PERFORMANCE MEASURES FOR SATELLITE AND SELF-CONTAINED ELEMENTARY SCHOOLS WITHIN A MAJOR CITY CHILD NUTRITION PROGRAM: IMPACT OF AN INNOVATIVE BAKE CENTER

By

SUSAN C. LINNENKOHL

Bachelor of Science
Eastern Kentucky University
Richmond, Kentucky
1975

Master of Science
Kansas State University
Manhattan, Kansas
1980

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
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Thesis Approved:

Lee L Ebro
Thesis Advisor

Esther Winterfeldt

John L Burt

Duncan Hunsucker

Dean of the Graduate College

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CHAPTER I

INTRODUCTION

Accountability is becoming increasingly important in today's fast paced information age (Owen, 1984). Financial accountability is a key output generated by foodservice organizations (Spears, 1991). Any business needs to operate on a sound financial base in order to be successful. This requires that management monitor key performance measures for cost control and productivity (Sink, 1985). Naisbitt (1983), in his book Megatrends, reemphasized Toffler's (1980) Third Wave, which directed today's manager to recognize the need to process a record amount of information.

Van Edmond Pannell (1985) suggested that school foodservice managers need to know the financial goals and objectives of the school board. There should be a firm data base to estimate the potential income and expenses for the school. The system should be simple, yet efficient.

Matthews and Norbach (1984) noted that foodservice directors in healthcare were developing new strategies for controlling resources. The cost containment era has been replaced by a system with more rigid controls. Diagnostic-Related Groups (DRGs) have emerged as the cost accounting system which requires managers to do more with less, bringing the productivity issue in line with financial accountability.

While the United States continues to be productive overall, the rate of industrial productivity in this country has been on a steady decline since World War II. The National Restaurant Association estimates that the foodservice

industry has a 52% productivity level when compared to other industries (Mill, 1989). If performance measures were compared over time, one could determine how and when productivity improvement occurs. Every manager should design and implement a measurement and evaluation system which generates information for resource allocation and performance monitoring relative to organizational goals and objectives (Sink, 1985). A system like this needs to be developed for the foodservice industry. Additional research may suggest modifications for segments within the industry (Mill, 1989).

To study productivity, survey sampling was implemented at Oklahoma State University. Results identified performance measures utilized in various segments of the industry (Robertson, 1982; Lamb, 1983; Pickerel, 1983, Putz, 1985; Lischke, 1986; Czajkowski, 1988; Nazarieh, 1988). A technique to measure labor productivity was the studied at the University of Missouri (Klein, 1978; Dorsey, 1980). Research at Iowa State University focused on establishing a conceptual framework for labor analysis (Brown, 1972; Lebeau, 1976). The University of Wisconsin also supported productivity research (Ruf, 1975). An operational case study was prepared at Virginia Polytechnical State University (Mayo, 1981). Each study experienced limitations in the methodology.

Questionnaire, interview, and observation data collection techniques are limited relative to the study of productivity (Price & Mueller, 1986). Survey design resulted in a low percent return due to misunderstanding or lack of productivity training, uniformity of terms, and the lack of sophisticated management information systems (MIS) to pull appropriate files and monitor trends (Lischke, 1986). While a case study approach provides valuable data, it limits the researcher as the results cannot be representative of other

foodservice operations. Validation requires a sampling from several units.

The foodservice industry is characterized by its constantly changing nature in response to market demands, financial constraints, and technological advancements (Spears, 1991). Developments in food processing and distribution expanded the options available to today's foodservice directors for the management of organizational resources (West, Wood, Harger, Shugart, Payne-Palacio, 1988). New and improved equipment designs continue to allow management to improve conventional production methods (Khan, 1991).

Convenience food items expanded the options to include an assembly-serve system which uses the maximum amount of processed foods. At the other end of the continuum is a commissary system which requires a minimum amount of processed foods. Conventional foodservice systems lies somewhere in between and can be equally effective if monitored closely (Minor & Cichy, 1984).

Foodservice directors should constantly evaluate their existing system and consider alternatives which may improve organizational performance (Spears, 1991). Reduced resources and increased accountability support the need for these efforts. In response to these issues, bakery production in four existing cluster bake sites within separate school foodservice units were consolidated in a major city child nutrition program. The result was an innovative bake center located adjacent to the central storage warehouse.

The bake center was a centralized production facility designed to produce large quantities of bakery items to serve several schools within the system. This concept is a modification of the commissary foodservice system described by the research team of Unklesbay, Maxcy, Knickrehm, Stevenson, Cremer, & Matthews (1977). Centralization of skilled labor and commodity

foodstuffs should expedite the food product flow of bakery items and reduce costs for the total foodservice system.

A two-phase implementation program was evaluated. Satellite schools were grouped according to the semester of the research intervention. Cost and productivity measures were used to compare the performance of the satellite and self-contained foodservice units. This innovative project may provide a feasible alternative to the skilled labor shortage and the use of government commodities in producing and serving bakery items within a multi-unit school foodservice system.

Purpose and Objectives

The purpose of this research was to contrast the cost and productivity measures for satellite elementary school foodservice units with measures for self-contained units. Emphasis was given to the performance of satellite schools serviced by an innovative bake center.

Operational costs (food, commodities, cleaning supplies, paper, labor), total revenue, and total meals served were recorded for each month. This information was used to compute operational ratios (cost/revenue and cost/meal) to be used in cost analysis. Institutional variables, such as total meals, labor hours worked, and average daily attendance, were used to calculate productivity ratios. Activities related to production, service, and labor thought to have an impact on these measures were also solicited.

Results were compared during two calender years to observe any variance likely to occur with the bake center implementation. Institutional factors which may affect operational costs were included in the analysis. Ratios

for the satellite schools were contrasted with those generated for the self-contained units.

Specific objectives were to:

(1) Review institutional variables for elementary school foodservice units.

(2) Compare institutional variables of satellite foodservice units with those of the self-contained foodservice units.

(3) Compare cost and productivity measures of the satellite foodservice units before and after implementation of the bake center.

(4) Contrast cost and productivity measures of the satellite units with the self-contained foodservice units.

(5) Analyze cost and productivity measures generated by the service records in relation to selected operational variables for each elementary school foodservice unit.

(6) Identify factors most likely to affect cost and productivity measures within this foodservice system.

Hypotheses

The hypotheses postulated for this study were:

H_1 - There are no significant differences in the cost of food, commodities (market value), cleaning supplies, paper, or labor as a percent of total revenue for the satellite units before and after implementation of the bake center (Cost/Revenue: Five forms of Ratio 1).

H_2 - There are no significant differences in the cost of food, commodities

(market value), cleaning supplies, paper, or labor in relation to total meals served for the satellite units before and after implementation of the bake center (Cost/Meal: Five forms of Ratio 2).

H_3 - There are no significant differences in the following productivity measures relative to total revenue for the satellite units before and after implementation of the bake center:

a. total revenue/total expenses (Ratio 3)

b. total revenue /average daily participation (Ratio 5)

c. total revenue/labor hours worked (Ratio 7)

H_4 - There are no significant differences in the following productivity measures relative to total meals for the satellite units before and after implementation of the bake center:

a. total meals served/total expenses (Ratio 4)

b. total meals served/average daily participation (Ratio 6)

c. total meals served/labor hours worked (Ratio 8)

H_5 - There are no significant differences in the cost and productivity measures listed in H_1, H_2, H_3, and H_4 for the satellite versus the self-contained foodservice units when contrasted by month, semester, and over the two calender years.

H_6 - There are no significant differences in the cost and productivity measures listed in H_1, H_2, H_3, and H_4 based on the following production and service parameters:

a. participation in the breakfast program

b. sack lunch preparation

c. salad bar preparation and service

d. contract meals

e. number of serving lines

f. number of point of sale terminals

g. use of dishmachine

h. use of disposables

Assumptions and Limitations

In an attempt to provide a scientific design for this study, the primary source of data was service records which were assumed to be complete and accurate. All elementary schools were believed to be "equivalent." The researcher was neither a member of the management team, nor employed by the school system at any time.

Data collection was limited to information routinely recorded. The use of dishmachines was the only equipment information furnished. It was in the original agreement that personnel data would not be solicited and that the cost of transporting goods from the bake center to the satellite schools was absorbed in the expense of current procedures.

