

The Philippine Statistical System and Total Quality Management

Burton T. Oñate ¹

ABSTRACT

The principles of Total Quality Management (TQM) as used in Industry are applied to the flows and processes of the surveys (censuses) of the Philippine Statistical System (PSS). Guidelines and details are given which appear to be a first contribution of TQM and its applications to statistical operations in the Philippines to generate quality (Q) data (the product), delivery (D) in time and at least cost (C). TQM approaches will be found to be remarkably useful, refreshing and motivational to the management and leadership, employees and "delighted" customers of the statistical agencies in the Philippines. Keywords: Humanware, Continuous Quality Improvement, Customer Focus, Benchmarking

KEY WORDS:

I. INTRODUCTION

1.1 Statistical Operations (SOs) and TQM

The Philippine Statistical System (PSS) is decentralized with a National Statistical Coordination Board (NSCB), a major statistical operating office (National Statistics Office) and other statistical bureaus and offices. Statistical agencies (SAs) in the PSS have been concerned with how to produce the finest quality (diversified) data and how to deliver quality services with the least cost. A simple model to produce quality data is a minimum Mean Square Error (MSE). But the SAs realize that their work consists of a systematic but interlocking flows of processes and operations (akin to Industry) where each process must pass certain quality improvements (Figure I-**Attachment I**) in order to generate the finest quality data (the product/service) from the surveys and censuses, etc at least cost. This principle is referred to as the Quality, Delivery and Cost (Q,D,C) of TQM.

"TQM Towards the 21st Century" was the theme of the International Conference on Quality (ICQ'96) held in Yokohama, Japan in October 1996 where TQM principles were discussed. On a broader scale, TQM includes such dimensions as: (1) Humanware (HuW): (a) Leadership and Management; (b) Human Resource Development and Management (Total Quality Care Management); (c) Customer Focus, Satisfaction and Expectation; (2) Hardware (HaW): (d) Quality Process and Product Control Management; (e) Quality of Operational Results; (f) Continuous Quality Improvements (CQIs) and Self Assessment; and (3) Software (SW): (g) Strategic Quality Planning (and Management); and (h) Documentation, Information and Analysis. Other criteria such as the Environment (i), Impacts on Society (j) and others have also been mentioned. The sources of these criteria are: the Awards (Hart and Bogan, 1992; George, 1992), Deming (Prize), ISO 9,000 and 14,000 certification series and other frameworks (Feigenbaum, 1996). TQM is applied to sectors of Industry and Business, establishments in the Philippine Standard Industrial Classification (PSIC) and has invaded

¹ Past President, Philippine Statistical System; Chair, Inter-Agency Technical Committee on Survey Designs, NSCB, and Affiliate Professor, University of the Philippines at Los Baños.

government activities such as health care management, education, finance, housing and many others (Gore, 1993; Hutchens, 1996). But TQM in statistical operations is not easily available in the global literature (Oñate, 1996a/b). One of the primary sub-goals of TQM is making delightful customers (Haller, 1996).

Objective of Paper. This paper is an initial contribution of the application of TQM in the statistical operations (SOs) of the PSS. This approach is known as benchmarking, one of the important tools of TQM, the results should be remarkably useful and refreshing to the management and leadership, employees and fieldforce of the PSS.

2. TQM IN THE STATISTICAL OPERATIONS (SOS) OF THE PSS

TQM in Statistical Operations (SOs). The SAs are establishments under PSIC code 72500. The commodity of, say, NSO is quality data which is subjected, as in Industry, to a series of quality processes and data quality control (Mears, 1990; Curid, 1994) at each process (sampling and non-sampling errors (NSEs) with lower and upper limits). There are multiple sets of data obtained from households, farms, establishments, etc. For simplicity, a good model, as a final arbiter, of good quality data is the minimum level of the Mean Square Error (MSE):

$$\text{MSE} = \text{Variance} + \text{Bias}^2$$

where:

Variance (σ^2 or S^2) is referred to as precision (not applicable to complete census) while Bias (Non-Sampling Error, NSE) as accuracy.

In SOs, there are sizes of households, farms, establishments, etc. and the variations are relatively much larger than the specs of Industry (six σ or no defects where σ is already very small). In the semi-conductor industry, there are multiple (hundred) processes with complex equipment and a thousand control points (electronically operated) before the quality commodity is produced (Mullinez, 1995). Also, the specs in Industry are measured with very accurate instruments (very objective) generally for inanimate (non-living) objects. In SOs, the data are collected on face to face interviews and/or mail and followed by telephone or other techniques but with direct contact with respondents (human beings)-rather subjective. The point specs on quality (precision) is:

$$\begin{aligned} \text{Coefficient of Variation (CV)} &= [S(x_{ij}) / \bar{X}_{ij}] 100\% \\ \text{of a given } x_{ij} &= \frac{\text{Standard Error of Sample Mean}}{\text{Population Mean } (\bar{X}_{ij})} 100\%, \end{aligned}$$

the level of (CV), say (1%, 5% or 10%) will depend upon the needs, requirements and expectations of the customers or users of the particular \bar{x}_{ij} . The overall NSE could be kept at a limit of 2 to 3%. Elements of TQM are applicable to the SAs in the PSS.

Correspondence: TQM in Industry and SOs. The criteria of TQM in Industry has correspondence with SOs which are important government activities in the circular processes of

agencies but the correspondence of the TQM criteria in Industry as applied to SA is not yet well appreciated in general.

3. TQM IN SOS OF PSS.

Applications of TQM Criteria on SOs. These criteria are arranged to illustrate the correspondence and application of TQM on the SOs. Elements of TQM can make remarkable improvements in the survey (or census) agency (the enterprise) with reference to the statistical processes and operations through "benchmarking", "standardization" and "continuous quality improvements (CQIs)". The interviewer (In) has a special relationship with respondents (Re) and serves as link between Re and the SA and these new TQM approaches can make Ins more efficient in the field work and promote more participation of Re.

3.1 Humanware (HuW)

Leadership and Management in PSS

There is no Board in the PSS. The NSCB may be termed as a pseudo- Board assisted by the Inter-Agency Technical Committees (IATCs) on Survey Designs, Population and others. The leadership of the SA must be an arouser of agency/community spirit with a shared vision and synergism in the SA to produce the desired quality data and deliver them promptly at minimum cost (Q,D,C of TQM).

