June 20, 2011 (Monday) Pre-Congress Seminars

Ministry of Rural Development **Kossuth Lajos tér 11. Budapest V.**
CONFERENCE ROOM **Monday 10:00 – 18:00**

1.4. NEW QUALITY AND SAFETY REGULATIONS AND DEVELOPMENTS ON THE AGRIFOOD AREA

Seminar Chair: Zoltán Kálmán, Ministry of Rural Development, Hungary

16.20 Sensory Quality Measurement: The Case of Red Ribbon Bakeshop, Inc.
Miflora M. Gatchalian*, Quality Partners Co. Ltd., Philippines*
Marife Cruz, Red Ribbon Bakeshop, Inc., Philippines

Gatchalian, Miflora M. (Philippines), Member of the International Academy for Quality (IAQ)

She earned Doctorate's degree from the University of Tokyo in Japan, Master of Arts in Statistics and BS Food Technology degrees from the University of the Philippines (U.P.). Her graduate Diploma in Industrial Quality Control was obtained with distinction in Holland. Her certification as "HACCP and SCP (Sanitation Control Procedures) Trainer" was obtained from the Association of Food and Drug Officials Sea Food Alliance, FDA, United States.

She is a member of the prestigious International Academy for Quality and is the Philippine Counselor and Fellow of the American Society for Quality (ASQ). She is the Secretary General, *Emeritus* of the Asia Pacific Quality Organization and had been past President of both the Federation of Institutes of Food Science and Technology in ASEAN and the Philippine Society for Quality. She is the Founding President of the Philippine Association of Food Technologists. She received several major honours and awards. She has written and published a lot of books on Sensory Evaluation, quality and statistics, research articles in internationally peer-reviewed Journals. The 3rd edition of "Sensory Quality Measurement: Statistical Analysis of Human Responses" was launched in March, 2009.

SENSORY QUALITY MEASUREMENT: THE CASE OF RED RIBBON BAKESHOP, INC*

Dr. Miflora M. Gatchalian
CEO, Quality Partners Company, Ltd. PHILIPPINES
and
Ms. Marife Cruz
Quality Assurance Manager, Red Ribbon Bakeshop, Inc.

ABSTRACT

The ultimate judgment on any product consumed or service rendered is given by the end-user – the customer. Any decision for a repeat buy is determined by the personal satisfaction gained from its consumption or use by the consumer. For this reason, scientific approaches to sensory quality measurements that will define product characteristics, has increasingly gained much global attention during the last fifty years down to the present. One of the leading food companies in the Philippines, "Red Ribbon Bakeshop, Inc" (RRBI) had recognized the value of this tool and adopted it as one of their major spearheads in their meteoric rise in the bakery and fast food business. Yet, by year 2006, when a company review of strategic directions was necessitated, RRBI decided they also needed "rehabilitation" of their existing Sensory Evaluation Program. Together with their chosen external consultant-trainer, the RRBI Quality Assurance Manager designed a series of training and coaching in-house programs. This was expected to enhance employee capabilities for sensory quality measurement in the company's four major operations. The training, interspersed with regular coaching, covered in sequential fashion the following modules: (a) Basic Sensory Evaluation Methods; (b) Advance Sensory: Focus on Customer Satisfaction; (d) Panelist Selection, Training and Calibration; (c) Applied statistical Methods; (d) Statistical Process Control; and (f) Design of Experiments with Focus on Product Development and Improvement. The sensory programs were spread out with-in one year with regular twice–monthly coaching as each module was applied on the shop-floor after training. The Consultant's coaching activities, to ensure proper applications and corrective action (when needed), is continuing to date. Sensory score-sheets, designed as tools for the measurement processes were statistically-based covering data collection, hypothesis-testing, analysis, interpretation and reporting. Because of its highly scientific and statistically-based approaches, sensory quality measurement is now utilized beyond food and related products. This is used not only to determine customer requirements, but also to monitor one's performance in providing customer satisfaction relative to their competitors. ###

KEY WORDS: product profile, customer satisfaction, statistical analysis, panelist selection, acceptance test, human responses, experimental designs