According to Rossi and Freeman (1985), the major challenge in applying evaluative research design lies in the inevitable changes that occur during program intervention. Within the research time frame, some changes occurred which may have affected the performance of a foodservice unit. For example, several schools began offering salad bars during lunch services. Others were in the middle of phasing out the use of dishmachines and converting to disposable serviceware.

A few extraneous variables appeared over the course of the two years of the study. One school lost a baker, so its status was changed from a self-

contained to satellite unit. Two other schools switched from a satellite unit to self-contained status, as enrollment and participation was sufficient to justify the expense of a baker. These three schools were deleted from the study (Appendix A). The researcher did not anticipate an administrative decision that involved the closing of eight schools in the research population during the fall of 1988, these were also deleted from analysis (Appendix B).

Operational Definitions

The definitions selected for this study were:

Average Daily Attendance (ADA) - figures from each school's unit office indicating the number of students in attendance for the day (Van-Egmond Pannell, 1985).

Average Daily Participation (ADP) - figures from each school's cafeteria indicating the number of students selecting a lunch meal which meets federal guidelines for reimbursement (Van-Egmond Pannell, 1985).

Bake Center - a centralized production facility designed to produce large quantities of bakery items to serve several school units within the system; a modification of the commissary foodservice system.

Child Nutrition Programs - meal preparation and service governed by federal restrictions for a cost reimbursement based on the number of meals served to a sample of school-aged children. Nutrition education is also a requirement for this concept. It originated from the National School Lunch Act of 1946 and has been affected by several amendments over the years. (Van-Egmond Pannell, 1985).

Cluster Bake Sites - a school foodservice unit in which bakery items

were prepared for neighboring school units, in addition to a complete meal for the students within that school unit. Four of these were operating prior to the implementation of the bake center.

Collection Points - points at which data was collected (Rossi & Freeman, 1985). Two spring semesters of five months each and two fall semesters of four months each, for a total of 18 months which served as the collection points in this study.

Commodity - surplus food items donated to federally subsidized programs through the United States Department of Agriculture (USDA).

Control Group - a selected group which remains untreated, and is compared to experimental groups on outcome measures in impact evaluations (Rossi & Freeman, 1985, p. 230).

Constructive Controls - the equivalent group to whom the group targeted for the intervention is matched (Rossi & Freeman, 1985, p. 266). Conventional foodservice units in H_5 served as constructive controls when compared with satellite units.

Reflexive Controls - targets who experienced the intervention are compared to themselves (Rossi & Freeman,1985, p. 266). In H_1, H_2, H_3, and H_4, the satellite units are compared to themselves before and after the research intervention.

Dishmachine - an accepted term in the industry, synonymous with dishwasher. It is among the most expensive pieces of equipment in any type of foodservice operation (Khan, 1991).

Experimental Group - a selected group to whom the intervention is delivered and whose outcome measures are compared with those of the control group (Rossi & Freeman, 1985, p. 230).

Food Service - accepted by the American School Food Service Association (ASFSA) and the School Food Service Research Review (SFSRR) as the appropriate spelling; "foodservice," originated with the Foodservice Systems Management Education Council (FSMEC, 1973), and is the more universally accepted spelling in the literature. These two terms will be used interchangeably in the text.

Foodservice Information System - an orderly arrangement of foodservice related data procedures and decision-making criteria designed to increase managerial effectiveness through proper handling and flow of information (Kasavana, 1984).

Foodservice System - any foodservice firm, regardless of size can be thought of as a system of interrelated functions or operational activities which comprise its operational flow (Minor & Cichy, 1984). An integrated program in which the procurement, storage, preparation and service of foods and beverages, and the equipment, methods (and personnel) required to accomplish these objectives are fully coordinated for minimum labor, optimum customer satisfaction, quality, and cost control (Livingston & Chang, 1979).

Foodservice Systems - four classifications to denote food product flow (Unklesbay, et al., 1977):

Assembly-serve System - food is produced from a maximum amount of processed foods requiring minimal reheating for service. It is also known as a convenience food system.

Commissary System - food is produced in a central location with distribution to the service outlets, referred to as "satellite" units in this study.

Conventional System - food is produced from raw ingredient for

service on the same site.

Ready-Food System - food is produced on-site and chilled or frozen until ready for service.

Intervention - implementation of the bake center, the commissary production site for this multi-unit foodservice system.

Management Information Systems - a systematic approach to the enhancement of managerial effectiveness achieved through improved handling of information (Kasavana, 1984).

Performance - the result of several criteria that affects the outcome of an organization. The outcome of the combined functions of innovation, effectiveness, efficiency, productivity, profitability, quality, and quality of work life (Sink, Tuttle, & DeVries, 1984).

Performance Management - involves the management functions of planning, organizing, controlling, directing, and staffing; based on the results of various performance measures. A process of measurement, evaluation, control and improvement (Koontz, O'Donnell, & Weihrich, 1987; Sink, 1985)

Performance Measures - criteria used to evaluate actual performance against predetermined standards. Cost and productivity measures were used in this study.

Productivity - a combination of efficiency and effectiveness (Tuttle, 1986); the relationship between the outputs generated by a system and the inputs provided to create those outputs, ie. meals/labor hour (Sink, 1985). It is the source of all economic value, the first test of management performance (Drucker, 1980).

Population - all the elementary school foodservice units within the school system.

Satellite Units - schools which receive menu items produced in the bake center for service within these schools. These schools were divided into two groups because of the two-phase implementation plan for the bake center.

Sample A - the satellite units receiving bakery items beginning in the Fall of 1987.

Sample B - the satellite units receiving bakery items beginning in the Spring of 1988.

Self-contained Units - schools which prepare all menu items on-site for service within these schools. These schools were not subjected to the research intervention, each exemplified a conventional foodservice system and served as the constructive control group.

CHAPTER II

REVIEW OF LITERATURE

The concept "foodservice systems" takes on several meanings. It is often used to designate the various segments within the foodservice industry (West, et al., 1988; Spears, 1991). Commercial systems are open to the public, operate for a profit, and serve noncaptive clientele in hotels, restaurants, clubs, recreational facilities, and fast foods. This type accounts for nearly 85 percent of sales in the foodservice industry (Khan, 1991).

Institutional foodservice systems provide meal service to a more captive audience and is provided as an auxiliary service to complement other activities. Typical settings would include schools, college and university campuses, hospitals, nursing homes, retirement centers, and employee cafeterias. The primary distinction lies in organizational goals and objectives.

Organizations perceived as systems are the result of various subsystems collaborating to achieve goals and objectives. Burch, Strater, and Grudnitski (1983) delineated three subsystems found in all organizations: operational, managerial, and informational. Operational subsystems enclose primary functions, such as producing food for service. Unklesbay, et al. (1977) identified four major classifications applicable to the foodservice industry.

Managerial subsystems support the execution of planning, organizing, directing, staffing, and controlling functions. Cost accountability and productivity result from an effective performance management system (Sink,1985). Information subsystems are designed to gather, process, and store pertinent data, they

are a necessity for effective reporting, according to Kasavana (1984) and Coltman (1989). A review of each of these subsystems relative to this study follows.

Operational Foodservice Systems

Four major classifications of foodservice systems appear in the literature as: assembly-serve, commissary, conventional, and ready-foods systems (West, et al., 1977; Minor & Cichy, 1984). A description of each system,with advantages and disadvantages to assist today's foodservice manager in choosing the most suitable alternative, is provided.

According to Van Egmond-Pannell (1985), the decision would be the result of decreasing enrollments, increasing labor and operational costs, increasing numbers to be served (due to federal subsidies for free and reduced-price meals), and lack of facilities. These factors affected 25% of the meals served in school lunch.

Assembly-Serve

These systems utilize a maximum amount of convenience food products and require minimal cooking (Merrick & Sutton, 1972). Tempering and rethermalization prior to service are the primary production activities. Service requirements would be limited to preportioning or minimal assembling, depending on the form in which the food was purchased. Foods are purchased in bulk, preportioned or preplated for storage in the traditional dry, refrigerated, or frozen state.

This system was in response to a shortage of skilled labor. Ongoing

research efforts were conducted to assess the feasibility of utilizing these items in foodservice operations (Zolber, 1971). In general, this system required less preparation equipment, more storage space, less energy, and fewer staff. Food products carried a higher unit price; managers should respond by minimizing the cost of labor, while maximizing quality.

Advantages included reduced requirements for skilled labor, a simplified system, more potential profit, and more consistent quality. Disadvantages included higher cost and lower food quality, a limited supply of available menu items, and a reduction in overall clientele acceptance (West, et al, 1977).

