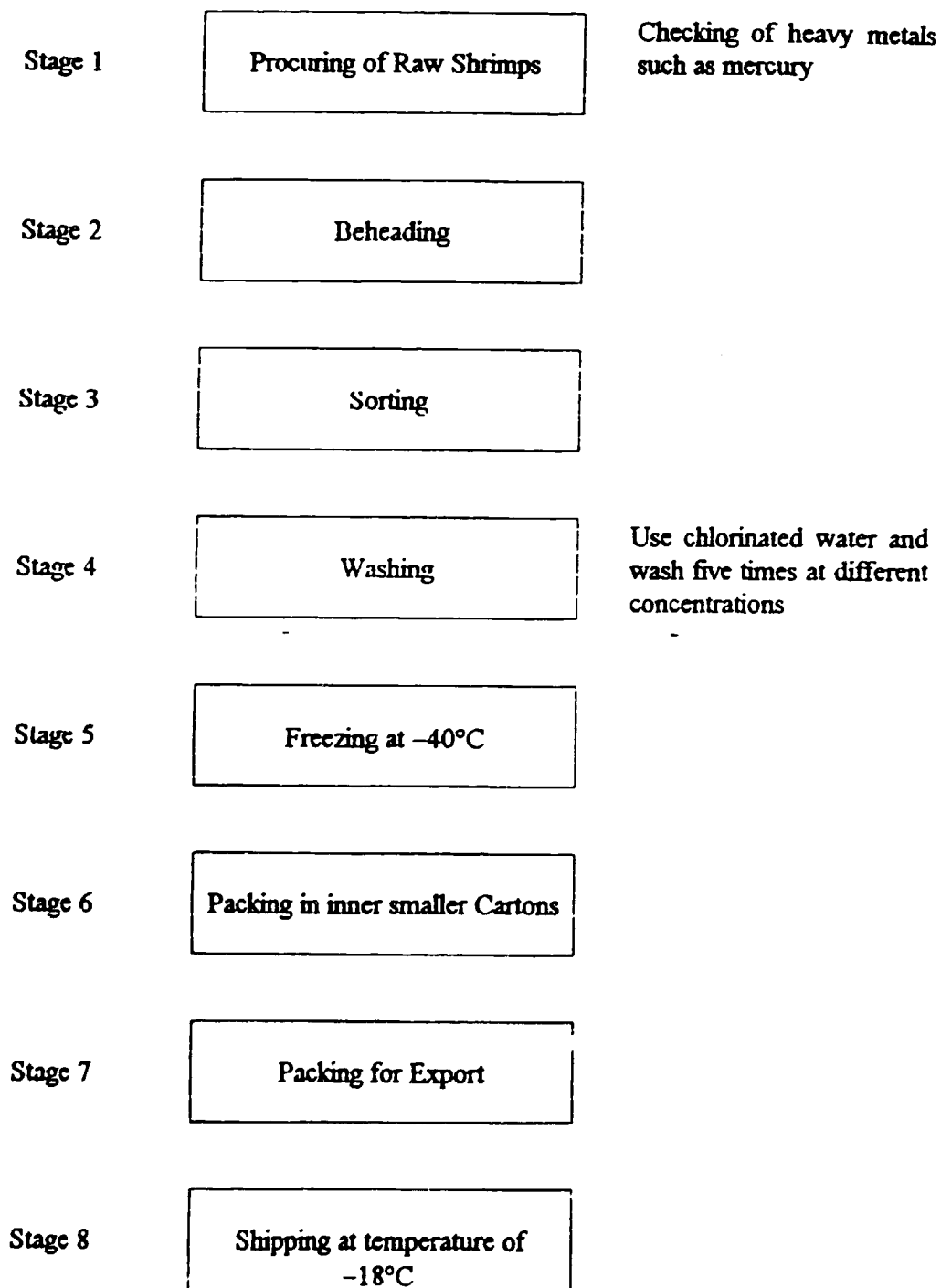
The country has exported frozen shrimps for a long time. It has, however, experienced rejection of the shipments by the importing countries a number of times, thereby incurring heavy monetary losses.

A critical examination showed that the lack of proper knowledge of processing technology has deprived the country of foreign exchange earnings, thus creating unemployment. To overcome the above barrier, it has become an imperative need to set up a new industry where shrimp could be processed scientifically.

In selecting the location of this industry, all infrastructure facilities has been duly studied. In choosing the capacity of a plant which can operate without interruption, availability of raw shrimp throughout the year has been calculated. Careful thought has also been given to advise and train the cultivators or fisherman so that the quality of shrimp remains as per standard. In planning the process layout, it has been observed that the major part of the processing plant can be fabricated from indigenous technology, with testing and quality control parts being imported. To utilize the leftover part of the shrimp, a by-product plant may also be set up for the optimum utilization of the raw materials.