This statistical leadership must also be a force for economic and personal growth of its workforce (care management in TQM), an advocate of the environment, as a vehicle for social change, incorporating local values and cultures (NSO and Ateneo de Manila University, 1994) into every aspect of the SA's work and is guardian of the SA's reputation and performance by adhering to the worldwide recognized principles of **independence, objectivity and integrity**. He/She must be an innovator for the improvement of the QOL of employees and the community, operate on a sound financial basis, (most funds are from taxes paid by the people based on the annual budget approved by Congress), a creator of career opportunities and financial rewards to all employees. A SA cannot convince its customers and users and its own employees that it is committed to CQI unless all its senior officers fully participate and are advocates in the CQ processes.

The quality of data is what the customers/users want and not what the SA and its officers believe quality should be. Also, the basic principle is to provide the quality service determined by the service receiver (customer, general public) and not by the service provider (producer of data) (Feigenbaun, 1996). Free world trade may bring new prospects of a comfortable life, a real hope of eliminating poverty and eradicating ignorance for the massive poor of the developing (Third) World by creating new scenarios in which knowledge (management (TQM), technical and statistical) will be the fundamental conditions for survival in the 21st century. The most important of these for any entity and society is the leadership and management (TQM) knowledge (F.Campos, 1996). Levels of Management must empower leaders and managers in SA to involve employees and staff in all CQIs which are within the Leadership and

to involve employees and staff in all CQIs which are within the Leadership and Management function (Oberg, 1996). This is benchmarking. What is the status in the PSS? in NSO?

Re-engineering and TQM are neither identical nor in conflict; they are complimentary. If a statistical agency (NSO) is seriously committed to TQM, then extreme care must be taken to carefully position re-engineering relative to this TQM program. TQM and re-engineering share a number of common themes - recognition of the importance of process and both start with the needs of the customers (users) and work backwards, a different approach to change management (Hammer, M. and J. Champy, 1993). Too often, re-engineering is stopped at its tracks due to the resistance of upper management (Administrators, Directors). Thus, J. Champy in his "Reengineering Management" (1995) provides guidelines on how managers or executives need to lead, organize, inspire, deploy, measure and reward the new work re-engineering creates.

Human Resource Development and Management (HRDM): Guidelines

Involvement of People. Greatest assets of SA are people who are encouraged to participate in CQIs. Quality Circles (QCs) dominate the workforce and useful suggestion schemes are rewarded accordingly. SA workers are treated as human beings and not as tools. Leadership and management must promote harmony between its personnel and technology (techniques and approaches). HRDM's key elements include employee involvement, education and training, well-being and satisfaction, performance and recognition, and human resource planning and management. The totality of this sub-goal area is called Total Quality Care Management (TQCM) in TQM. QC group creates social impacts and economic efficiency and benefits since the QC group can organize and motivate employees' activities for service, technology, quality, energy savings, consumption reduction, technological break-through processes, hardware, software and products and services development (Fang, 1996). Are there QCs in the SAs? In NSO?

TQM processes are focused on safety, order and cleanliness. SA areas for personal use such as bathrooms, rest rooms, lockers, kitchens, dining room, living room, medical services, etc. are given priority. Creating an environment that promotes habits that eliminate unsafe and unhealthy practices is a must. Also, management commitment is by doing rather than mere saying - care for people issues - improving the quality of life (QOL) of the workforce. Quality is manifested through the initiative of people, achieved by people but eventually to be meaningful to the satisfaction of humans/people's needs or eventually the improvement of their QOL (Inda and Icaza, 1996).

Quality of Life (QOL) and Quality as a Way of Life (QWOL) are fundamental issues. QOL addresses the balance and richness of how individuals and groups lead their personal lives as social areas of concern (SAC) of human development (Ofiate, 1997). QWOL, on the other hand, addresses the use of quality principles of TQM in all activities of SA. Workers who know that their working

more willing to improve efficiency and cut costs to produce quality data. These benefits accrue not only to Management (higher efficiency) but more importantly, to the general public (society and humanity) through higher data quality, better methods of data production, higher productivity, improved services, lower costs and a better satisfied customer market (the public) (Bester, 1996). Investing in SA's human capital or resources will lead to a healthy management bottom line (Rubinstein, 1996). Better quality data means more efficient and effective decision making. In 1991, NSO stated in its vision that "NSO's human capital is precious". What is the status of this vision?

Education and Training. SA's long range view on quality education and training to improve knowledge and skills for improved quality workers for technology transfer is a must. One of the foremost of these care factors is the education and training to generate quality employees (at all levels) who will manage the key processes of identifying, designing, changing and delivering standard quality data and services. SA workforce must be nurtured over time in terms of respect, mutual understanding and a common shared vision/philosophy on quality which will have synergistic effects at all levels (Tansuvan, 1996). The education process will change and expand to include life long learning requiring new quality contents and delivery vehicles and a more elevated understanding of the process of effective learning. What is the status at SAs? at NSO?

TQM will expand to cover all aspects of the quality of human life and its upgrading. TQM will involve not only data and process quality management and service quality but also SA's social responsibility (Dole and Copper, 1992) and improvement of the QOL of humankind including the protection of the quality of the environment (Makower, 1994). In 1991, NSO's vision stated that "its output (general-purpose statistics) is instrumental in the improvement of the QOL of the Filipino". What is going on now in NSO? How will this vision be accomplished?

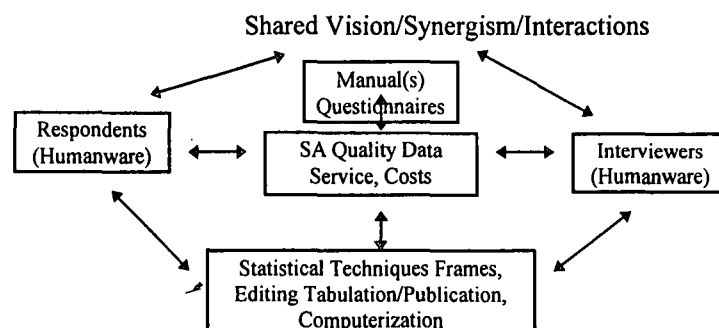
Customer Focus, Satisfaction and Expectation. As early as 1982, Dr. W. E. Deming advocated that the customer is the most important part of the production line and the quality should be aimed at the needs and expectations of the customers, present and future (Out of the Crisis, p.5,87,145, Chapter 6, 185). Deming's 14 points (Walton, 1986) fit into the principles of TQM and other quality frameworks (ICQ '96). Customers and the public in general always come first. Quality function deployment (QFD) translates these customer's wants into the design, requirements and built in at the source. Data banks on customers profiles, their current needs and future expectations must be made available at SAs. What do we have at NSO, and others?