Commissary

A system of centralized production and distribution for service to various satellite units served as the basis for this system, as food, prepared at a central location, is transported to surrounding service units (Balsley, 1973). Technological advancements in production equipment support the popularity of this alternative. It was designed to utilize resources more efficiently through economies of scale in food purchasing and production.

With production and service in separate facilities, distribution should receive special consideration in response to time and temperature controls (Spears, 1991). This system possesses additional advantages in costing accuracy, increased computer usage, efficient scheduling of personnel, and reduced labor turnover (Minor & Cichy, 1984).

Perhaps the primary disadvantage is in capital expenditures, particularly with equipment for transportation and distribution. There is less opportunity for individual creativity with the food products, potentially another disadvantage. Technical problems may occur from sanitation and government regulations

(West, et al., 1977).

If implemented, production costs should be allocated to satellite units. Equipment and storage container returns need to be monitored. Packaging requirements may pose an unexpected challenge. According to Van Egmond Pannell (1985), some school districts operate these kitchens for parts or all of the lunch, particularly baked products, for an entire city

Conventional

A truly conventional kitchen would have a butcher shop, a bakery, and a vegetable prepreparation area. All food is purchased raw and processed on the premises shortly before service (West, et al., 1977). With technological advancements, today's foodservice operations are not likely to have all the specialized work areas. Livingston and Chang (1968) defined the most common system utilized today as a semi-conventional system.

Food preparation is minimized with the purchase of preportioned meats, frozen or canned vegetables, dessert mixes, prepared breads and salads (Rappole, 1973). Labor is easily divided into production, service, and sanitation. As the traditional system, an ongoing demand is presumed for this alternative (Reed, 1973). Adaptability allows special requests and cultural or socioeconomic differences to be offered. Creativity is encouraged and environmental factors affecting market trends are less threatening to the operation.

The most common frustration with this system lies in the immediacy of production demands throughout service, creating a great deal of tension and higher stress levels than the alternative systems. Meal distribution three times a day, results in lulls around mid-morning and mid-afternoon. A sporadic work distribution lowers overall productivity (West, et al., 1977).

Ready-Foods

This system allows the foodservice unit to prepare its own convenience products and store them until time to serve. Foods are prepared from raw ingredients, then frozen immediately and held for use at some later time. This concept was first researched at Cornell University and has since been installed in several health care facilities (Rappole, 1973).

Food is mass produced for chilling or freezing in a "food library." This allows choices to be "ready" and prepared well in advance of service. The terms "cook-freeze" and "stored labor concept" may be used for this alternative. Williamson (1975) referred to this concept as a "food factory." Rappole (1973) described ready-foods as a system providing tighter control over food quality than a convenience system. A variation is the "cook-chill" concept, where food is preplated, chilled and rethermalized just prior to service.

The primary advantage is the elimination of traditional "peaks and valleys" for labor, a common characteristic in the conventional system. Proper production scheduling to maintain a menu item inventory reduces the stresses to complete preparation at the time of service (West, et al., 1977).

A skilled labor force, normally scheduled to cover three meals a day, seven days a week, can work a single 40 hour work week, Monday through Friday. Less skilled personnel are trained to rethermalize foods prior to service. Two limitations include investment capital for expenditures such as blast freezers, rethermalizing units and others. Second, a strong food science background is needed to maintain consistent food quality.

Summary

In any discussion of alternative foodservice systems, emphasis should be placed on product flow, microbial quality, and critical control points (Unklesbay, et al., 1977). Food product flow is essential considering that the production site may be physically separate and some distance from the service location. Time and temperature relationships should be monitored to improve the assurance of microbial quality. Sensory and nutritional quality should be evaluated using critical control points (Bobeng & David, 1978).

These systems are continuously reviewed (Jones & Heulin, 1990). Rinke (1976) offered an evaluation of three alternatives. Greathouse (1989) surveyed 32 health care facilities to determine the most cost efficient alternative. A summary of advantages and disadvantages of the four systems appears in Table I. This information can provide valuable insight in determining the appropriate alternative for a foodservice operation.

Managerial Subsystems

Basic management functions are applied as human, material, physical, and operational resources are transformed into high quality meals, in a desired quantity, within the constraints of the system (Figure 1). The key to increasing productivity lies in improving organizational output, both quantitatively and qualitatively (Mill, 1989). Management is held accountable for organizational performance. Accountability is a preferred response, to the responsibility accepted with the position, assumed by the individual. It may be directed to an employer, a set of employees or clientele, or to the public. Productivity and cost accountability are two measures discussed in this section.

TABLE I

ADVANTAGES AND DISADVANTAGES OF FOUR FOODSERVICE SYSTEMS

ADVANTAGES	DISADVANTAGES
ASSEMBLY - SERVE	
Reduce labor costs	Limited availability
Reduce preparation time	Food cost may exceed savings
Minimal capital expense	Sensory quality in question
Convenient, 'fool-proof'	Customer satisfaction?
COMMISSARY	
Contains costs	Microbial quality of foods
Maximizes skilled labor	Larger capital expense
Reduces amount of supervision	Requires precise scheduling
Economy in volume	Delivery of foods
Uniformity of product quality	
Portion control	
CONVENTIONAL	
More adaptable (requests)	Peak production demands
Cultural & socioeconomic	Higher stress levels
Flexibility with market trends	Uneven work distribution
More creativity	Lowest productivity level
Customer satisfaction	
Minimal capital expense	
READY - PREPARED	
Reduces 'peaks & valleys'	Major capital expenditures
Reduces stress levels	- blast freezers
Quality & quantity control	- rethermalizing equipment
Contains costs	Requires a conceptual base
Offers 'bankers' hours	- food science data base
On premise product flow	- limits food choices

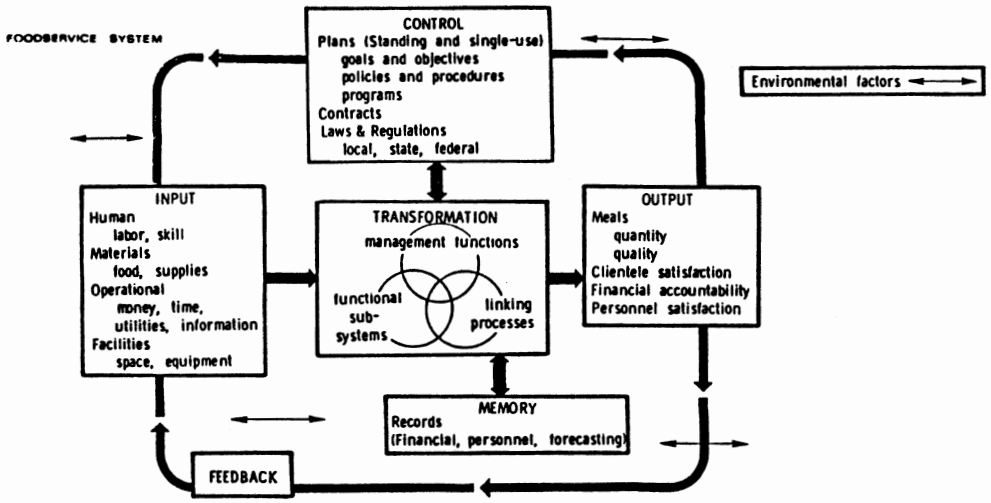

Figure 1. A model of a foodservice system (Spears, 1991).

Accountability in Child Nutrition Programs

As with any federal program, Child Nutrition Programs are administered according to predetermined standards. For centuries, communities found ways to nourish their children as they attend school. The first indication that our Nation's children might be undernourished occurred as a result of the first world war. From this point, various forms of legislation were passed to fund these programs. Today, schools can receive federal and state reimbursement for feeding children breakfast, lunch, and summer meals, provided the program complies with government regulations.

School Lunch Programs. In 1946, Americans witnessed the passage of The National School Lunch Act. Its purpose was "... to safeguard the health and well-being of the nations children, and to encourage the domestic consumption of nutritious agricultural commodities ..." (Van Edmond Pannell, Appendix I).

Operation of a school lunch program may appear over-simplified. As a Monday through Friday operation serving a single meal, the stresses are

generally minimal compared to other foodservice operations. The scene becomes more complex in a major city district offering a multitude of child nutrition programs to several schools. Compliance with a menu pattern, use of commodities, government reimbursements, and competitive foods are a few of the every day stresses with school lunch. Salad bar with lunch service and furnishing catered and contract meals are two ways a lunchroom manager can generate revenue to achieve organizational goals..