The proposed plant, in addition to the above specifications, shall operate using the following scheme:

1. preparation of specification
2. preparation of training manual
3. preparation of testing manual
4. preparation of a manual to maintain hygienic condition
5. preparation of a manual for identification of critical points
6. preparation of a manual for preventive and corrective actions
7. training of the workers
8. storage of finished product

**PROCESSING OF SHRIMPS**

## PROBLEMS IN EACH STAGE AND POSSIBLE SOLUTIONS

### Stage 1 Procurement of raw material

Shrimps caught from deep sea areas can normally be taken free of any defects. But shrimps produced in sweet water may contain heavy metals since these are produced unknowingly in polluted water. Therefore, during procurement, every lot or batch should be checked for heavy metal, i.e. Hg, so that it would not be included in the processing since shrimp containing heavy metal is hazardous to the health. This step is, therefore, termed as a critical control point.

### Stage 2 Beheading

Beheading should be performed in hygienic conditions with properly trained personnel so that the maximum quantity of meat could be included in the shrimps.

### Stage 3 Sorting

Sorting includes grading and checking the quality of shrimps. Sometimes, shrimps with black or colored spots are found during sorting. These spots may be due to the growth of parasite over the meaty part of the shrimp. Therefore, during sorting, these shrimps must not be taken for processing. Care should also be taken to assess the masses of each group of shrimps so that a reasonable number of shrimps are contained in each kilogram package. This process should be carried out at controlled temperature.

### Stage 4 Washing

Washing to remove the dirt should be done a number of times with chlorinated water of various concentrations.

### Stage 5 Freezing at a temperature of 40°C

Freezing should be done within two and a half hours to prevent growth of bacteria. This is a critical control point, therefore care should be taken to avoid any error.

### Stage 6 Packing in inner smaller cartons

Packing is normally done in cartons with capacity of 500 grams and 1 kilogram and is performed at a constant temperature of -18°C.

### Stage 7 Packing for export

The cartons are placed into big boxes for shipment. During the packing operation, the temperature should not in any case vary. Random samples should be drawn and tested.

**Stage 8      Loading to the ship for shipment**

Loading to the ship for shipment should be done during night time to avoid deviation from the freezing condition which again may cause the growth of bacteria.

**CONCLUSION**

"Prevention is better than cure" is the philosophy behind total quality management. This can not be achieved without commitment by the top management. Quality cannot be one man's job. The major point of the quality problem can be overcome by monitoring and training. Quality management is, therefore, needed at every step of production process. Industrial meteorology, i.e. periodic calibration of measuring instrument, is one of the pre-condition of good manufacturing practice.

The consumers all over the world nowadays are very much conscious about health hazards including environmental pollution that comes from food industries. Food processing industries, therefore, should be cautious during hazardous analysis and critical control point to avoid corrective action. In most cases, corrective action does not prove fruitful and this leads to the rejection of the products and the loss of market share. To increase the market share, the manufacturer should acquire quality assurance capabilities including reduction of cost.

# **BEER MANUFACTURING PROJECT**

**BY: Mr. SOK MENG SE (Cambodia)  
Ms. VIENG PHONE VIRAVONG (Laos)  
Mr. JAMILUL HUQ (Bangladesh)  
Mr. PRAK BORETH (Cambodia)  
Mr. SENEKHAM VONGVORALATH (Laos)**

## PROJECT: BEER MANUFACTURING

Beer is an alcoholic drink that contains up to 9% alcohol. Different beers have different names according to their alcohol content, colour, bitterness etc. They may be termed 'Stout' 'Lager', 'Bitter', 'Ale' etc. Normally, Beer contains 4-5% alcohol.

Beer drinking has been reported as far back as 1000 B.C. However, it was only in the last 100 years that Beer is manufactured scientifically.

It is envisaged by the participants in this group to set up a Brewery in Cambodia with a daily production capacity of 600 HL in two shifts of eight hours each.

The per capita consumption of Beer in Cambodia is 1.33 C.L. The consumption is increasing annually at a rate of 2%. Presently, there is one Brewery at Cambodia with a daily production capacity of 600 HL/day while a second Brewery is in the process of being set up in Phnom Penh with an annual capacity of 17 million HL. Cambodia has to import Beer from Singapore in order to meet its demand. Thus, there is ample scope for setting up a third Brewery. This will not only meet the entire demand of the country, but there will be scope for exporting the surplus Beer to Japan where, market already exists as our market survey shows.