Important factors affecting customers (users/public) satisfaction are: (Q,C,D); precision/reliability (minimum variation in data) and acceptable data (accuracy); customer's concept of values, practicability/usefulness, timeliness, new value ideology, esteem, uniqueness and plain satisfaction due to relevance. There must be a complementary program toward the satisfaction of the agency, stakeholders (public), employees, etc. for without this latter group's satisfaction and motivation, the sub-

employees, etc. for without this latter group's satisfaction and motivation, the sub-goal to meet customer's needs and satisfaction cannot be met. Even if all these sectors from customers to the workforce are satisfied, internally, the product may not be satisfactory to society at large - are SA's data vehicle for improvement of the QOL of the Filipinos? What is the quality of government policies and politics relevant to the statistics produced by the PSS? How about the negative impacts of graft and corruption in government and private sectors on these criteria of TQM? Total Quality Satisfaction (TQS) must consider the customer, agency, the nation and also the international level (Donovan and Samler, 1994). Is there an intersection of these satisfactions which could be used as a common ground for discussions at SAs? What is the status of NSO's 1991 vision on "the NSO response fast to the data needs of users and NSO ensures easy accessibility to what it generates and compiles"?

SA's customer delight and employee satisfaction must rank in priority for SA's success. Customers and employees alike respond positively when they understand SA's vision, values and its service proposition. Active communication of their ideals is vital to SA's projecting a shared vision and synergism. The five Ps that delight the SA's customers are : Product (what quality of data does SA offers); Price (what SA's charge/competitive/cost); Promotion (what SA communicates); Place (how, when and where SA delivers/services offered); and Perceptual (experience and reputation offered by SA).

Although SAs may use a mixture of strategies, these efforts or drives must bring the customers' voice in-house. Long term results of this strategy will keep SA's customers for life. What is the status of this strategy at SAs ? This strategy requires a CQI network and employees first loyalty is to the customers and not to the organizational chart. Employees cross boundary lines and work together to whatever it takes to delight customers and keep them for life. Managers at all levels at SA become Customers-Champion and a Coach or Counselor - an Integrator or molder of teams from cross-functional groups (Cannie and Caplin,1993). This is SA's vision and synergism by sharing talents, time and resources (Africa, 1991 and 1994).



3.2 Hardware (HaW):Details

Management Process and Product Control. As in Industry, SOs consist of sequences of Process Control which are: strategic planning and management (allocation of resources and schedules) and the quality instruments such as the

sampling errors [NSEs]. Other cognitive factors are the interviewers, respondents and the agency (NSO) (Figure I-Attachment I).

Quality of Operational Results. Each process (instrument) and humanware in the chart is subjected to process control and the results of this quality endeavor are documented. This approach is a dimension of Self-Assessment.

CQIs and Self Assessment. Factors for each instrument/humanware are evaluated as the basis of CQI to arrive at the quality of data. For example: (i) Questionnaire(s) - language, dialect, format, sequence of questions, others.; (ii) Manual(s) - documentations and consistency of concepts, definition and methodology, etc. over time.; (iii) Statistical Technology-Use MSE; change of design and estimation; NSEs and other cognitive studies in the chart.; (iv) Leadership/Management and the use of Internet in data collection in surveys and censuses. Some of the cognitive approaches for CQI in the SOs (processes) are given by Oñate (1994) and Tanur and Fienberg (1992). A CQI regarding change of design and estimation in the rural sector of NSO's Integrated Survey of Household (ISH) using a Combined Ratio with equal take vis-the old ISH Design 1990 is shown in Table 1. The range of efficiency is 250% to over 1,300%, with 6 provinces. Both precision (lower CVs) and cost (only 3 strata/province) are minimized. Is SA

Table 1 Rural Sector: One Percent Sampling Fraction, ISHINSO

Province (SAS)	Old ISH (Stratified)		Oñates' Design (Combined Ratio)	
	L	CV (∞)%	L*	CV (∞)%
Bohol	6	13	3	0.9
Bukidnon	5	8	3	1.5
Camarines Sur	8	7	3	1.8
Leyte	9	3	3	1.3
Misamis Occidental	3	13	3	1.4
Pangasinan	10	4	3	1.2

Note: Optimum Allocation and Equal Take, 3 Strata with Combined Ratio. Oñate, B.T. (1961,1990).

producing the CVs of its indicators at specific time periods? How about short cut methods for variance estimation?; (v) Self assessment of the SOs, closely linked to the strategic planning (management) processes, is a powerful means toward wider participation. In NSO where quality management is the goal, it is also a necessary condition to generate customer, stakeholders (public), employees and agency partners and society's satisfactions. From time to time, NSO must balance quality management with professional ethics (independence, integrity and objectivity) and must be fully aware of the big risk of taking care of the agency more than the social and economic system (society in general) which NSO is bound to serve (Conti, 1996). SA must also be an advocate of a healthful environment. What is the status of computer software development and re-engineering of tabulation processes?; (vi) NSO has spent millions of pesos for faster and smarter information technology (IT) but these related systems may have become so powerful that they have outstripped the capacity of NSO workforce to use them efficiently. NSO needs to develop and apply a major workforce - centered innovation (Winslow and Bramer, 1994), a design

capacity of NSO workforce to use them efficiently. NSO needs to develop and apply a major workforce - centered innovation (Winslow and Bramer, 1994), a design strategy which helps knowledge “smart workers” in NSO turn information into knowledge and eventually to technology as means of improving data quality and apply the new innovation as a component of CQI and self-assessment. How about the status of old and non-performing equipment and other assets?; and, (vii) Research and Development. Is the SA, say, NSO investing on new and old data series development and machine technology at a much shorter product life cycle? NSO corporate prestige is related to its R&D. Effective quality assurance is a working environment which is clean and comfortable and in harmony with employees. There must be a balance between operational or process requirements and the important needs for R&D. Operations and R&D are conflicting flows. What is the status in the SA? How does NSO balance these conflicting needs? Why are innovations in CQIs difficult in the SA’s surveys and censuses?