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INTRODUCTION

The future of quality depends largely on how people in the industry measure and respond to customer requirements. Particularly in food and related fields, a company's profitability requires fast and immediate understanding of the end-users' desires and expectations. Thus, some tools to measure customer product and/or service specifications should be made available and practicable. Human responses are perhaps one of the most difficult to characterize especially because no two human beings are the same. How to obtain accurate data and information from each of the potential customer for use as guide in product development, sales/promotion and continual improvement is indeed a major challenge. In fact, in the last sixty years, sensory quality measurement had undergone continuous studies in its applications as a tool to gain greater understanding of the constantly changing customer requirements, acceptability and preferences particularly as it pertains to food and related products (Duxbury, 2005; Gatchalian and Brannan, 2011; Mielgaard, et al. 2006) .

In the Philippines, there exists a huge competition in the bakery and fast food business. Relative to this, Red Ribbon Bakeshop, Inc.(RRBI) is considered as one of the most successful companies today compared with its competitors. RRBI has several branches in different parts of the world, especially in the USA and China. Among their many quality-related practices, the company leaders believe that sensory quality measurement played a pivoting role in their leadership status. For this reason, the quest to "rehabilitate" the RRBI's "Sensory Evaluation Program" became a major goal of their Quality Assurance Department after the company conducted its organizational review in year 2006. To ensure success in this effort, the company hired an external consultant to guide the whole "rehabilitation" process until stabilization, which to date is still a work-in-progress.

METHODOLOGY

The Chief Executive Officer (CEO) of Quality Partners company, Ltd (QPCL), known to be one of the leaders in the field of Sensory Evaluation in the Philippines, was invited as the RRBI Consultant in their quest to "Rehabilitate" their "Sensory Evaluation Program". Together, the RRBI Quality Assurance (QA) Manager and the QPCL-CEO worked out a plan that would enable the existing RRBI Sensory Evaluation Program to become more stable and responsive. The following were the agreed specific objectives: (a) update data and information on the scientific approaches to sensory quality measurement; (b) strengthen the foundation for an efficient and effective sensory evaluation program; (c) increase and enhance the pool of trained panelists' capability to measure sensory characteristics of products during development, improvement, storage and distribution; and (d) Sharpen the tools for sensory quality measurement necessary for monitoring and prediction of their products' market performance.

To achieve the above objectives a design was prepared which would involve consultancy, training and long-term (three or more years) coaching at RRBI. The whole program, with full support from top management, would be led by the QA Department with participation of the other major company players such as the Departments of : (1) Sales and Marketing (S&M); (2) Research and Development (R&D) and (3) Production (Prod). Their respective representatives would join in the training programs, then use their acquired knowledge to support their important measurement requirements. They were also expected to actively participate in the improvement/ development of a pool of trained laboratory panelists. Those showing potentials for leadership would be further developed to become either

sensory coordinators or "expert judges". Based on the Consultant's long-term experiences in the development of a working "Sensory Evaluation Program" which could answer the set objectives, it was agreed to implement a training session one at a time, followed by coaching in a sequential fashion . The approach also took into consideration that RRBI had a few existing leaders with years of experience in sensory evaluation. But, there were many more who were either new or relatively new employees with little or no knowledge at all about concepts and practices pertaining to sensory quality measurement.

Within a period of three years starting early 2007, the training sessions included the following courses : (1) Basic Sensory Evaluation Methods (BSEM- 3 days); (2) Advance Sensory Evaluation – Focus on customer satisfaction (ASEM - 2 days); (3) Selection, Training and Calibration (STC-2 days); (4) Applied Statistical Methods (ASM-2 days); (5) Statistical Process Control (SPC- 3 days); and (6) Design of Experiments (DOE- 3 days). Participants serving as core sensory program implementers attended all sessions and depending on the respective Department's requirements, their selected representatives were sent to participate. As each program was completed, coaching visits were regularly done by the Consultant at which time, implementation approaches were reviewed and problems met during the process were studied for immediate resolution .