### The Process

Beer is manufactured from malt, hops, sugar, water and certain chemicals. Sugar and maltose are fermented using enzymes to form alcohol and carbon di-oxide. A process flow diagram of the process is given in Figure 1. The process is brief is given below:

- 1) Imported malt is sent to the Mill Malt, where malt is milled to a size of 1.5-2 mm.
- 2) Hot water at 50°C is added to the malt in the 'Mastune', where the mixture is heated from 50-66°C for 16 minutes and kept at that temperature for one hour. Then it is heated to 77°C for 10 minutes.
- 3) It is transferred to Filter Wort, where it is filtered, which takes 30-45 minutes. The product is known as "Wort".

- 4) The Wort is transferred to the Brew Kettle and heated to 104°C. Then sugar and Hops mixture are added. The mixture is boiled for 2 hours at 104°C. Then Wirfloc is added and the reaction is allowed to continue for 5 minutes.
- 5) The mixture is transferred to the Whirlpool to settle the flocs at 90°C for 30 minutes.
- 6) From the Whirlpool, the mixture is pumped through a pipe to the cooler. In the pipe the mixture is aerated by a compressor. Initially, the mixture, is cooled from 90°C to 45°C using water at normal temperature. Very cold water at 0°C is then used to cool the mixture down to 10°C. The entire cooling operation takes about 45 minutes.
- 7) The mixture is then transferred to the Fermenting Tank. Pure strain of Yeast (*Saccharomyces cerevisiae*) is added. The PH of the mixture is maintained at 4.5 while the temperature is controlled at 10-15°C. The enzymes break the mixture to alcohol and carbon di-oxide. The carbon dioxide is recovered and purified for later use. The fermentation takes between 7-10 days to complete.
- 8) The fermented Beer is stored in a Storage Tank for 30 days at 0-3°C.
- 9) After the storage, Beer is transferred to the centrifugal and filter press. During the transfer, carbon dioxide is injected into the Beer through the pipe. The filtered Beer is pumped to a storage tank and it is stored at a pressure of 1.5 bar. The quantity of carbon dioxide is checked here. If the content is less than 60, more carbon dioxide from cylinders is added.
- 10) In a separate section, 66 CL and 33 CL bottles are washed with Caustic Soda solution, rinsed and sterilized.
- 11) The sparkling clear Beer from the storage tank is filled in sterilized bottles in the filling room. It is then capped with crown caps.
- 12) The bottles are pasteurized at 60°C for 45 minutes, and then labelled and transferred to storage for distribution to the end users.



The above process is a very sensitive one and as such strict process and analytical control is necessary. In this case the entire process has to be computer controlled. However, at each stage, samples will be taken from time to time and analyzed. The critical process/quality conditions are given below:

- 1) At the Mill malt, it has to be ensured that the particle sizes are 1.5-2 mm. If it is too large, mixing with water will mean less dissolution and hence less carbohydrate. Too small diameter will mean process problems due to clogging.
- 2) The temperature in the Mashing has to be maintained to ensure that it reaches 50°C, 65°C and 77°C in the correct time. The time has to be 1 hour 26 minutes. Counter checks are necessary. Too much time will make the Beer too bitter. Too little time will make it less palatable.
- 3) The PH in the Brew Kettle must be 5.2. If it is less, measured amount of Sulphuric acid has to be added. This is for the yeast to survive in a later stage. The temperature must be maintained at 104°C.
- 4) The PH in the Fermenting Tank must be 5.2 in the initial stage and 4.5 at the final stage. The temperature must be maintained between 10 and 15°C. This is because the Yeast can be most active in this conditions while if the PH is too high or too low, or the temperature is higher or lower, the yeast either does not survive or the fermentation time is extended, other by-products are produced.
- 5) The Yeast strain must be pure *Saccharomyces cerevisiae*. This is absolutely essential. If the Yeast is found to be contaminated, the entire Yeast is rejected and fresh and pure strain of Yeast is used.
- 6) The cooling temperature has to be controlled precisely.
- 7) The storage time in the tank after fermentation is very important. If Beer is stored for less than 30 days, the Beer becomes 'Junk Beer'. It becomes stale. The temperature of 0-3°C is similarly critical.
- 8) The carbon dioxide content in the storage tank must be checked to ensure quality.

- 9) The bottles must be properly sterilized. They must also be non-alkaline. If the bottles contain caustic soda, it is a health hazard and these have to be washed and sterilized again.
- 10) The Beer must be pasteurized at 60°C for 45 minutes precisely since improper pasteurization may result in contaminated bacterial growth. If the temperature exceeds 60°C, breakage of bottles occur.