3.3. Software (SoW)

Strategic Quality Planning (and Management)

Management of Improvement. Quality is non-negotiable but quality is also so pervasive. With a shared vision there is no doubt that quality synergism will pervade throughout the SA hierarchy. If all are involved, they will feel like “owners” of SA, loyal, value oriented and motivated. Autonomous improvement where all employees manage for themselves the improved efforts and investment in people and equipment is a priority. Equipment must be relatively basic but used to improve SOs efficiently, eliminate waste and save on transportation and others. (ii) Long Term Planning (Management). Quality, service, delivery and cost (Q/S,D;C) are main objectives. Total commitment of senior management on a long term basis is stressed. One goal/one vision is a spiral upward movement from line (field) operators to the Administrator/NSO. (iii) Visible Management System. Operating data must be visible in the sections or shop floor. There is transparency and openness on management concepts. Lifetime employment is guaranteed, flexibility, job rotation, long term education and training programs are stressed. It may be worthwhile to benchmark NSO’s 1991 vision that NSO will “optimize the use of its resources in well-planned and coordinated activities undertaken under appropriate working environments”.

Documentation, Information and Analysis. Ample documentation on instruments used by SA in all its operations are made available in order to study the changes on a time series. In addition, analysis of the results of these activities (R&D) is a natural consequence of TQM. Thus, information and analysis must be a component of TQM with regard to the guidelines. The aspects on the environment and impact on society are important dimensions.

4. OPERATIONAL PROCESSES OF A PROBABILITY SAMPLING SURVEY: CONTROL POINTS AT EACH STAGE AND CQIS - DETAILS

4.1 Quality Processes and Quality of Data (the Product)

Operational Processes. The processes or flows of a probability sample survey is shown in Figure I-Attachment I. The criteria of TQM are applied to these flows. There are a number of instruments, namely: strategic quality planning and management, quality control checks for questionnaire(s), manual(s), sampling techniques (including minimum sample size), quality supervisors and interviewers, motivated respondents, quality checks on data collection and reduction, estimation and inference, editing, coding, data processing, machine (or manual) tabulations, data analysis, report writing, publications and minimum costing.

Quality of Data: These control checks will eventually generate the quality data with the following attributes: (a) precision (minimum standard error); (b) accuracy (minimum NSEs); (c) timeliness (just in time, JIT, in industry); (d) consistency (contents of questionnaire/manuals); (e) usefulness (relevance to problems of many users); (f) user-friendly-including its role in the circular process of planning and development (satisfaction and focus on customers, general public, etc.); (g) least cost (competitive prices/affordable to customers); and (h) quality of the operational results.

CQIs. Improvements in the quality of these instruments and humanware are implemented on a time series and correspond to the Continuous Quality Improvements (CQIs) and Self Assessment program, an important criterion of TQM. A major problem in the generation of quality data is the presence of NSEs which will affect accuracy. The presence of NSEs is a rather complex problem requiring a study of the sources and types of NSEs which have theoretical and practical consequences in surveys and censuses and on the quality (accuracy) of data (Oñate and Bader, 1992). Systems approach to data collection in micro area planning and development in Appraisal Reports is given in PPBMES (Oñate, 1978, 1997).

4.2 Conceptual Framework: Sources and Types of NSEs in Surveys (Censuses)

Sources and types of NSEs occur in sample survey (and census) operations as shown in Figure II-Attachment II which was developed by Oñate in 1987 and applied to households, establishments and farm holdings surveys. At different periods corresponding to the stages of the survey operations, it is observed that the universe (U_i) or the domain of study may also change. With this change, there is a change in the parameters, namely: N (population size), X (population total), \bar{X} (population mean), S^2 or σ^2 (population variance) and also in n (the sample size). As shown in the Attachment II, errors of various kinds will occur from the target to the inference universe. These errors include coverage, non-response, estimation, editing, tabulation and publication. With erroneous or missing data sets, the estimates will also be in error. These sources and types of NSE that arise at the different stages of the survey operation have to be minimized, carefully accounted for (adjustments) in the estimation procedures and considered in the reporting of the survey results.

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Additional CQIs and Self-Assessment on NSE

Accountability Tables on NSE. The fourth round of the ISH Labor Force Survey (LFS) in 1989 illustrates elements of CQIs and self assessment. The sampling, questionnaire and system flow designs including the operations flow of the ISH particularly the LFS were studied using Figure III-Attachment III. Manuals, procedures and other related documents were investigated (Oñate, et al, 1990). Attachment III shows the components of NSE in the ISH/LFS. The U_s were identified in correspondence with the characteristics, nature, operation and intent of the ISH/LFS. The flows were used to provide answers to: What sources and types of NSE are generated, the possible causes of such errors, and how can these be measured, controlled, and evaluated? What are the different response and nonresponse rates and/or their components in the ISH survey operations? This is called an "Accountability Table". The NSE rates must be defined even before the survey is conducted.

Measurement of Response and Nonresponse Rates. Each box in Figure III-Attachment III represents the number of households which is essential in the estimation of the different response and nonresponse rates. These rates could be used as indicators of the extent and magnitude of nonresponse errors and could be useful for Management's Quality policies/procedures. The leadership and management at ISH must set the control charts for each non-response rate given below as one of the important measures for standard accuracy of data.

Definitions. Rates obtained from Figure III-Attachment III are: (i) Brgy non-response rate = Box (12) / Box (11); (ii) Brgy response rate = Box (13) / Box (11); (iii) **HH non-response rate = Box (19) / Box (17)**; (iv) HH refusal rate = Box (26) / Box (17); (v) Not-at-Home rate = Box (28) / Box (17); (vi) Item non-response = Box (30) / Box (29); (vii) Item response rate = Box (31) / Box (29). ISH/LFS does not have a long series of R and D related to NSE. In the 4th Round, 1989, the following data were obtained on (iii) **HH non-response rate = Box 19/Box 17.**

Table 2 HH Non - Response Rate = (Box 19 / Box 17)
(Percent - %)

Region / Province	Non-Response Rate at First Visit	Substitution Rate after First Visit (Call Back)
Nat'l. Cap. Reg. (NCR)		
Pasig	14.5	9.9
Mandaluyong	16.0	7.4
Manila	17.1	16.2
San Juan	23.9	20.9
Makati	44.8	31.4
Reg. I to Reg. XII	Ranges	11.5 to 19.4
		3.2 to 9.5

Source: Oñate, et al. 1990. op. cit

that (a) on-going survey maintains a given *nr* rate only by increasing their efforts to contact sample households. If not, *nr* rates will increase (In 1991, the *nr* rate in Sweden ranged from 14% for the Labor Force Survey to 21% for the Living Condition Survey); and (b) demographic characteristics of refusers are gender, age, income, education, race and household size. The trend worldwide is high; *nr* rates in the Central City (say Makati), lower in Outer City and Suburbs (San Juan) and lowest in Rural Areas (Region I to XII) for ISH/IFS.