Cost Accountability and Productivity

Federal audits may have been a mechanism to trigger an interest in tighter cost controls and a review of sound business practices. All managers should analyze sources of income and determine the necessity of expenses incurred (Van Egmond Pannell, 1985). Several school foodservice units are self-sufficient, placing an emphasis on financial accountability (Spears, 1991).

Cummings and Metzger (1987) promoted a "back to basics" technique to reduce operating costs without sacrificing quality, thereby increasing sales volume. Managers were encouraged to offer "more for less," or initiate a new plan to increase profit without inconveniencing customers or employees (Stankard, 1986). Several authors have provided tools to assist managers in understanding foodservice financial management (Sneed, 1988; Keiser, 1989).

Productivity can be described as a measure of an organization's accomplishments and a function of resources consumed to produce those accomplishments (Tuttle, 1986). The management practice group in The American Dietetic Association (ADA) developed a manual to assist dietitians in measuring productivity. Outputs are either total meals, sales dollars, or nutrition-related services, such as diet instructions or classes (ADA, 1986).

Once specific ratios are identified, management needs to provide a stimulant to increase productivity. Working smart, not hard; reducing operational cost; initiating innovative ideas; or a combination of these activities were suggested by Tuttle (1986). Both profitability and productivity begin to improve when resource allocation s increased and the same number of items are produced with fewer resources (Miller, 1984). Today's manager should recognize the interrelationship between profitability and productivity (Sink, 1985).

Productivity Management

Evaluation of organizational performance includes a mechanism for measurement and improvement. (Price and Mueller,1986). In his book, Productivity Management: Planning, Measurement and Evaluation, Control and Improvement, Sink (1985) enumerated four steps in this process: to measure and evaluate, to plan control and improvement interventions, to implement the interventions, and to assess the impact of the intervention(s).

Every manager should design and implement a measurement and evaluation system which generates information for resource allocation and performance monitoring relative to the organization. When compared over time, it is possible to determine how and when productivity improvement occurs. A system like this needs to be developed for the foodservice industry .Additional research may suggest modifications for segments within the industry.

Control Standards. In foodservice management the control function focuses on monitoring three areas: quality, quantity, and cost controls (Kotschevar, 1979). The process begins with predetermined standards from which actual performance is measured. Once the standard is defined, an evaluation tool, a comparison of "plan versus actual", and a policy and

procedures system to maintain the standard, should follow (Keiser, 1989). These steps parallel those for productivity management.

The evolution of management thought focused on the need for standardization in the early development of an industrialized world (Toffler, 1980; Koontz, et al., 1987). As seen by Figure 1, page 20, these standards serve as a guide to direct departmental activities. They may originate internally, such as a menu pricing technique, or externally, such as the lunch pattern which serves as a prerequisite to qualify for state and federal reimbursements.

Standard cost measures are lacking for various segments of the foodservice industry. Foodservice managers generally look at cost categories as a percent of the revenue generated, as in the case of budgeting, or as a fraction of the cost per meal, to balance high cost with lower cost items.

Performance Measurement System. While performance was considered a topic for evaluation early in this century, most research took place in after the first minimum wage legislation in the sixties. Attempts to define, measure, and analysis productivity and performance began in the seventies. By the 1980s, researchers were concentrating on the foodservice industry (Lischke, 1990).

To judge the worth of ongoing programs and estimate the usefulness of attempts to improve them requires evaluation (Rossi &Freeman, 1985). Reduced resources and an increased need for accountability support the need for evaluation efforts. Impact assessment is essential for comparative analysis. It gauges the extent to which a program causes desirable change and implies specific goals and criteria for success.

A performance management system can be established for a foodservice operation. Figure 2 depicts a flow process which begins with clearly, defined standards, a measuring device, and decisive action immediately following.

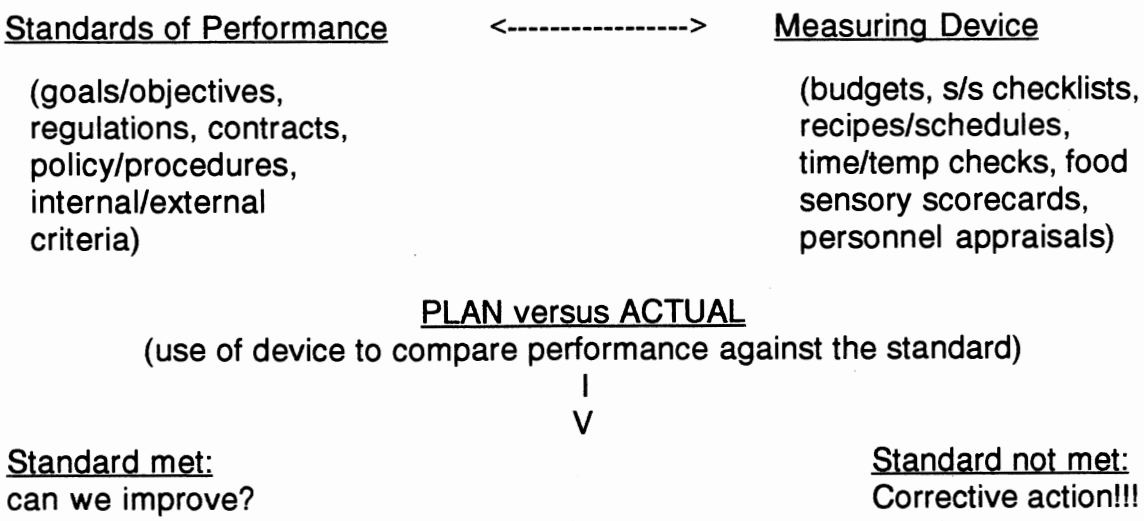

Figure 2. The performance measurement system.

Management Information Subsystem

Information subsystems support the function of gathering and processing data to monitor individual and organizational performance. Timely and accurate methods for recordkeeping and reporting are essential to the success of an operation. Once an organized system is in place, computers can generate valuable information for decision-making.

Formalized data provides the basis for a "management information system" (MIS). Coltman (1989) defined MIS as an integrated system which provides information to support the operating and decision-making functions of a business. Options continue to become more complex with the technological advancements in computer science.

Routine calculations and recordkeeping can be replaced by a software package with far-reaching potential. MIS constitute a total process in which raw

data are supplied and redefined to give the desired information to management (West, et al. 1988). It facilitates the functions of management at all levels. Cost and productivity measures serve as a prime example of the output generated from operational and institutional data.

According to Matthews and Norback (1984) the integration of information is critical to managerial effectiveness. Goals and objectives of the organization should be clearly defined and a system of policy and procedures should be in place. Investing in computers may enhance product delivery and accountability (Conine, 1986).The success of such a system depends on its design and utilization. When planning for a management information system, West, et al (1988) stressed:

> remember the desired result: placing data into a meaningful context for those who are to use it, disseminating the information to the right people when needed, and making certain that the data are complete, accurate, and free from bias. Only when this is accomplished will the MIS have achieved its greatest potential value for the foodservice operation.

Summary

Three subsystems common to all organizations were discussed with application to cost accountability, productivity, and a performance management system. The focus was on school foodservice, but would apply to all segments of the foodservice industry. Management of a foodservice system involves the interrelationship between its resources, operational processes, outputs, and organizational goals and objectives. Continuous monitoring is essential for maintaining an organization in peak performance.

CHAPTER III

METHODOLOGY

Planning and Development

A feasibility study (depicted in Appendix C) was conducted to evaluate the consolidation of four existing base kitchens into a new "bake center" with capabilities of expanding production to service additional schools. Theoretically, centralization would maximize the use of existing resources within each school, lower total operational costs, and increase the productivity rate of the satellite schools, thus improving total organizational performance.

Plans for the bake center were initiated in the Fall of 1986. The management staff met to determine which schools could support a totally self-contained production system, and which ones would become candidates for the innovative bake center. Oklahoma State University faculty were approached to solicit a graduate student to follow the project. An initial visit was made in the Spring of 1987 to gather preliminary information from staff in the school system's central office. Additional contact, as necessary, was planned to formulate the research design for this project.

Historically, smaller kitchens received prepared menu items from larger base kitchens. A school's enrollment would generally determine the amount of resources allocated to each kitchen. As equipment depreciated and student populations continued to shift, management addressed economic decisions concerning equipment replacement and the food production system most feasible for each kitchen.