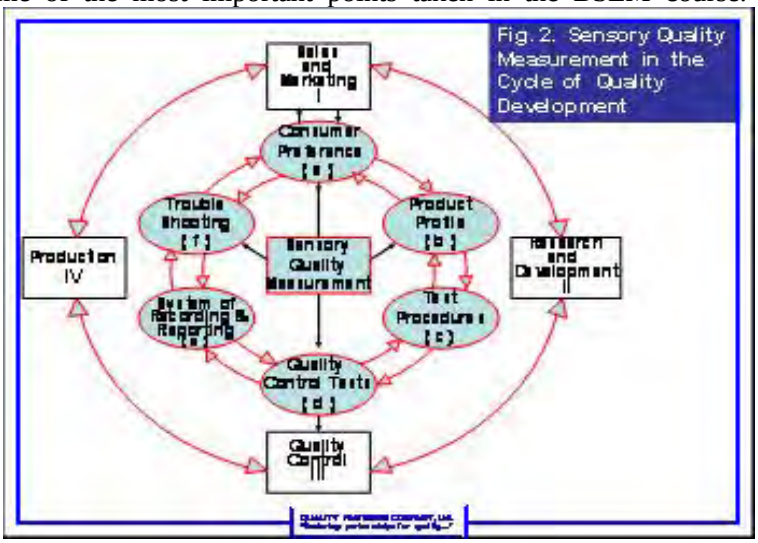
RESULTS AND DISCUSSION

The training programs had an average of 25 participants per session and these were conducted at the plant site of RRBI All courses included a discussion-forum on the theoretical basis of the major topics followed by hands-on workshops which enabled the participants to actually conduct the different sensory evaluation methods. From the evaluation results, they performed data collection, analysis and interpretation using appropriate statistical tools and techniques. After each set of completed workshops per session, a well-designed report was presented to share experiences with fellow participants. Then the outputs were processed by the Consultant, making them ready for final refinements.

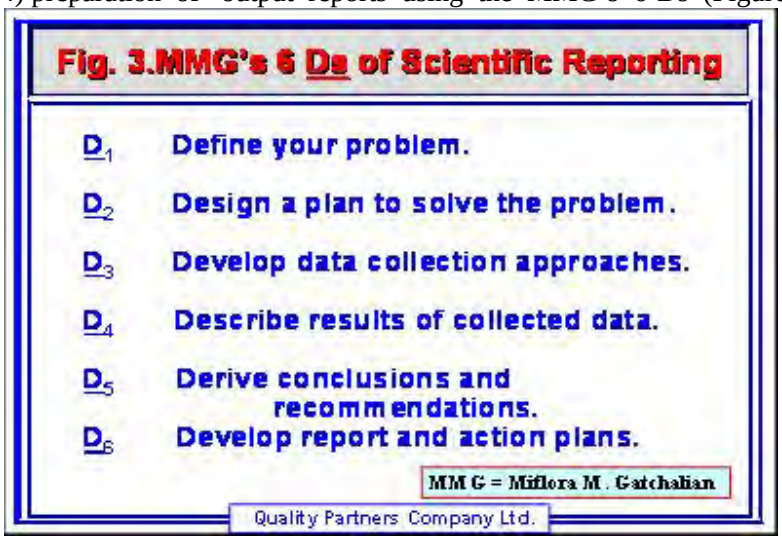
Basic Sensory Evaluation Methods (BSEM). The course started with a review of the participants' understanding of the definitions of "Sensory Evaluation" and the word "quality". Usefulness of sensory quality measurement, presentations of the basic sensory evaluation methods and their applicability to RRBI products (Figure 1) were discussed.