Control Charts For Non-Response Rates (*nrr*): In the PSS, there are a number of large scale surveys, where resources are allocated for the control of NSEs, leading to more accurate estimates of key indicators. A major concern of NSEs is non-response rate. ISH has a long historical background. Its forerunner is the Philippine Statistical Survey of Households (PSSH) which was implemented in mid 1950's and is a panel quarterly longitudinal survey with some rotation. The sample size is relatively large $\gg n = 6000$. There are suspected auto-regressive process and data are auto-correlated (Hapuarachichi and Wronski, 1994). In Industry, the measurements are assumed independent and normally distributed with seasonal and cyclical fluctuations. Thus, Woodall and Faltin (1993) give a good summary of statistical process control when data are autocorrelated. With the Canadian Labour Force Survey (1984 to 1993), a modeling procedure using Box and Jenkins (1974) or Pankratz (1983) approach is:

$$(1-\theta)(1-\theta^{12})X_t = (1-\theta_1\theta)(1-\theta_2\theta^{12})e_t$$

where $X_t, t=1, \dots, n$ is a time series

θ is the backshift operator such that $\theta X_t = X_{t-1}$

n is the number of observations in the survey

θ_1, θ_2 are coefficients, and

$s=12$ is the period of seasonality (monthly)

θ_1 and θ_2 are estimated by maximum likelihood and solved as $\hat{\theta}_1=0.54$ and $\hat{\theta}_2=0.75$

and the estimated model becomes:

$$(1-\theta)(1-\theta^{12})X_t = (1-0.54\theta)(1-0.75\theta^{12})e_t, t=1, 2, \dots, n$$

The residual, r_i , is independently and normally distributed

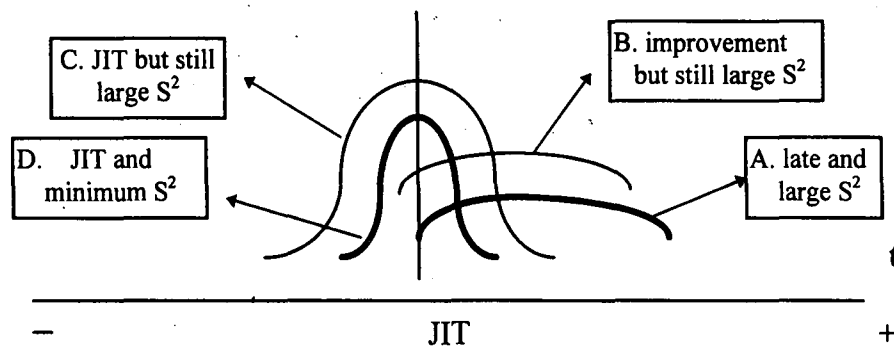
So, $\bar{r} = \sum r_i / n$ and $s_{r_i} = [\sum (r_i - \bar{r})^2 / (n-1)]^{1/2}$ are the sample mean (\bar{r}) and standard deviation, s_{r_i} , respectively. The control limits are $\bar{r} \pm 3s_{r_i}$, where $\bar{r} = 0$, $s_{r_i} = 0.353$. The upper control limit (UCL) = $0 + 3(0.353) = +1.059$ and the lower control limit (LCL) = $0 - 3(0.353) = -1.059$. Any point that falls outside the UCL and the LCL is considered out of control and action is taken.

Timeliness or Just-in-Time (JIT) principle of TQM is another important dimension. In the PSSH, later, the ISH, the schedule of the release of data was generally late with large variation (A). This improved but still the variance remained high (B). Through CQI, the

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Figure IV
Timeliness in the Release of PSSH/ISH Results
(sequences A to D)



The control charts by the size of households (i) and urban/rural (j) in minutes to accomplish the Interview Per Respondent are indicated by $X_{ij} + S_{ij}$. If length (L_i) of interview falls outside this limits, the Interviewer (I_n) will explain why too short or too long using the following factors: Type of respondents, time of day, prevailing weather and socio economic variables, gender or sex, age, income, educational level, translation of English to the dialect, free for all v.s. verbatim, work done by respondents, his behavior at first visit, frequency distribution of negative, positive comments, time delay and questions. Separate control charts are indicated-narrow limits in highly urbanized areas and wider limits in purely rural sections. Some data (Oñate et.al.,1990) support these observations but must, however, be an element of CQI. Thus,

Manila City	: $17 + 9.0$ (minutes)
Camarines Sur	: Urban : $23.0 + 10.0$
	Rural : $26.0 + 10.0$
Leyte	: Urban : $30.0 + 17.0$
	Rural : $32.0 + 17.0$

Only one sigma is used to make the length of interview a little bit restrictive since length (L_i) is an important indicator in the strategic quality planning (and management) - JIT,

adult son/daughter(3) and relatives(4) to provide equally good quality data - measurement errors. How about Non-relatives(5) who provide about 13.1% of 1990 data from Makati? (Table II).

Table 3 Distribution of Type of Respondents (Householders) in Percent During the First Visit (ISH) National Capital Region (NCR) and Non-NCR. 1990

Area	Type of Respondent									
	Urban					Rural				
	1	2	3	4	5	1	2	3	4	5
Whole NCR	28.4	44.1	12.3	7.3	2.8	---	---	---	---	---
Makati	28.6	39.6	11.0	7.5	13.1	---	---	---	---	---
Mandaluyong, San Juan	36.4	45.0	10.1	8.5	0.0	---	---	---	---	---
NCR IV	27.5	56.9	9.6	5.3	0.6	---	---	---	---	---
NCR VII	25.1	46.3	20.8	6.8	1.0	---	---	---	---	---
Non-NCR	40.0	46.0	10.0	3.0	1.0	46	40	70	20	1.0

Source: Oflate, et.al. Op.cit. Table 9/10. Unpublished. 1990.

Code: (1)Head, (2)Wife, (3)Son/Daughter, (4)Relative, (5)Non-relative, --- no entry

Incentives and Advanced Letters: When Res (householders) are exposed to Re burden and physical strain, unpleasant questioning, painful medical examination, opportunity costs of answering and locating records, the motives for giving incentives are based on the economic exchange theory. The giving of incentives will depend on the survey, country and culture (See Table III-Attachment IV) as guidelines for **policy on incentives**. In the Philippines, the giving of incentives has not yet been formally adopted due to many reasons. Will the participating respondents receive the incentives? But the non-response rates in Philippines surveys (censuses) are high and a policy on the use of incentives will have to be studied and applied to reverse the trend which is happening even in developed statistical systems. Measures are needed to reinforce the response behavior in the Philippines. In addition to incentives, advance letter or announcement should at least contain simple, honest but concrete information on all aspects of the survey. These letters appear to improve the participation in the surveys (Luppes, M., 1994). What is the status of incentives and advanced letters in PSS? This is another dimension of CQI.