Although the process is computer-controlled, counter checks must be made. Samples have to be taken from each processes every 2 hours. These have to be analyzed in the laboratory to check various parameters such as PH, bitterness, acidity, microbiological analysis, alcohol content, original gravity (OG) etc.

Above all, total quality control measures must be maintained. As such the raw materials, chemicals, bottles etc. all must conform to the required quality. The quantity and specification of materials are given below:

#### Raw material (Daily requirement)

1. Malt 86 days @ 50 kg = 4,300 Kg  
 Spec - Dry Extract: 77-81%  
 Total Nitrogen: 10-12%  
 Soluble Nitrogen: 3.5-3.9%  
 Kolbach Index: 28-37

The malt will be imported from France.

2. Sugar: 10-11 bags @ 50 Kg = 500-550 kg  
 Spec - White sugar  
 Sucrose Content: 99.6% (min)  
 Moisture Content: 0.05% (max)  
 Colour: 150 ICUMSA (max)  
 Polarization: 99.5% (min)  
 Invert sugar: 0.1% (min)  
 conductivity ash: 0.1% (max)  
 loss on drying (3 hours at 105°C) - 0.1% (max)

3. Water 6,000 HL  
 Spec: Odorless, colourless and tasteless  
 Iron content - Nil  
 Manganese - Nil  
 Suspended matter - Nil  
 Calc. - Moderate  
 Sulphate - Moderate
4. Hops: Residual Moisture: 4.7-5.0%  
 Alpha Acid (Humulone): 5.6-5.9%  
 Beta components (dry): 7.9-8.5%  
 Hard Resins: 1.8-3%  
 Bitter value alpha + Beta/96 (dry): 6.5-6.8%  
 Various Hops will be required as given below:
- a) Aromatic Hop: 3 Kg
  - b) Hop Extract: 6 Kg
  - c) Hop Perlite: 6 Kg

Hops will be imported from Singapore, originally supplied from France.

Chemicals:

- a) Soda - D: 6 Kg
- b) Biotine: 3 kg
- c) Polyclar: 1.5 Kg
- d) Bioform: 3 kg

All the Hops will be imported from Singapore, country of origin being France/Belgium/Germany.

The quality management diagram has been given at Figure 2 & 3.

The final Beer specifications are given below:

- Bitterness: 21  
 Carbon dioxide content: 4.5+0.5 g/L  
 PH: 4.5  
 Alcohol content (V/V): 4.5%  
 Colour: 5 (EBC)

## Conclusion

The production of Beer involves several physical, chemical and microbiological processes. The process control requires rigid measures. It is a customer-oriented product and as such strict quality control measures must be maintained. It should neither be less bitter nor more. It must have the necessary 'holding' strength to ensure proper frothing. From the hygienic point of view, we must ensure that the product does not pose health hazard to the consumers.

All the analysis mentioned will be undertaken by chemists and microbiologists. The samples will be collected by operators. The overall supervision must be undertaken by the Production Manager. He will be aided by the Production Supervisor, Chemists, Microbiologists and operators. He must oversee that proper records are kept every 30 minutes by the operators. He must also ensure that the records are counter-checked and counter-signed. In case of accidents or sub-standard quality of production, he must fix up the responsibility to the guilty person. Since the project is a two shift one, he should be available for 16 hours. Above all, he must inform the company management of all the developments in the plant and process, whether there are any problems or not. He should also ensure that the plant is maintained from time to time. The computer works on data fed back from instrumentations. These should be checked and re-calibrated every one month.

The overall project is a profitable one. But that should not be a criterion of the efficiency of the plant. We must ensure that the data compiled, the analysis made, the marketing activity etc. must be recorded and kept for future references. The efficiency of a project does not depend on profitability and above all strict quality will ensure that the production of Beer will be a small step for this project towards a giant leap for future expansion, planning and implementation.

*Continuing Education Center*  
Asian Institute of Technology

**OPENING CEREMONY**  
**Training Programs**

**Quality Management in the  
Food Industry in Asian and  
Pacific LDCs**

14 August - 1 September 1995

Co-organiser UNIDO

**Training of Trainers on  
Project Implementation  
Management**

14 August - 1 September 1995

Co-organiser ADB

Venue: AIT CENTER AUDITORIUM

08:00-08:45

Registration

09:00-09:30

Opening Ceremony

Welcome Remarks

Dr. Nicanor C. Austriaco  
Executive Director, CEC

Keynote Address

Prof. Alastair M. North  
President, Asian Institute of Technology

Remarks

Mr. Ari Huhtala  
UNIDO Country Director

Mr. Barry W. Adler  
Senior Project Specialist, ADB

Closing Remarks

Prof. K. Harigopal  
Program Director, CEC

Coffee Break

**CLOSING CEREMONY  
AND  
AWARDING OF CERTIFICATES**

**Training Course on:  
Quality Management in the Food Industry in Asian and Pacific LDCs  
14 August – 1 September 1995**