Fig. 1. RED RIBBON'S MEALS AND BAKERY ITEM SAMPLES

Also studied was the importance of sensory evaluation to the four major players in most food operations as seen in Figure 2's outermost circle (S&M, R&D, QA and Prod). The next inner circle show arrows that move clockwise where the quality development cycle starts with consumer preferences towards product profile, test procedures, quality control tests, system of recording and reporting then to trouble shooting ending with consumers (Gatchalian and Brannan, 2011). On the other hand, arrows in counter clockwise direction (inner circle) indicate that should there be trouble arising from customer complaints, the cycle can help locate the source of the problem. Generally, deviations from sensory quality expectations are known to be the major reasons for consumer complaints. Thus, with the product profile, there could be a better understanding of potential variations in characteristic which could be detected by trained laboratory panelists. As such, the role of the different types of judges as well as information on basic senses and their functions in sensory evaluation were some of the most important points taken in the BSEM course.



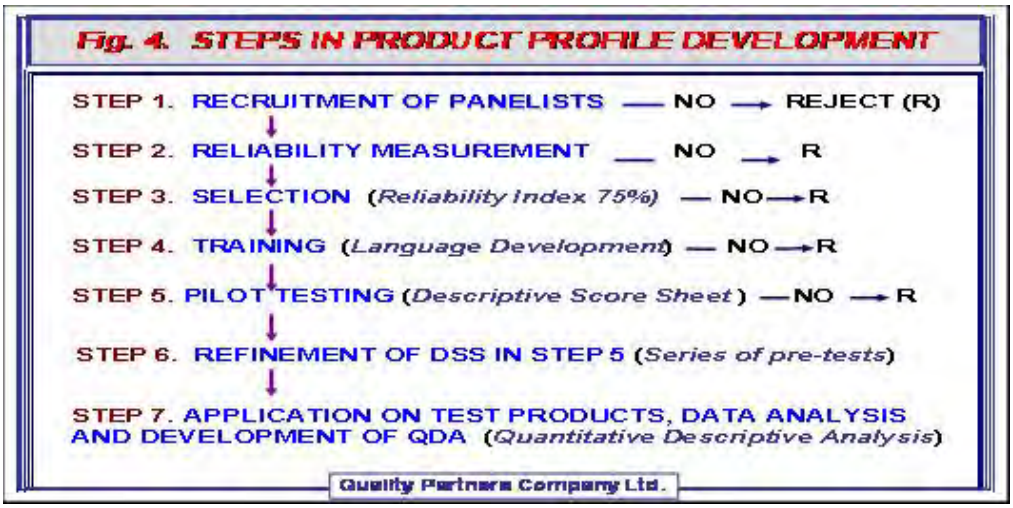
Major sensory quality measurement approaches which included tests for difference, acceptability and preference were experienced by the participants in the workshops. For this Course, the following were covered in the workshops: (1) preparation of coded samples for evaluation;(2) proper use of designed score-sheets; (3) data analysis using simple statistical approaches; (4) preparation of output reports using the MMG's 6-Ds (Figure 3); and (5)



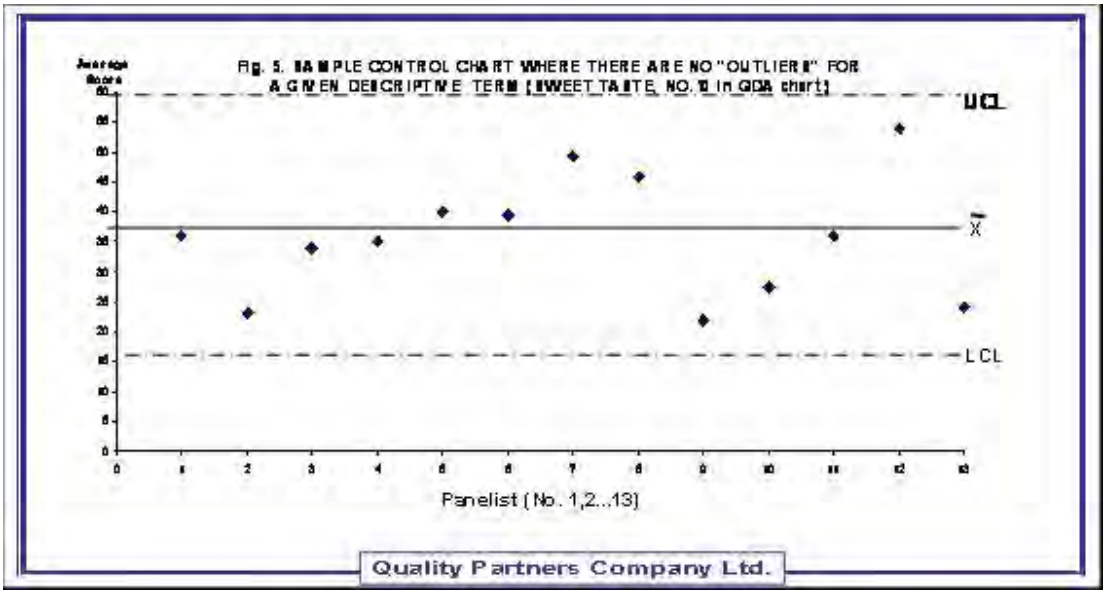
presentation of reports for constructive criticisms and improvement. The topics covered partly achieved "rehabilitation" program objectives (a) and (b) mentioned in methodology.