Site visits were made to the four existing base kitchens, hereafter referred to as "cluster bake sites." As food carriers depreciated, on-site production for satellite units was expanded with the purchase of convenience food items. Off-site production was reduced to bread products and desserts, eliminating the expense of replacing temperature-controlled insulated food carriers.

The purpose of this research was to study cost and productivity measures for 64 elementary school foodservice units. Emphasis was placed on the impact of this bake center on the participating satellite units. Performance measures for the self-contained units were calculated and presented in contrast to the satellite units. To determine what level of research interest hospitality corporations had in academic research, Brymer and Johns (1990) surveyed 200 chief operating officers from hotel and restaurant corporations nationwide. The highest level of interest reported by foodservice respondents was in productivity. Hotel respondents' level of interest in productivity research was ranked sixth out of 45 topics.

Research Population

All elementary school foodservice units (N=64) within the school system were included in the study (Appendix A). An observation code replaced the school codes used for cost accounting purposes to assure confidentiality of the data. Approximately one-half (n=28) of the schools prepared all menu items on-site and the other half (n=36) limited preparation to the entree, meat accompaniment, and the two fruit/vegetable items, which comprised the National School Lunch requirements.

The bread item, whether a quick bread or yeast bread, and/or a dessert

item, would be received from the new bake center. These menu items were prepared from "scratch", portioned, frozen or prepared for dry storage, and then packaged for transportation to the satellite schools. Deliveries were scheduled to coincide with regular grocery orders from the central warehouse, which was adjacent to the bake center. This schedule would minimize any additional expenses incurred for transportation of the bakery products.

Control Group

Schools which did not experience the research intervention (bake center) were self-contained and comprised the control group. Twenty-eight elementary schools functioned as a conventional foodservice system. Since all of the production activities were prepared on-site, these schools were identified as "self-contained." In the fall of 1988, one of these schools lost their baker and became a satellite school. A second school was closed, reducing the number of schools in the control group to 26.

Experimental Group

Implementation of the bake center occurred in two separate time intervals. Service was initiated in the fall of 1987 for 17 schools classified as Sample "A". Nineteen additional schools (Sample "B") were added to the bake center's production schedule in the spring of 1988.

Sample A. Initially two cluster bake sites designated as "O" and "S" in Table II serviced 11 satellites. Cluster bake site "O" was in an elementary school, became a satellite school and was designated as A-1. The other cluster bake site was the kitchen for a secondary school and therefore was deleted from the study. Eleven satellite schools, previously served by one of the four

cluster bake sites, were identified by subgroups A-2 and A-3. Five previously self-contained schools (A-4) were added to the list, for a total of 17 schools serviced by the bake center during Fall 1987. This number remained constant before and after the intervention (see brackets in Table II).

TABLE II

SAMPLE "A" BY SUBGROUPS (n=17)

Subgroups	S'87	F'87	S'88	F'88
A-1 Previously a cluster bakesite	1	1	1	0
A-2 Clustered from "O"*	4	4	4	3
A-3 Clustered from "S"*	7	7	7	5
A-4 Previously self-contained	5	5	5	2
Total number of schools	[17	17	17]	10

Note: * These were two of the four original cluster bake sites.

Sample B. By Spring 1988, the two remaining cluster bake sites, designated as "W" and "EC", ceased bakery production for their satellite schools. Cluster bake site "W" was in an elementary school, became a satellite school and was classified as "B-1" in Table III. The other cluster bake site was the kitchen for a secondary school and, therefore, was not included in the study.

Satellites served by each cluster bake site were identified as "B-2" and "B-3" in Table III. Three additional schools which were previously self-contained ("B-4") raised the total number of satellites in Sample B to 19. Administration closed several elementary schools in Fall 1988, reducing this total to 17. While

this action did not alter the total number of schools in Sample A (Table II), the brackets used in Table III revealed the reduction that occurred in Sample B. Other schools experienced a shift in the population served and remained in the study.

TABLE III

SAMPLE "B" BY SUBGROUPS (n=17)

Subgroups	S'87	F'87	S'88	F'88
B-1 Previously a cluster bakesite	1	1	1	1
B-2 Clustered from "W"*	8	8	8	8
B-3 Clustered from "EC"*	7	7	7	5
B-4 Previously self-contained	3	3	3	3
Total number of schools	19	[19	19	17]

Note: * These were two of the four original cluster bake sites.

Subgroups. As indicated in Tables II and III, both Sample "A" and "B" contained four subgroups according to the original source of bakery items. The first group in each sample contained a single school, which was previously a cluster bake site (Subgroups A-1 and B-1). Since production activity in these two schools provided menu items for additional elementary and secondary schools, both schools listed first in Sample "A" and "B" were deleted from analysis.

Schools in the second and third groups of each sample were previously recipients of the original cluster bake sites. Consequently, they were satellite

schools prior to the research intervention. The schools in the fourth group were originally from a self-contained status and remained in part of the study.

Research Design

The research design according to its purpose was applied, as it was conducted to evaluate the usefulness of an innovative bake center within a major child nutrition program. Evaluation is the systematic process of collecting and analyzing data in order to make decisions (Gay, 1987). The methodology selected was nonrandomized, quasi-experimental (Campbell & Stanley, 1963). The two-phase intervention of the bake center created Sample A and B, providing two subgroups within the experimental group of the study. Although the bake center intervention was the same each time, the treatment was staggered with Sample A in the fall of 1987 and Sample B in the spring of 1988.

Repeated measures were used by tracking data over two calender years, for the before and after comparison, as well as by contrasting performance measures between the experimental and control group. An illustration of this design can be found in Table IV.

Researchers have suggested this as the best type of quasi-experimental design (Rossi & Freeman, 1985). The treatment effect can be compared once with a series of a second group (Sample A and B) and once with the observations of the experimental group(s) before the intervention occurs. This enhances the reliability of the research findings (Huck, Cormier, & Bounds, 1974, p. 319).

In the first part of the study, the satellite schools were reflexive controls, as each received the research intervention and were compared to themselves before and after the intervention (Rossi & Freeman, 1985). All of these school

foodservice units received bakery items from the bake center.

Self-contained foodservice units served as constructive controls when compared to their "equivalent" counterparts. In this case the "equivalent" counterparts were the satellite schools serviced by the bake center. Strategies for isolating effects of extraneous factors involve the establishment of "controls," or groups which are not subjected to the intervention; suggesting what may occur in its absence (Rossi & Freeman, 1985).

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TABLE IV

MULTIPLE GROUP (SAMPLE "A" AND "B") WITH A STAGGERED AND CONTINUOUS SINGLE TREATMENT

	Spring						Fall						Spring						Fall			
	J	F	M	A	M		S	O	N	D		J	F	M	A	M		S	O	N	D*
"A"	O	O	O	O	O	X	O	O	O	O		O	O	O	O	O					
"B"							O	O	O	O	X	O	O	O	O	O		O	O	O	O

Note: * Months of the year.

Table V identified the constructive controls as the control group. The experimental group contained two subgroups (A-2, A-3 and B-2, B-3). from Samples A and B. Schools, in these two subgroups, were satellite schools from the cluster bake sites before and after implementation of the bake center.

Of the four subgroups, the first subgroup (A-1 and B-1) was previously two cluster bake sites. The fourth group of schools (A-4 and B-4) originated from a self-contained status. In order to compare the satellite with the self-contained units, neither of the latter two subgroups were included in this part of the study. This allowed for a trend comparison between the schools which were satellite units and the schools which were self-contained for the two years.

TABLE V

RESEARCH DESIGN BY CONTROL AND EXPERIMENTAL GROUP

Research Design Groups	S'87	F'87	S'88	F'88
Control (n=26 to 28)	28	28	28	26
Experimental (n=21 to 26)				
Sample A-2	4	4	4	3
Sample A-3	7	7	7	5
Sample B-2	8	8	8	8
Sample B-3	7	7	7	5
Totals (n=47 to 54)	54	54	54	47

Data Collection

Institutional Data

A research instrument to collect institutional data was developed in the Summer 1988 (Appendix D). Factors which may affect operational costs of the elementary school foodservice units were reviewed. Forms completed by the supervising dietitians after a site visit, labor analysis sheets, and additional service records were utilized to construct the instrument.

A meeting with the management staff, the researcher, and the research advisor was held to pre-test the instrument. Discussion resulted in the limitation to focus on elementary schools in an attempt to control any extraneous variables which would exist with the inclusion of secondary schools, such as expansion of the menu.