**Friday, 1 September 1995**

**Venue: Rama Garden Hotel**

17:00	Start from AIT
18:00	Cocktails
19:00	Dinner
20:00	Awarding of Certificates
Welcome Address:	Dr. Nicanor C. Austriaco Executive Director Continuing Education Center
Address:	Mr. Mircea Dauthy UNIDO
Address:	Prof. P. Ricardo Pama Vice President of Academic Affairs Asian Institute of Technology
Awarding of Certificate	Prof. P. Ricardo Pama Dr. Nicanor C. Austriaco Prof. K. Harigopal
Participants' Response	Mr. A.S. Salahuddin Ahmed
Closing Remarks:	Prof. K. Harigopal Course Director Continuing Education Center
Vote of Thanks:	Dr. N.N. Nagarur Course Co-director Continuing Education Center
21:00	Group Photo and Departure

Master of Ceremony

Mr. Mukunda Raj Pandeya

Continuing Education Center  
Asian Institute of Technology



## CERTIFICATE

has satisfactorily completed the training course on

from to

at the Asian Institute of Technology  
Bangkok, Thailand

Course Director

Executive Director  
Continuing Education Center

# PROGRAM EVALUATION

PROGRAM Quality Management in the Food Industry in Asian and Pacific LDCs (14 August - 1 September 1995) WEEK: 1

Please complete this evaluation sheet giving your true and unbiased evaluation for each of the following instructors. Indicate your opinion on each question by encircling the appropriate number. The number represent an ascending scale with **1 the Lowest and 4 the Highest.**

DATE	15 August 1995	15 August 1995	15 August 1995	16 & 18 August 1995	16 August 1995
INSTRUCTOR	Dr. S K Pakshit	Dr. S Chayovan	Dr. Boonjit T.	Dr. Athapol N.	Prof. V. K. Jindal
TOPICS	Problems of Food Processing in Developing Countries	Food Industry in Thailand	1) Stru. of Food Industry 2) Scope & Problems	1) O/A of Food Processing 2) Post Harvest Tech'gy 3) Selection of App. ..	Food Processing & Quality Assessment

TOPIC COVERAGE	15 August 1995				15 August 1995				15 August 1995				16 & 18 August 1995				16 August 1995			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
The topics covered matched my expectations																				
My knowledge on the subject was increased																				
Much of the materials covered are new																				
The course materials are relevant to our organizations																				
<b>**AVERAGE</b>																				
PRESENTATION	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
The instructor presented the material at an intellectual level suitable to my experience and background																				
I found instructor knowledgeable in the subject area																				
The instructor showed how course concepts are applied to real problems in our organization																				
The instructor spoke in clear, precise language																				
I find presentation methodology effective																				
<b>**AVERAGE</b>																				
<b>OVERALL AVERAGE</b>																				

\* If one lecturer covers more than one topic, please use one column for one topic.

\*\*For Official Use Only



## PROGRAM EVALUATION

PROGRAM: Quality Management in the Food Industry in Asian and Pacific LDCs (14 August – 1 September 1995)

WEEK: 2

Please complete this evaluation sheet giving your true and unbiased evaluation for each of the following instructors. Indicate your opinion on each question by encircling the appropriate number. The numbers represent an ascending scale with **1 the Lowest and 4 the Highest.**

DATE	17 August 1995	17 August 1995	21 & 22 August 1995	22 August 1995	23 & 24 August 1995
INSTRUCTOR	Mrs. Suwalee C.	Mr. C. Perera	Dr. N. N. Nagarur	Mr. Satis S.	Dr. Preeya V.
TOPICS	1) Processing Tech. & Equipments 2) Gender Issues	Computer-aided Quality Control (Software Demonstration)	1) Quality/TQM 2) Est. of MOS	ISO 9000	1) HACCP Approach 2) Dev. & Imple. 3) Hazards & Control 4) HACCP G/Work

TOPIC COVERAGE	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
The topics covered matched my expectations																				
My knowledge on the subject was increased																				
Much of the materials covered are new																				
The course materials are relevant to our organizations																				
<b>**AVERAGE</b>																				
PRESENTATION	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
The instructor presented the material at an intellectual level suitable to my experience and background																				
I found instructor knowledgeable in the subject area																				
The instructor showed how course concepts are applied to real problems in our organization																				
The instructor spoke in clear, precise language																				
I find presentation methodology effective																				
<b>**AVERAGE</b>																				
<b>OVERALL AVERAGE</b>																				

\* If one lecturer covers more than one topics, please use one column for one topics.