Interviewer (In) Profiles for CQIs: Link to Re and SA. The In is the key link and vehicle of communication between the SA and the Respondents (Re). SA is represented by the Management, Supervisors and Researchers. In communicates with the Re the purpose(s) of the survey, importance of Re's participation and then collects the data (use of Questionnaire/Manual) from the Re. In turn, In communicates to the SA the characteristics of the Re and the non-Re, Re's reactions and substantive responses to questions. Behavior coding involves analysis of behaviors of both interviewers and respondents using recorded interviews and coding respondent behavior without recording which is more objective, less cost, more coverage, better timeliness and useful to the redesign of long and complicated questionnaires and when pre-tests involve a relatively larger sample of interviewee. (Burgess and Paton, 1994). The PSS could consider the aspect of behavioral coding in its surveys. There is little documented experimental research to support the view that the same

purpose(s) of the survey, importance of Re's participation and then collects the data (use of Questionnaire/Manual) from the Re. In turn, In communicates to the SA the characteristics of the Re and the non-Re, Re's reactions and substantive responses to questions. Behavior coding involves analysis of behaviors of both interviewers and respondents using recorded interviews and coding respondent behavior without recording which is more objective, less cost, more coverage, better timeliness and useful to the redesign of long and complicated questionnaires and when pre-tests involve a relatively larger sample of interviewee. (Burgess and Paton, 1994). The PSS could consider the aspect of behavioral coding in its surveys. There is little documented experimental research to support the view that the same interviewers return to the same respondents in order to maintain the already established rapport and good response rates in longitudinal surveys. What are the correlates of non-response examining characteristics of interviewers (number of nr household and adults of working age, gender), response variable and interviewer continuity indicator through the qualitative impressions of the interviewer (Campanelli, 1994)? Should the PSS maintain interviewer continuity? To what extent is it possible? ISH uses inter-penetrating samples which could expand the CQI study to include non-response attributes. In 1991, NSO stated in one of its visions that "The respondents sow the seeds. The NSO nurtures these to fruition". What is the status of this vision?

Fieldworkstrategies, Quality Processes and Product Control and CQIs: Benchmarkings on Interviewer (The Link) are shown in **Attachment V** while the **Other Concerns on CQI** in **Attachment VI**. A **checklist** contains aspects of TQM at various stages of the statistical operation. The criteria for quality data are presented at critical points of the TQM processes. This checklist is rather voluminous and is not attached to this paper. These principles, criteria and tools of TQM are presently (1997/1998) being applied to the activities of the National Statistics Office (NSO).