Schools were coded to identify the appropriate group for the research design. Self-contained schools were identified as "000" and the satellite schools were tagged with a sample and subgroup code, ie., A-1 or B-3. The school's size was defined by the average daily participation (ADP) in the school's lunch program. These values were averaged over four semesters and converted to a multiple of 25 to determine a production forecast.

Production demands varied within each school; some provided a hot breakfast, while others prepared sack lunches or contract meals for a local day care program. Implementation of a new program was recorded since some schools introduced a salad bar as a new mechanism for service delivery.

All elementary schools followed the same five week cycle menu and received food and supplies from a central warehouse. The majority of items were purchased on an annual bid, so prices were stable throughout the school year. The selling price for a breakfast or lunch had not increased since 1981.

The hourly wage for personnel increased less than five percent throughout the study.

Labor intensive production activities were discussed. A menu analysis revealed that the meat, milk, and fruit and vegetable component of the school lunch pattern originated from convenience food items. Therefore, labor demands for production efforts were considered reasonable and consistent within the satellite schools. Bakery items required greater culinary skill and were considered labor intensive.

Service activities which varied among the satellite schools included the number of serving lines and point of sale (POS) terminals. Data for the use of disposable serviceware and the number of dishmachines still in operation was also solicited for analysis.

Information on the number of staff positions and total labor hours was available from the supervising dietitian for each site. Labor figures were consistent for the self-contained schools over the two consecutive years. While figures for some satellite schools were lowered following implementation of the bake center, comparisons between the two research populations were made on data prior to the research intervention. When performance ratios were tracked over the two consecutive years, the reduction of labor hours in the satellite schools was used in the analysis.

The two schools in subgroups A-1 and B-1 (Tables II and III) went from a cluster bake center to a satellite and lost their bakers. These were the only schools that lost a staff position following implementation of the bake center. This was a direct result of the above mentioned change.

Institutional data sets were sent to the central office in Spring, 1989 for verification by a member of the management staff. The final set of data was

returned to the researcher in the fall of 1989.

Operational Data

Raw figures on cost and operational data were collected. In order to compare "like" months before and after the research intervention, the collection points began with January 1987 and continued through December 1988. Considering the academic calender, this provided 18 operational months of data to the researcher. There were five collection points in the spring semesters (January, February, March, April, and May/June) and four months in the fall semesters (September, October, November, December).

Cost information was categorized into revenue and expenses. Revenue included daily cash receipts, state and federal reimbursements, and additional income from contract meals and special events. Expenditures included cost for purchased food, market value of commodities used, cost of cleaning supplies, cost of paper supplies, and labor cost.

Average daily attendance (ADA) and average daily participation (ADP) were compared to identify any differences between the two groups. Total meals and labor hours were used to compute productivity ratios. The number of operational days varied with each collection point and served as an equalizing factor when daily information was compared to monthly figures.

Data Analysis

Data collected from the instrument and service records were coded (Appendix B) and entered into the computer using PC-File (Button, 1984). Data were transferred to an IBM System to permit analysis using the Statistical

Analysis System (SAS) (Barr & Goodnight, 1985).

The comparison of the two satellite groups before and after the research intervention constituted a split plot with repeated measures design. Nonparametric statistical analysis was selected to analyze cost and productivity measures, since mathematically, a ratio is not normally distributed (Hollander & Wolfe, 1973). A rank transformation, credited to Conover and Iman, was incorporated into the analysis of variance (ANOVA) procedure for the operational data.

Results from the satellite units were contrasted with the self-contained schools. Scattergrams were prepared to track performance measures over the two calender year period (Isaac & Michael, 1985). Wilcoxon's rank sum of squares and Kruskal-Wallis' test for chi-square approximation demonstrated the association between the production and service parameters, as well as the cost and productivity ratios, the dependent variables in this study (Huck, Cormier, & Bounds, 1974; Hollander & Wolfe, 1973).

CHAPTER IV

RESULTS AND DISCUSSION

Performance measures of 64 elementary school foodservice units were monitored over two calender years. The purpose was to compare and contrast performance measures of satellite and self-contained foodservice units as production alternatives. White (1984) suggested that the productivity ratios might differ according to the type of production system in use. Variations in these measures were assumed to be the result of the bake center on the satellite schools which it served. In the process, other factors which affect cost and productivity measures in school foodservice were investigated.

Institutional and operational data were collected to develop a cost and productivity profile of the foodservice operations within these schools. Institutional data included the size of each school, production and service parameters, and information on labor usage.

Operational data consisted of five cost categories as a percent of revenue and as a cost/meal. Revenue/expenses and meal/labor were monitored as productivity measures. Monthly averages were used to generate the performance measures. For example, the monthly average for the total meals/day (Figure 3) and for the percent of participation in the school lunch program (Figure 4) were tracked monthly over two calender years to determine fluctuations which might influence the results.

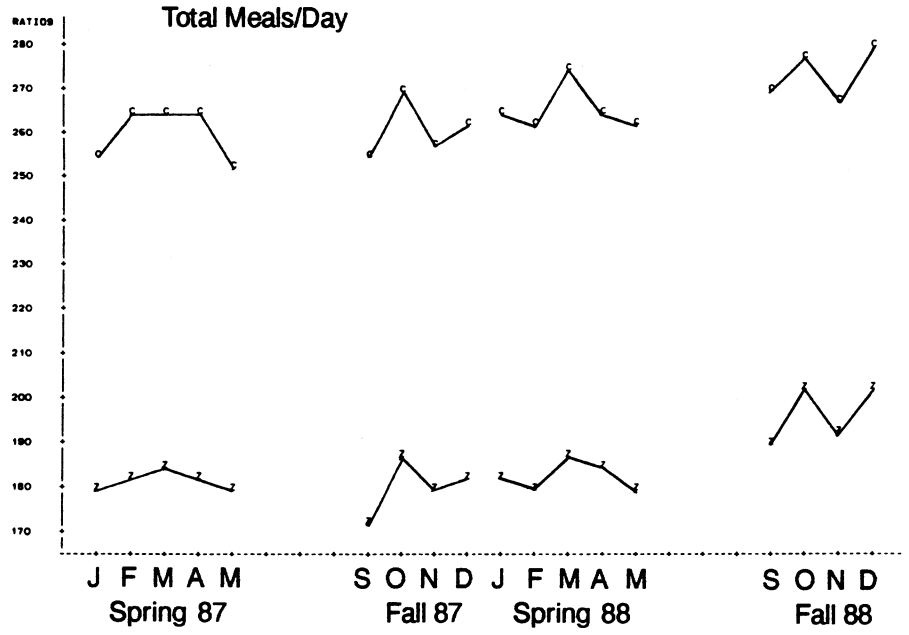

Figure 3. Monthly average of total meals/day for satellite (z) and self-contained (c) units over two calender years.

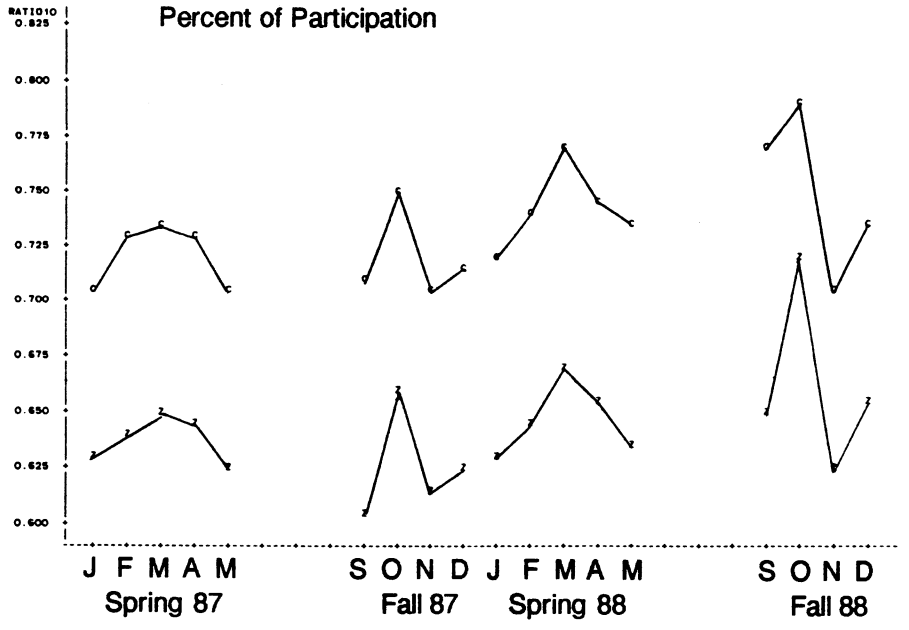

Figure 4. Percent of participation in the school lunch program for satellite (z) and self-contained (c) units over two calender years.