\*\*For Official Use Only

# PROGRAM EVALUATION

PROGRAM: Quality Management in the Food Industry in Asian and Pacific LDCs (14 August – 1 September 1995) WEEK: 3

Please complete this evaluation sheet giving your true and unbiased evaluation for each of the following instructors. Indicate your opinion on each question by encircling the appropriate number. The numbers represent an ascending scale with **1 the Lowest and 4 the Highest.**

DATE	29 August 1995	30 August 1995	31 August 1995		
INSTRUCTOR	Mr. K. W. Boegl	Mr. M. H. Yousif	Mr. P. Molnar	Mr. M. Dauthy	
TOPICS	Food Standards/ Legislation	Introduction to Marketing	Quality Requirements for Processed Food		

TOPIC COVERAGE	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4						
The topics covered matched my expectations																									
My knowledge on the subject was increased																									
Much of the materials covered are new																									
The course materials are relevant to our organizations																									
<b>**AVERAGE</b>																									
PRESENTATION	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4						
The instructor presented the material at an intellectual level suitable to my experience and background																									
I found instructor knowledgeable in the subject area																									
The instructor showed how course concepts are applied to real problems in our organization																									
The instructor spoke in clear, precise language																									
I find presentation methodology effective																									
<b>**AVERAGE</b>																									
<b>OVERALL AVERAGE</b>																									

\* If one lecturer covers more than one topics, please use one column for one topics.

\*\*For Official Use Only

Training Course on:

**Quality Management in the Food Industry in Asian Pacific LDCS**  
14 August - 1 September 1995

**COURSE EVALUATION**

A. Please mark the appropriate block on the right to indicate your following items.

1. Were the subjects dealt with in this course appropriate in satisfying your need for your professional practice?

Excellent	Very Good	Good	Fair

Comments:

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2. Please rate the course book and other printed materials used in the course.

Excellent	Very Good	Good	Fair

Comments:

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3. Course organization and execution.

Excellent	Very Good	Good	Fair

Comments:

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4. Please evaluate the likely usefulness of the printed course materials for your reference in future professional practice.

Excellent	Very Good	Good	Fair

Comments:

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5. Please rate the usefulness of the new techniques, and procedures presented in this course in relation to their applicability to problems in your country.

Excellent	Very Good	Good	Fair

Comments:

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6. Over all view and evaluation of the course.

Excellent	Very/Good	Good	Fair

Comments:

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7. Please rate the usefulness of the course.

Excellent	Very Good	Good	Fair

Comments:

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- B. Which aspects or features of the course did you find the most interesting or useful, and which least ?

Please comment on these aspects. In order to assist in formulating future short course, please do not hesitate to mention any shortcomings. Your frankness will be appreciated.

Most Interesting	Least Interesting

- C. Would you consider participating in a follow-up short course on any aspects related or associated with the current course?

[ ] Yes [ ] No

Perhaps, depending upon subject area \_\_\_\_\_

- D. Do you think the subject matter of the current course would be beneficial to other individuals in your agency, ministry or firms in your country?

[ ] Yes [ ] No

## F. How useful was the field trip.

Item	Project	Very Good	Useful	Some what Useful	Not Useful
1	Jing Muad Co., Ltd.				
2	Sam Mai Kur Sausage Factory, Chonburi				
3	Bio-Thong Food Processing				
4	Nong Poo Milk Product				
5	Villages Activities on Dairy Cooperative				

## G. Services and Facilities.

Item	Services and Facilities	Very Good	Satisfactory	Fair	Poor
1	Welcome from airport / departure service				
2	Accommodation				
3	Lecture facilities				
4	Field work / labs facilities				
5	Quality of food at cafeteria				
6	Assistance given by Continuing Education Center for general needs				

7. Other (specific)

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- H. Please write down your comments about the course considering your own field of profession. (i.e. Owner, Manager, Etc.)

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*THANK YOU*

**TERMS OF REFERENCE**

Project XP/RAS/94/125

TRAINING PROGRAMME ON QUALITY MANAGEMENT  
IN FOOD INDUSTRY IN ASIAN LDCs  
Bangkok from 14 August to 2 September 1995

April 1995



## I. BACKGROUND

The Special Programme for the Industrial Development of Asia and the Pacific, launched by the General Conference of UNIDO in 1989, has focused on two industrial subsectors supporting the vital agricultural sector of the least developed countries of the region: agro-related metalworking and food-processing industries (GC.4/Res. 8 and 9, GC.5/Res.14). The priority areas to be addressed by the agro- and food processing industries were-identified in 1992-1993 through a process of research, expert missions to ten countries and a UNIDO/ESCAP Regional Workshop with representatives from most LDCs in the region. The report of the Regional Workshop and the subsequently completed reports on the development of the food processing industries in eight LDCs identified poor food security systems and quality control facilities as the key constraints facing the industry.