The QA Team continued to review all existing score-sheets, methods of product presentation, analysis and interpretation of data as the "rehabilitation" program progressed. Echo seminars on major applications of the BSEM were conducted, for other employees in RRBI, by the Core participants from the QA Department. The QA Team also evaluated the performance of existing laboratory panelists and prepared plans for their improvement where necessary. It was considered very important that the "rehabilitation" program should enhance their capability to determine customer requirements through sensory evaluation. There was also a need for continuing selection and training so that new panelists can be added to the dwindling numbers in the existing pool. All these concerns were discussed in detail during the coaching sessions and improvements in the approaches were designed into the plans being implemented .

Advance Sensory Evaluation Methods (ASEM). The company desired to give priority to the evaluation of their existing "bread and butter" products while still providing support to R&D in their new product development activities as regularly required by S&M. It was, thus, necessary to know how to facilitate understanding of product variations relative to the customers' ever-changing demands. The ASEM course focused on how to identify critical product characteristics required by customers to give them satisfaction while at the same time develop approaches to facilitate new product development. Use of acceptability test by hedonic ratings and preference tests learned in BSEM, now needed supplementary methods to focus on specific product characteristics. These were the approaches emphasized in the ASEM course and one such example is shown in Figure 4. The first step in product profile development started with recruitment of committed and skilled panelists who would



be willing to participate in intensive training towards the development of a quantitative descriptive analysis (QDA) for specific products. Utilizing this method, the sensory coordinator could identify product characteristics critical to consumers and monitor changes through time. One of the approaches to determine comparative panelist variation level is the use of Gatchalian Modified Control Chart (GMCC, from Gatchalian and Brannan, 2011). A sample is shown in Figure 5 where the performance of panelists in three trials are compared with others. In the evaluation of a product characteristic, like "sweet taste" of coconut meat..



Selection, Training and Calibration (STC). As the "rehabilitation" process progressed, the need to have an improved approach to panelist selection, training and calibration was felt strongly all through the stages of sensory program improvement. The existing pool of sensory panelists did not only have a high rate of attrition but it was also accompanied by the lack of evaluation skills. The planned program anticipated this situation and this was why there was continuous echoing of the major points of the BSEM to most potential sensory panelists. The STC was a highly specialized course with considerable statistical applications. It had several workshops that allowed the development of selection process through a survey and several tests that enabled determination of potential panelists' **W**illingness, **A**vailability, **C**apability, **S**ensitivity and **R**eliability (WACS-R) .

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Applied Statistical Methods (ASM). As the "rehabilitation" process continued, it became apparent that strength in the use of statistical tools and techniques was a most desired

capability among the RRBI employees involved with the program. This confirmed the plan to conduct statistics modules which included: (a) applied statistical methods (ASM); (b) statistical process control; and (c) design of experiments. One important application of ASM was the understanding and use of statistical requirements for sensory modules presented above. Also, *anchoring* sensory descriptions with physico-chemical test was emphasized to enhance the scientific basis of sensory quality determination. Thus, correlation and regression analysis would be needed to establish either simple relationship or predictive value between sensory and physico-chemical measures. For instance, Figure 7 shows that color score of cooked fish flesh where fresh (score of 3.5 below) or spoiled (3.6 above) had a negative correlation with *trimethylamine* (TMA) readings in raw fish.