Institutional Characteristics

Size of the Schools

School size was determined by using the average daily attendance (ADA) and participation (ADP). Values were raised to the nearest multiple of 25 to determine production levels (Appendix E Table XXII). The range in size of the elementary schools is illustrated in Table VI which categorizes schools by production level. Twenty-nine schools (45.3%) served 200 or fewer lunches, while 14 (21.9%) served 300 or more.

A comparison between the satellite and self-contained schools revealed a major contrast in the size of the school. Twenty-five (69.4%) of the satellite (experimental) schools produced less than 200 lunches daily. Only four (14.3%) of the self-contained (control) schools served such a small number. These four schools were located in the outer perimeters of the school district and were not serviced by the bake center.

Nearly 50 percent (n=13) of the self-contained schools, compared to one satellite school, served 300 or more lunches each day. Based on the data analysis, the larger schools supported the additional labor hours necessary for a conventional foodservice system. These provided the labor for production and service functions to occur on the premises. The single satellite school which served over 300 lunches was in an area experiencing from a labor shortage; the management staff planned to hire a skilled baker when one became available. This would convert the school's status to a self-contained unit.

TABLE VI

PRODUCTION LEVELS BY CONTROL (SELF-CONTAINED) AND EXPERIMENTAL (SATELLITE) GROUPS

Production Level (No. Lunches)	All Schools N	%	Control N	%	Experimental N	%
150 or less	8	12.5	1	3.6	7	19.4
175	7	10.9	0	00.0	7	19.4
200	14	21.9	3	10.7	11	30.6
225	11	17.2	8	28.6	3	8.3
250	8	12.5	2	7.1	6	16.7
275	2	3.1	1	3.6	1	2.8
300	6	9.4	5	17.9	1	2.8
over 300	8	12.5	8	28.6	0	0.0
TOTAL	64	100.0	28	100.0	36	100.0

Another performance measure related to size of the facility was the percent of participation in the National School Lunch Program. A comparison of these figures for the two research groups can be seen in Table VII. Percent participation was computed by dividing the ADA by the ADP.

Overall, elementary schools within this major city child nutrition program experienced a 67.5% rate of participation. The 28 self-contained schools had a higher rate,75%, than the 36 satellite schools, which averaged 62%. This variable should be of particular importance to foodservice operators to maximize the use of all their resources.

TABLE VII

AVERAGE DAILY ATTENDANCE (ADA) AND PARTICIPATION (ADP) BY CONTROL (SELF-CONTAINED) AND EXPERIMENTAL (SATELLITE) GROUPS

Groups	ADA	ADP	%
Control (N=28)	362.55	266.17	75.03
Experimental (N=36)	297.60	184.41	61.97
Total (N=64)	326.01	220.18	67.53

Production Parameters

Various production activities, identified in Table VIII, were reviewed to determine differences in the two research groups. Participation in the breakfast program and a salad bar service during lunch appeared to be governed by the Principal of each elementary school. Offering a sack lunch option to increase participation in some schools was a popular activity. Contract meals provided additional income for schools conveniently located in an area to provide this service.

Among the 64 elementary schools in the study, 75% (n=48) participated in the breakfast program. A breakfast meal was prepared in 89.3% (n=25) of the control schools and in only 63.9% (n=23) of the schools in the experimental group. Children in some schools were provided breakfast at home, hence there was little need for such a program in their schools. The breakfast program was popular in neighborhoods where breakfast was not available in the child's home.

Slightly more than one-fourth (n=17) of the foodservice units prepared sack lunches to increase lunch participation. This provided a convenient alternative for students in 38.9% (n=14) of the satellite schools and only 10.7% (n=3) of the self-contained schools.

Another strategy to generate interest in the lunch program was to provide a salad bar service during lunch. Nearly 36% (n=23) of all the schools offered a salad bar. Both research groups were receptive to the salad bar idea at 35.7% and 36.1, respectively.

Aside from increasing total meals, these school foodservice units had alternative ways to increase funds for their programs. Contract meals were provided by 43.8% (n=28) of the schools. These were more popular in self-contained schools at(n=14; 50%) than in the satellite schools (n=14; 38.9%).

Self-contained units had the labor to prepare additional meals for distribution elsewhere. Private and parochial schools were common customers for these schools. Clients of the satellite units were in-house preschool programs such as Head Start.

Twenty schools (31.3%) were initiating a new program at the time of the study. For the most part, it was the first year for the salad bar option to be offered. Other new programs in the elementary schools were insignificant to the objectives of the study.

Service Parameters

Service factors thought to impact cost and productivity measures appear in Table IX. These included the number of serving lines, point of sale (POS) terminals, and the use of a dishmachine and disposable serviceware. Of the 64 schools, half (n=32) had two lines and 92.2 (n=59) had one POS terminal in

TABLE VIII

PRODUCTION PARAMETERS BY CONTROL (SELF-CONTAINED) AND EXPERIMENTAL (SATELLITE) GROUPS

Parameters	All Schools		Control		Experimental	
	N	%	N	%	N	%
Breakfast Program						
yes	48	75.0	25	89.3	23	63.9
no	16	25.0	3	10.7	13	36.1
Sack Lunches						
yes	17	26.6	3	10.7	14	38.9
no	47	73.4	25	89.3	22	61.1
Salad Bar						
yes	23	35.9	10	35.7	13	36.1
no	41	64.1	18	64.3	23	63.9
Contract Meals						
yes	28	43.8	14	50.0	14	38.9
no	36	56.2	14	50.0	22	61.1
Initiated New Program						
yes	20	31.2	7	25.0	13	36.1
no	44	68.8	21	75.0	23	63.9

their cafeterias. The five (7.8%) largest elementary schools required two terminals.

Although half of the schools had one serving line and the other half had two serving lines, a comparison of self-contained and satellite schools revealed major differences. Twenty-two (79.6%) self-contained schools had two serving lines compared to only 10 (11.1%) satellite schools. All satellite (n=36) and 82.1% of the self-contained units had a single POS terminal.

Use of the dishmachines was discontinued in 59.4% (n=39) of the schools. The average age of an elementary school was 35 years with some as old as 83 years. As original dishmachines wore out, they were either replaced with one from a closed school or the school began using disposable serviceware. This decision was made as a result of sanitation audits as well as an effort to reduce labor costs.

Dishmachines were utilized in nearly two-thirds (n=18) of the self-contained schools compared to only 18.8% (n=8) of the satellite schools. Of the eight satellite units, three used the dishmachine solely for pots and pans because they were not equipped with a three compartment sink for manual dish washing. For these reasons the use of disposables had increased to nearly two-thirds or 64.1% (n=41) of all the elementary schools. Most of these (86.1%, n=31) were satellite schools because of the labor issue. Other schools kept a supply of disposable serviceware on hand for emergencies.

Labor Parameters

The number of staff positions and total labor hours/day were collected for each school. The number of positions ranged from one to eight with the majority (61%, n=39) of schools dependent upon two or three positions (Table X). About 30% (n=19) of the schools operated with four or five positions.

The number of positions within each school revealed a distinct difference their cafeterias. The five (7.8%) largest elementary schools required two terminals.

TABLE IX

SERVICE PARAMETERS BY CONTROL (SELF-CONTAINED) AND EXPERIMENTAL (SATELLITE) GROUPS

Service Parameters	All Schools		Control		Experimental	
	N	%	N	%	N	%
Serving Lines						
1	32	50.0	6	21.4	26	72.2
2	32	50.0	22	78.6	10	27.8
POS Terminal(s)						
1	59	92.2	23	82.1	36	100.0
2	5	7.8	5	7.9	0	00.0
Dishmachine						
yes	23	35.9	18	64.3	5	13.9
pots/pans only	3	4.7	0	00.0	3	8.3
no	38	59.4	10	35.7	28	77.8
Disposables						
daily	41	64.1	10	35.7	31	86.1
occasionally	23	35.1	18	64.3	5	13.9

in the two research groups. Two or three positions were provided for 80.5% (n=29) of the satellite schools compared to four or five positions found in 50% (n=14) of the self-contained schools. Satellite schools did not exceed five, while self-contained schools used as many as eight positions.