Limited capabilities in all Asian and Pacific LDCs in testing and quality control of food and processed food result in poor consumer protection and erratic quality in local markets and for export. Most LDCs have taken steps to introduce central standardization and quality control facilities, and attempts are being made to promote quality management systems in public and private food-processing enterprises. The institutional basis and development plans for the countries proposed to be invited to the training activities in this field are as follows (details are available in the country reports and country briefs in document PPD.R/166, prepared in 1993):

### BANGLADESH

The share of food processing industries contributes to about one-fourth of the total gross output and 21 % of the total value added in the manufacturing sector. The total employment in the food processing industries is close to one million. Most of the products cater the domestic market, but particularly in the marine-based industries the share of exports is rapidly growing. The Ministries of Agriculture and Livestock and Fisheries are responsible for the policies and plans, whereas the Institute of Food Science and Technology aims at, i.a., improving the nutritional status of the population. The Bangladesh Standards and Testing Institution (BSTI) under the ministry of Industry, strengthened through UNDP/UNEP project BHD/91/006, has developed facilities and capabilities for preparing standards and carrying out testing of selected food and processed food products. Other relevant institutions include the Bangladesh Agricultural Research Institute (BARI), the Bangladesh Food and Sugar Industries Corporation (BFSIC) and the Bangladesh Small and Cottage Industries Corporation (BSCIC).

### BHUTAN

The bulk of industrial enterprises is in the agro-industrial sector. Out of the ten medium/large agro-industries, three are fruit and vegetable processing plants, three distilleries, one flour mill and one plant each for animal feed, biscuits and dairy. Fruit processing has emerged as a major export industry. There are no central standardization or quality control facilities in the country. The Ministry of Trade and Industry supervises the industrial enterprises and the Ministry of Agriculture is responsible for R&D and extension services to the farmers.

### CAMBODIA

Food processing industries account for almost half of the entire industrial production. Capacity exists for sugar, vegetable oil, milk, soft drinks and fish processing for the local markets. The export potential for marine based industries is considerable. The Government has requested UNIDO to assist in formulating a programme for the establishment of a food safety system in the country and a preparatory assistance project XP/CMD/94/029 will be completed before the end of 1994. The institutions to be potentially strengthened by the multi-donor assisted programme will be the Technical Division of the Ministry of Industry, the laboratories of the Ministry of Agriculture and CAMCONTROL of the Ministry of Commerce.

### LAO PDR

Food processing industries in Lao PDR are very underdeveloped and include only animal feed, edible oil and coffee. There are so far no fruit and vegetable canning industries. The small business development programme of the Government, supported by the GTZ, UNDP and UNIDO, see food processing as one of the most promising potential industries in the country. There are no central facilities for standardization and quality control of fresh and processed food products in the country.

### MALDIVES

Processed fish is the country's export article. There are 39 small private firms engaged in the fish product export business. There is no specialized quality control adviser in the Ministry of Fisheries and Agriculture for the export of tuna and reef fish products. No capabilities and facilities are available for standardization, testing and quality control for local and export markets. The Government has emphasized the importance of quality control in all development programmes for the food processing industry.

### MYANMAR

Myanmar has a diverse and fairly developed food-processing industry catering mostly for local markets. Some standards and legislation are in place, but the training requirements for factory and laboratory staff are considerable. The Ministry of Industry No. 1 is responsible for the public and private sector enterprises in this field.

### NEPAL

Food-processing industries account for 15% of the manufactured value added and are characterized by a large number of cottage size industries, most of which are located in the eastern and central development regions. Food control programmes are geared to ensure food safety and prevent commercial fraud for the good of the consumers. The prime focus of the Food Control Agency is on achieving a good supply of standard food products, devoid of any hazards. The Nepal Bureau of Standards and Metrology (NBSM), established with UNDP/UNIDO assistance under the Ministry of Industry, is responsible for setting up standards, testing and providing quality certificates for a number of products. The Agriculture Enterprise Centre (AEC) attached to the Federation of Nepalese Chambers of Commerce and Industry, is the apex organization for food processing industries providing training and extension services to its members.

## SOLOMON ISLANDS

Food processing industries are mostly cottage-scale and have been assisted by the UNDP/UNIDO supported project for small business development. No central standardization and quality control facilities are available in the country. The Industrial Development Division of the Ministry of Commerce, Employment and Trade as well as the Ministry of Agriculture are relevant institutions for the development of these industries.