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ATTACHMENT II

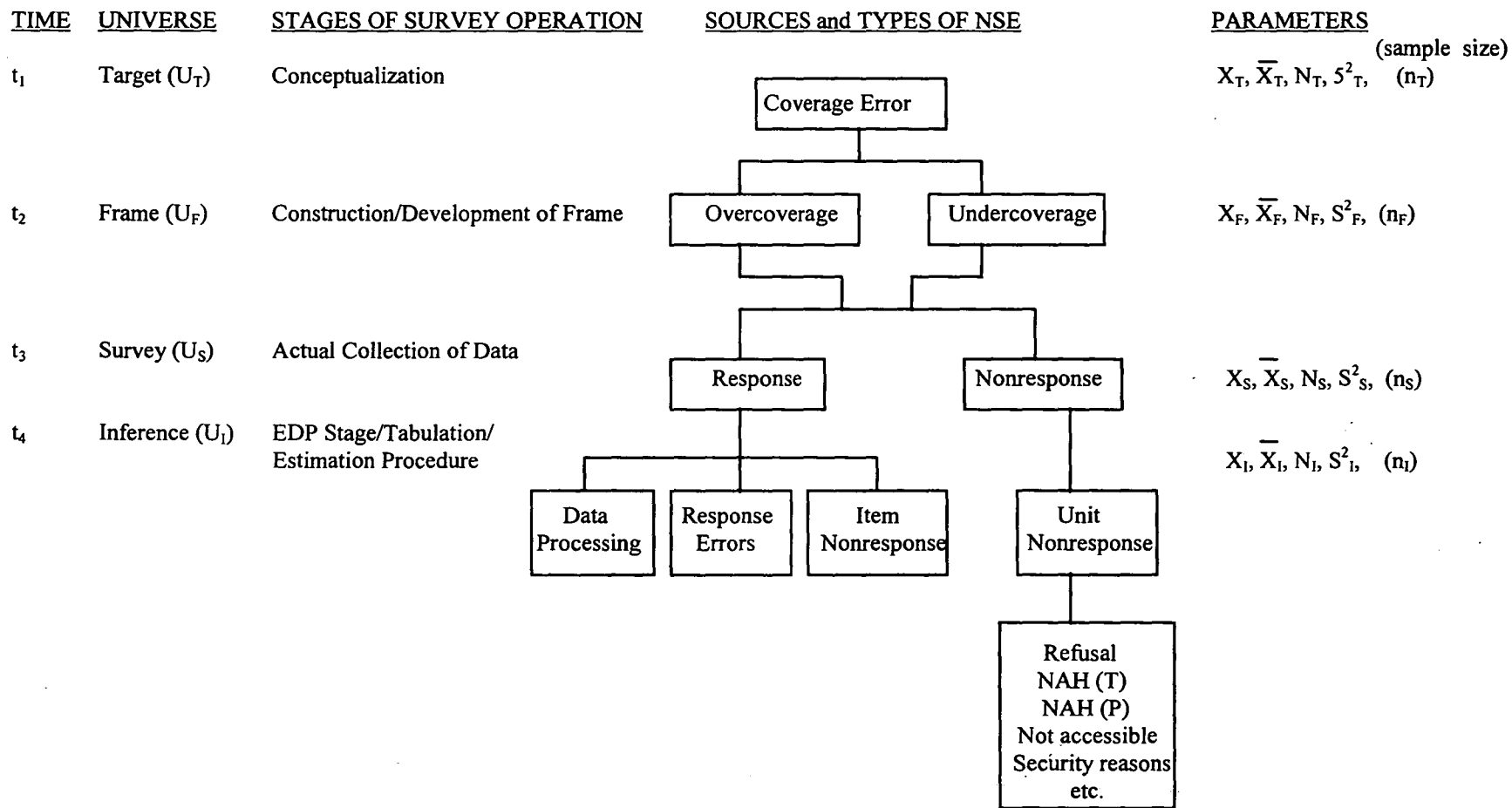
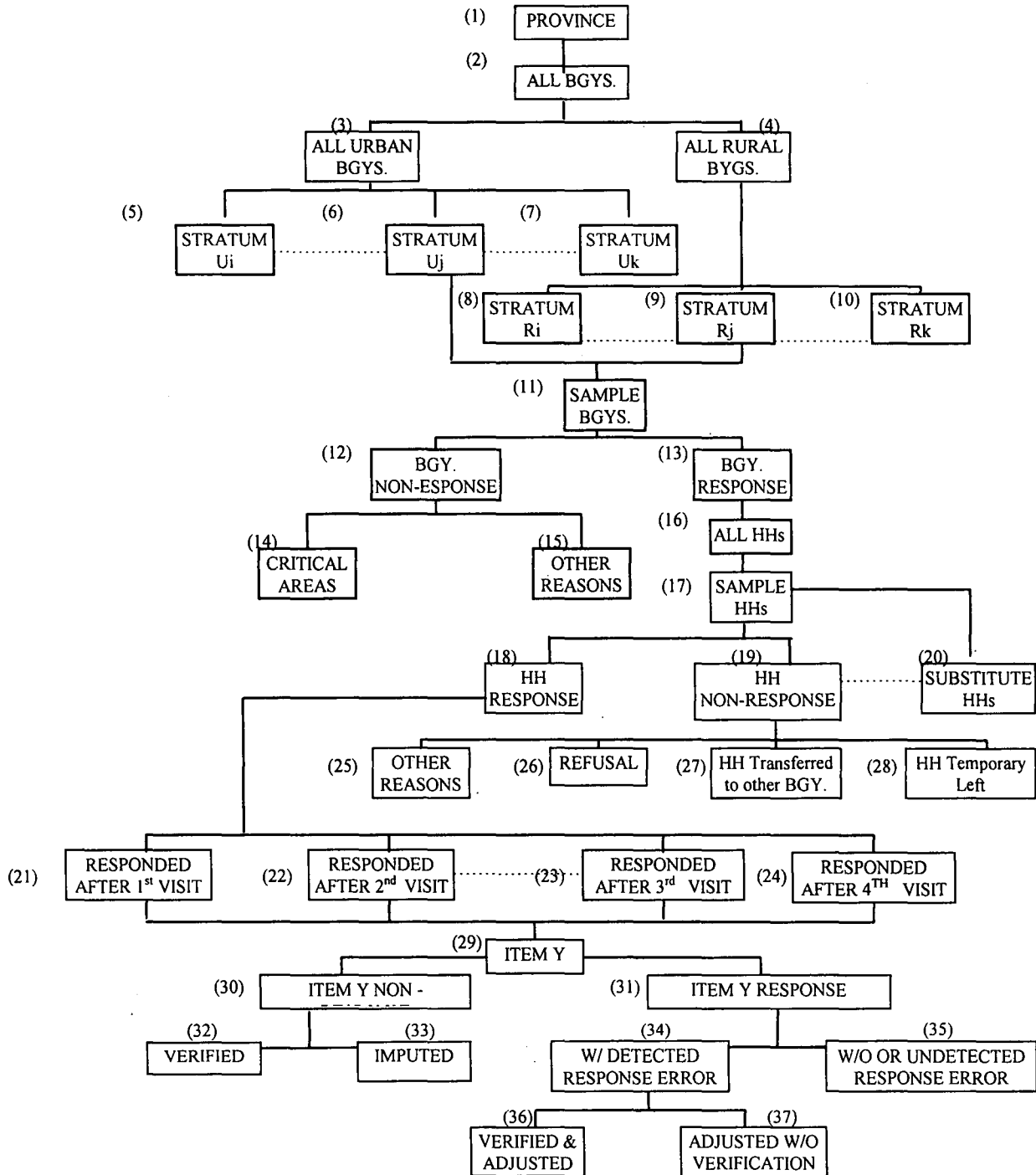


Figure II. CONCEPTUAL FRAMEWORK: Sources and Types on Nonsampling Errors in Field Surveys

Source: Oñate, B.T. 1987.. Sources, Types, Measurements, Control and Evaluation of Non-sampling Errors: Philippine Experience. Statistical Laboratory, UPLB.)

ATTACHMENT III



ATTACHMENT IV

Table III. Reasons for Using Announcements, Handing Out, Type, Average Worth (Net) Value in US \$, and Kind of Respondents Burden By Country and Survey: Guidelines for Policy on Incentives in the PSS*

Country by Survey	Reason for Using Incentives	Announcement of Incentives	Handling out Before/After Interview	Type of Incentive	Average Net Value (US \$)	Respondents burden?
America 1. Survey Income and Program Participation 1987 2. National Hospital Discharge Survey 1994 3. Survey of Adults on Probation 1993	Token gifts for lowering nonresponse rate	During interview	before	calculator	4.00	na
	Reimbursement for administrative work	RO supervisor can make a deal about the amount of the incentive	after	money	3.00	admin. efforts
	Reimbursement transportation cost	Advance letter & in doorstep-interaction; also by probation officer	after	money	15.00	transport costs
Denmark 4. Danish Household Budget Survey 1993	Lowering nonresponse rate	Advance letter & in doorstep-interaction (gifts were announced by letter but a list of gifts was handed out by the interviewer)	after	luxury goods & calculator	40.00	diaries (?)
Finland 5. Household Budget Survey 1994	To keep the respondent interested	Advance letter (set pen & pencil comes with it)	before	pen & pencil	na	diaries
Great Britain 6. Family Expenditure Survey 1993 7. National Diet & Nutrition Survey 1993	To achieve satisfactory level of response	Advance letter & in doorstep- interaction	after	money & pen	15.50	diaries
	To improve co-operation rates	Advance letter & in doorstep-interaction (by means of a leaflet explaining purpose of survey)	after	money	15.00	diaries
Israel 8. Family Expenditure Survey	To make the family feel obliged to answer	In-doorstep-interaction	before	calculator	15.00	diaries
Netherlands 9. Family Expenditure 1994 10. Social Economic Panel 1994	To compensate for the respondent burden	Advance letter	after	luxury goods	50.00	diaries
	To compensate for the respondent burden	Advance letter	after	luxury goods	50.00	question forms
Sweden	To get higher response rate		before	lottery ticket	6.00	na
	To compensate heavy workload for	Advance letter	before	lottery ticket	25.00	diaries

Source: Luppés, M. and B. Barnes. On the Use of Incentives: An Overview of Policies in Several Countries. Tables 4, 5 and 6. 5th International Workshop on Household Non-Response Surveys. Ottawa, Canada. 1994.