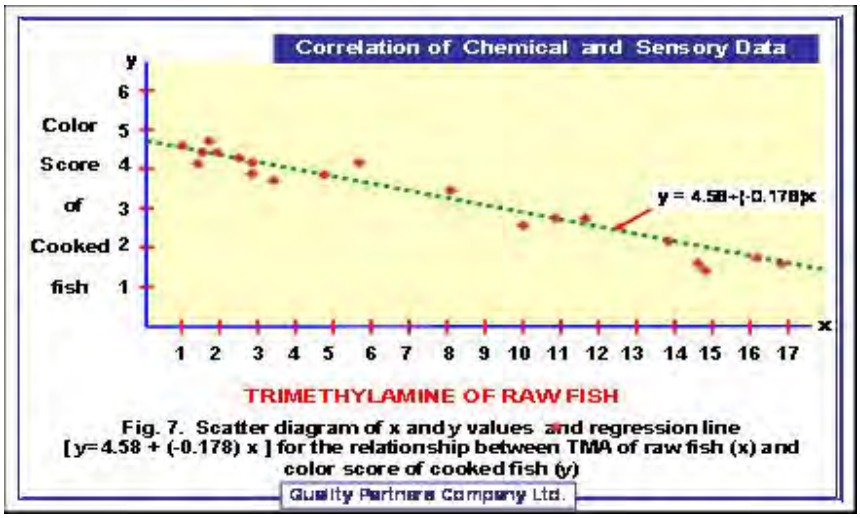
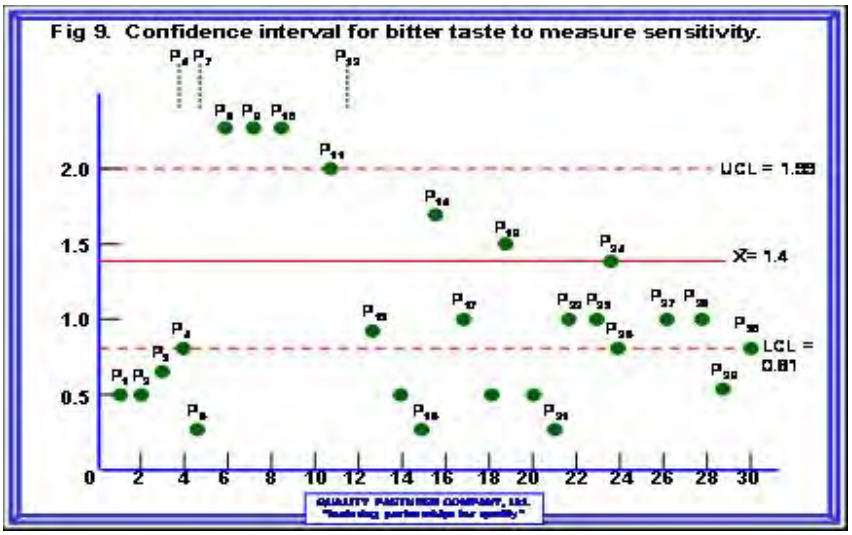


Figure 8 presents potential sensory panelists who went through a threshold determination test as part of the calibration process. Data collected from the series of tests would require statistical approaches such as data analysis, interpretation and interpretation.

Statistical Process Control (SPC). Process monitoring through the use of SPC approaches could be applied to sensory panelist's performance level (Gatchalian, et al.