## WESTERN SAMOA

Some 25 food processing companies are registered in the country, involved particularly in copra, coconut and taro processing. The Department of Agriculture, Forests and Fisheries is responsible for testing, development, distribution, extension support and marketing of new crops. No central standardization and quality control facilities are available in the country.

The main reasons attributed to the poor quality management aspects of the food processing industries in these countries are the lack of trained personnel, lack of knowledge regarding the appropriate technologies for food processing, lack of information regarding the legislation pertaining to quality and lack of marketing networks and skills. Thus there is a need for personnel training to create awareness of the structure and problems of the food industry in the various LDCs, to make them realize the necessity of producing quality products and to impart to them the principles and techniques of improving product quality. To contribute to this goal, UNIDO intends to make use of the expertise accumulated at the Asian Institute of Technology (AIT) in Bangkok, Thailand, in providing training courses in quality management in the food industries, specifically tailored for LDCs following the results of the identification phase described above. The proposed training will form an integral part of UNIDO's special activities promoted for the development of the food processing industries in the Asian and Pacific LDCs.

## II. OBJECTIVES AND INPUTS

### A. OBJECTIVES

To increase the capabilities of 20 technical staff from food quality control and testing institutions and food processing enterprises from nine Asian LDCs in applying and disseminating knowledge in appropriate processing technology, product quality and marketing in the food industry.

### B. OUTPUT

20 technical staff trained in the above-mentioned field.

## III. DUTIES OF THE CONTRACTOR

The contractor will provide the following, in collaboration with the UNIDO backstopping officer:

- Premises and training equipment (including audio-visual equipment) for the training purposes.
- Access to AIT's library.
- Lecturers to cover all the proposed subjects (themes) (except themes M 3 (4), M 4 and M 6) and one training manager who will, in close cooperation with the BSO, contribute to the preparatory work including candidates' selection, finalization of the training programme and supervision of the implementation.
- One person who will deal with the trainees' personal matters.
- Arrangements for practical assignments and field visits.
- Compilation of the lectures, to be distributed to the participants during the training course.
- Any other documentation or material needed for the implementation of the training course.
- Secretarial support and other services if and when required.
- An administrative report of the course, including a complete set of revised lectures, taking into account the explanations by the lecturers in reply to the trainees' questions.

#### IV. DURATION OF THE TRAINING PROGRAMME

The training programme will have a duration of 3 weeks (20 days, travel days excluded). The contractor will, after conclusion of the contract, take the required steps as described in paragraph III so as to enable the conduction of the training course from 14 August to 2 September 1995.

#### V. PERSONNEL INVOLVED

The contractor will have to submit as part of his offer the CVs of the lecturers and other staff involved in the implementation of the training course. The above lecturers and staff should cover all the subjects and activities as requested.

#### VI. REPORTING, FOLLOW UP AND EVALUATION

The training programme manager at AIT will have to provide the BSO with the required inputs for the preparation of the final report. The contractor will be requested also to contribute to the final evaluation of the training programme.

#### VII. JOB DESCRIPTION FOR LECTURERS AND OTHER STAFF INVOLVED

1. The lecturers should be highly specialized in their field of activity and have long experience in the theme they will present. They should be fluent in English.

2. The staff involved mainly in the practical assignments and field visits should be specialized engineers with experience in food processing and quality management. They should also be fluent in English.

#### VIII. DETAILED DESCRIPTION OF THE TRAINING PROGRAMME

A tentative training programme is attached. Based on UNIDO's proposal the contractor should prepare the final programme, giving a detailed description of each presentation to be made. The contractor should also indicate the honorarium of each lecturer.

#### IX. DESCRIPTION OF THE PRACTICAL ASSIGNMENTS AND FIELD VISITS.

The contractor should include in his offer a detailed description of the work and demonstrations to be carried out during the practical assignments and field visits.

#### X. ADMINISTRATIVE COSTS

The administrative costs should include the costs for coordination, travellers' assistance, secretarial work, documents' reproduction, local transport of the trainees and involved staff. The above costs should be indicated separately.

**COMMENTS OF THE BACKSTOPPING OFFICER**

The "Training programme on quality management in the food industry in Asian LDCs" was held in Bangkok at the Asian Institute of Technology (AIT) from 14 August to 1 September 1995. The training course was very well organized. The combination of lectures and practical work carried out by the participants during the field visits used in this course proved to be successful and resulted in an increased awareness and upgraded skills of the 20 participants representing 7 Asian LDCs.

Such regional training should be repeated. However, specific follow-up activities have to be organized in the countries concerned in order to sustain the achievements of the training course.