ATTACHMENT V

(6) Fieldwork strategies, Quality Processes and Product Control and COIs: Benchmarkings on Interviewers (The Link)

(a) **Recruiting and Selecting Interviewers.** How, when and what procedures to apply on new interviewers? What kind of documentary materials? Applicant questionnaire and items covered? What sifting criteria? Is a selection test used? Number of applicants when ADS are used? Number of applicants completing and returning application forms? What percentage is selected? What percentage passed the training course? Did the agency find difficulty in finding enough applicants in certain cities, regions or provinces and why?

(b) **Interview Training.** Do trainees receive material for home study? Materials, program, length, depth, trainer, etc.-effects on response rate? Is field training part of the course? Who give the training? Additional selection after the course? Is there a probation period? Paid for training hours? Are there special training courses for new service? New time series? Use of refresher courses? Voluntary vis. Legal (mandatory) service (CA 591 plus process and product control?)

(c) **Characteristics of the Crop of Interviewers.** General or special field forces? Status of job? Is size stable, variable (diminishing or growing) and implications of workload and response rate of interviewers?

(d) **Organization of Fieldwork and Support of Interviewers.** Workload? Time in field, interviewing and approach to households? Reporting and monitoring during field work? Process control? Use of advanced letters? Telephone or appointment? What support is given? By field officers? Others? Detailed call scheduling instructions - best time to visit each type of respondents? How about the Barangay head? How many field officers per group of interviewers or numbers of interviewers per field officer (supervisor)? How often do supervisors meet with interviewers? What are the completion rates, non-response errors (per day/month/period)? Motivation, practical support and others?

(e) **Re-assignment, Re-interview and Assessment (Control Charts).** Is re-assignment of household used? What are the reasons for re-assignment? What are the quantitative data on re-assignment? Quality of interviewers and re-assignments? Re-interviewing? Quality of data and interview and relations with response rate? Check all addresses and responses? Interviewer control and assessment?

(f) **Payments of Interviewers.** How paid? Based on performance? For travel expenses and travel time? Evening and overtime work? Different areas? What are the impacts of these factors on performance?

(g) **Materials or Documents for Prospective Respondents.** What advance letters and kind of letters? Personalized? Leaflets used? What special actions to solicit higher participation? Are incentives used? What are these? Respondents reaction about these incentives? Voluntary service needs more effort and energy to improve response level. How about mandatory services in the PSS? All these elements of fieldwork strategies are measures of process and quality control in order to improve the quality of data (the product), delivery of services and minimum costs (Q, D, C) for the full satisfaction and expectation of the customers (users) and the public in general. What is the status of these concerns in NSO, BAS, BLES and others? Is the rotation scheme in NSO fully understood by the interviewers?

ATTACHMENT VI

(7) **Other Concerns on CQI.** The need for CQI programs with special emphasis on NSEs (Ofiate's papers 1992, 1994, 1995) in the surveys and censuses of the PSS is magnified by:

(a) The number of studies on NSEs that contain definite time series comparisons over an appreciable span of time are very few and not standardized. Analysis of trends cannot, therefore, be done. (b) The range of the type of surveys is available (LFS, FIES, Crop Surveys, Employment related surveys and others) but the kind of random respondents changes (head, wife, children, relatives, non-relatives) on a time series.

(c) Time series data on response and non-response (Marton, 1994*) errors (nre) are confounded by lack of consistency and standards in the format, contents and language of questionnaires, manuals, procedures of selecting households (respondents), standards on substitution, call-back procedures, mode in assessing the changes in these factors, training and education of interviewers and field force, loads and motivation, the integrity and reputation of the survey agency and other related problems. (d) New efforts must now be considered to include NSE studies/research in the budget of the PSS in order to improve the quality of data and services provided by the System in its CQI. What is the status of these concerns in the PSS? This TQM principle is called benchmarking. (e) Adjustments: CQIs. Like most household surveys (ISH, crop surveys, labor force and employment and others), the non-responses of varying levels are reported and the weigh-adjustments are done using or inflating the weights for responding households. The ISH/LFS (1989 4th round) showed the magnitude of these non-response rates in descending order from the central urban city (Makati), outer city, suburbs, and rural sector (lowest). This straight weighing introduces error since characteristics differ between respondent and non-respondent householders. The bias is, therefore, introduced in the estimation procedures. What are the effects of non-response on (i) by month (m) in sample (ii), household size (s), month in sample by household size (mxs), (iv), average household size (as) by month (m) in sample (asxm), (v) by age (a) group, (vi), age (a) group by household size (s), (vii) age group and month (m) in sample (axm), (viii) average age of individual by month in sample [(aa)xm], (ix) labor force (f) status; (x) labor force status by response rate (fxrt); (xi) type of area (ar); and (xii) post stratification methods. The results of CQIs will depend on the specific surveys, period and organization (Allard and Dufour, 1994) and the need for including these dimensions into the CQI of the PSS Surveys and Censuses. This is a dimension of benchmarking. (f) Split-Questionnaire. There are a number of drawbacks in the use of long questionnaire(s) such as more cost in time and long interviews will result in overall high survey (census) costs; long questionnaire(s) will result in more respondents' burden, more non-response and less cooperation and participation of householders; and, long interviews will also make interviewers very tired, less efficient and effective which may negatively affect the accuracy of the survey results. In view of these problems, each respondent will be asked only a smaller number of questions but still making sure that all questions are covered by the survey. One solution is the use of split questionnaire techniques developed by Forsman and Wretman (1994). These aspects can be included by the PSS in its CQI program on TQM. Total Survey Error (TSE) or MSE was presented earlier but it is worth mentioning that standard error (or S.E.) and NSEs are the two pillars in the TQM flagship and must be closely monitored and evaluated in the TQM - process and product quality control management.

* In Hungary, the refusal rates are as follows:

Type	Refusal Rate%	
	Hungary	Budapest
Labor force, 1 st Q, 1984	3.6	7.6
Family Expenditure, 1993		
Diaries 1993	30.1	56.7
End of the Year Interview, 1994 March	5.0	15.5