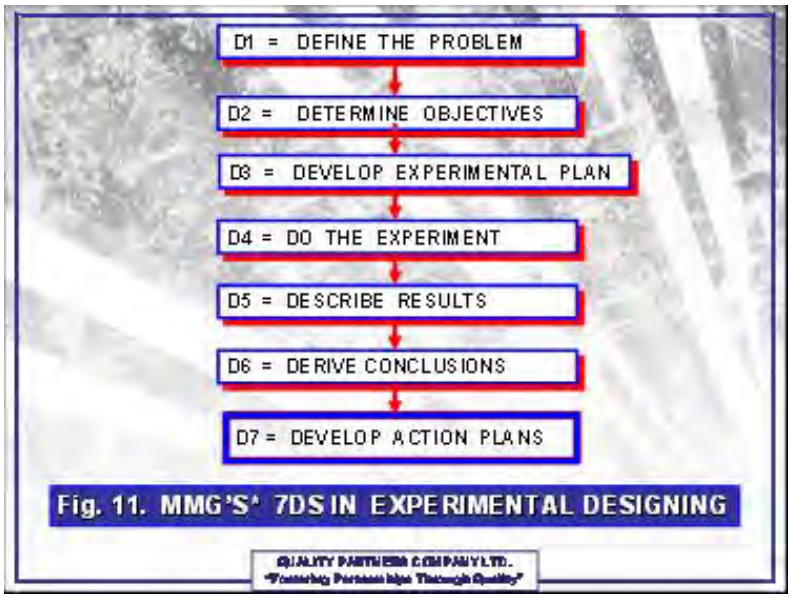
1991). This was employed to follow-through changes in their capability to perform evaluation activities (see Figure 5) as well as their relative abilities during the selection and calibration tests. Figure 9 presents the simulated control chart used in the determination of relative panelist performance in the test for bitter taste sensitivity. Panelists (Pi) who are highly sensitive to bitter taste are those "Ps" below the lower control limit (LCL) and those who could identify only at high concentrations are the "Ps" above the upper control limit (UCL). Those with average sensitivity to bitter taste are the "Ps' within the LCL and UCL control limits.



Design of Experiments (DOE). For the "rehabilitation" process, the DOE was deemed necessary particularly for R&D and QA. The course was expected to facilitate the improvement and development processes for the company products by virtue of its multi-variate capability to develop/analyze situations. S&M was always concerned with the speed with which existing product improvement processes are completed and more so was the urgency to be always the first to release new products in the market. Aside from speed, the company also wanted assurance of consistent and sustainable quality. Only through scientifically-based approaches utilizing the DOE can these requirements be achievable.

Although DOE had to start with concepts and theories , it also utilized simple workshops like the "card drop' game (Figure 10) which was later translated into factors and their treatment levels as they are applied to the RRBI product formulations and presentations. The participants were given the opportunity to set-up experimental designs from bi-variate to multi variate situations. Simulated results were later analyzed by various approaches like the analysis of variance and these were then presented as Team outputs in their daily workshops. Sharing of outputs enhanced understanding while at the same time allowed the Consultant to see mistaken applications or wrongly obtained interpretations.

The basic steps in the implementation of experimental designs is shown in Figure 11 where the *MMG's 7 Ds* show the steps from problem definition to the development of action plans after results of experimentation had been obtained. It was emphasized that problem definition is one of the most important steps in the preparation of experimental design and this would also determine the choice of design most appropriate for the study.



CONCLUSION AND RECOMMENDATION

RRBI is at present still continuing its quest to maintain a good pool of trained panelists who are regularly calibrated. Although both Jane Ali (the first QA Manager, 2006) who turned over the reigns to the current QA Manager, Marife Cruz (2008 to date) believe that the objectives of the "Rehabilitation" program were achieved, they signified their fears of a potential "backsliding" (drop-outs). This is the reason why it is very important that there is proper documentation for use to review performance. It is also important that regular refresher courses, selection, training and calibration must remain as major components of the " Sensory Evaluation Program". It is wise to remember that those who participated (Figure 12) in the training will need to be constantly appreciated and their capabilities continuously enhanced aside from the RRBI's incentive programs for all their panelists.

At this point in time, although the presentations mainly focused on sensory evaluation of food products, it may be worthwhile to mention that to date, the practice has a great global appreciation. Applications of sensory evaluation is now extended not only to food products but also to other commodities such as packaging materials, measurement of taint from paints in refrigerators, color and odor of textiles, consumer surveys for products other than food like comfort in car seats and other measurable human responses to commodities.

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