Labor hours worked/day was another parameter used to develop a profile of the schools (Table XI). The range was from four to 45 hours. Nearly two-thirds (65.7%, n=42) of schools operated on eight to 20 labor hours/day.

TABLE X

NUMBER OF POSITIONS BY CONTROL (SELF-CONTAINED) AND EXPERIMENTAL (SATELLITE) GROUPS

Number of Positions	All Schools N	%	Control N	%	Experimental N	%
One	2	3.1	0	0.0	2	5.6
Two	19	29.7	3	10.7	16	44.4
Three	20	31.3	7	25.0	13	36.1
Four	8	12.5	5	17.9	3	8.3
Five	11	17.2	9	32.1	2	5.6
Six	1	1.6	1	3.6	0	0.0
Seven	2	3.1	2	7.1	0	0.0
Eight	1	1.6	1	3.6	0	0.0
Total	64	100.0	28	100.0	36	100.0

Differences between the two research groups were evident with this parameter. Results revealed that considerably more hours were required by the self-contained units than the satellite units. Most self-contained schools (42.9%, n=12) operated on 24.5 hours or more, however several of the satellite schools

The two satellite schools which functioned on more than 20 labor hours were previously cluster bake sites. Both schools lost labor hours due to the elimination of a baker's position following the implementation of the bake center. Two-thirds (n=18) of the self-contained schools utilized more than 20 hours/day and nearly all of the satellite schools (n=34) used less.

TABLE XI

LABOR HOURS PER DAY BY CONTROL (SELF-CONTAINED) AND EXPERIMENTAL (SATELLITE) GROUPS

Labor hours/day	All Schools		Control		Experimental	
	N	%	N	%	N	%
Less than 8 hours	2	3.1	0	0.0	2	5.6
8 - 12 hours	11	17.2	0	0.0	11	30.6
12.5 - 16 hours	19	29.7	4	14.3	15	41.7
16.5 - 20 hours	12	18.8	6	21.4	6	16.7
20.5 - 24 hours	7	10.9	6	21.4	1*	2.8
24.5 - 28 hours	7	10.9	7	25.0	0	0.0
28.5 - 32 hours	4	6.3	3	10.7	1*	2.8
More than 32 hours	2	3.1	2	7.1	0	0.0
Total	64	100.0	28	100.0	36	100.0

Note: *Previously cluster bake sites

Performance Measures

The operational data for the 64 elementary schools within a major city child nutrition program spanned a period of four semesters within two calender years. Two categories of performance measures emerged from the data. Cost measures were calculated from monthly profit and loss statements and monthly meal figures. Productivity measures were calculated using values for organizational inputs and outputs.

Cost Measures

Service records for the school system delineated five major cost categories: food, market value of commodities, cleaning supplies, paper, and labor costs. Two denominators, total revenue and total meals, were used to study the relationship of these costs to organizational outputs. These measures identified each cost as a percent of total revenue (Ratios 1) and as a fraction of the cost to prepare a single meal (Ratios 2).

Both examples of cost measures can be utilized in the financial management of resources for a foodservice operation. Costs as a percent of revenue are used to prepare budgets and to compare actual performance with the organization's financial plan. Segments within the foodservice industry have identified specific standards to respond to their particular settings.

Cost figures per meal can provide a standard meal cost for food and labor to encourage a balance between higher food cost menu items and the lower cost items. The amount of labor invested in a menu item is critical to a successful menu plan. A commissary foodservice system would use this information to establish a cost accountability program. Once the labor cost/menu item is determined, satellite units are assessed the cost incurred in producing the menu items at the commissary's center central production site.

Productivity Measures

Meals/labor hour continues to be the most frequently cited productivity measure in the foodservice industry. Five additional measures, documented in previous studies on productivity, were used in this study. The cost measures, mentioned previously, would be considered inverse ratios for productivity.

Each measure of productivity was signified as an organizational output

divided by an organizational input (Sink, 1985). Total revenue and total meals served were the two major outputs. Total expenses, labor hours, and customer counts were the inputs. These were later identified as Ratios 3, 5, 7, and 4, 6, 8 when compared by month, by semester, and over the two calender years of the study.

The amount of revenue generated and the number of meals served in each school would reflect the percent of participation in the lunch program and the size of the school. These two institutional variables were used to suggest differences between the satellite and self-contained schools.

Pre and Post Research Intervention

The intent of the bake center was to bring the cost/meal for the satellite units more in line with the self-contained units and reduce total operational costs. Creation of the bake center eliminated the need for four cluster bake sites which previously serviced the school cafeterias. The intervention occurred in two stages, in the fall of 1987, creating Sample A (see Table II, Chapter III) and in the spring of 1988, creating Sample B (see Table III, Chapter III). Each sample included an elementary school (A-1 and B-1) which was a cluster bake site elementary schools (A-2, A-3 and B-2, B-3) serviced by two cluster bake sites, and elementary schools (A-4 and B-4) which were previously self-contained.

It was obvious that the performance of the two elementary schools which originally served as cluster bake sites would be different following implementation of the bake center. So it was decided to eliminate data from these schools for the pre and post comparisons. Both Sample A and Sample B

contained 17 schools from the three remaining subgroups, for a total of 34 elementary schools in this part of the study. Cost and productivity measures were computed and compared before and after the intervention as well as within the three subgroups of the two samples. A nonparametric ANOVA was applied to 10 cost measures and six productivity measures to determine any significant differences which may be attributed to the implementation of the bake center.

Cost Measures

Significant differences were found within the three subgroups of the two samples for seven of the 10 cost measures. Table XII illustrates these differences for each cost measure. One explanation was the origin of each subgroup since schools in only one subgroup (A-4 and B-4) were previously self-contained. The other schools remained as satellite schools; production activities for bakery items shifted from four cluster bake sites to a single bake center or commissary. The rationale for selecting a commissary foodservice system included a reduction in labor hours which would reduce labor costs. Results indicated that the greatest variation occurred in labor costs (Table XII). A significant difference in the market value of commodities used was expected. The schools which were previously self-contained had a greater expense as the inventories for the commodities in the satellite schools were greatly reduced following the implementation of the bake center. Cleaning costs were not expected to be different. Operation of a mechanical dishmachine in the majority of self-contained schools could account for the higher cleaning costs as nearly all satellite schools used disposable serviceware.

TABLE XII

SIGNIFICANT DIFFERENCES IN COST MEASURES WHEN SATELLITE UNITS WITHIN THREE SUBGROUPS WERE COMPARED BEFORE AND AFTER IMPLEMENTATION OF THE BAKE CENTER

Costs	Percent of Revenue	Part of Meal Cost
Food	0.0022**	
Commodities	0.0058*	0.0034**
Paper		
Cleaning Supplies	0.0013**	0.0034**
Labor	0.0006**	0.0095*

Note: *$p \leq .05$, **$p \leq .001$, ***$p \leq .0001$.

Productivity Measures

Only two of the six productivity measures revealed a significant difference when compared before and after the intervention of the bake center. Revenue as a percent of expenses revealed the most significant difference ($p > 0.0002$). The amount of revenue generated per labor hour was the other productivity measure found to be significantly different ($p > 0.0052$).

A commissary foodservice system allows for the centralization of production activity and reduces the amount of labor hours needed in the satellite units. This reduces total operational expenses and explain the improved productivity following implementation of the bake center. All schools experienced a reduction in labor hours when bakery items were produced and delivered from the bake center, rather than being produced on-site. The two schools which were formerly cluster bake sites each lost a baker's position as well.

Although the school foodservice system has not increased meal prices

since 1981, state and federal reimbursements continued to increase over the three fiscal years of this study (Table XIII). This, coupled with an increase in total meals , would contribute to the variation in productivity measures since revenue and meals served as numerators in these ratios.

TABLE XIII

STATE AND FEDERAL REIMBURSEMENTS FOR PARTICIPATION IN AN ELEMENTARY SCHOOL LUNCH PROGRAM

	1986-1987	1987-1988	1988-1989
Free and Reduced Meals	$ 1.4050	$ 1.4650	$ 1.5025
Full Paid Meals	$ 0.9800	$ 0.9950	$ 0.9800

Summary

Overall, no significant differences in performance measures were found either of before or after the research intervention. A summary of Conover and Iman's analysis of variance and an analysis of raw ratios for performance measures before and after implementation of the bake center can be found in Appendix E, Tables XXIII, XXIV.

Therefore, schools in Sample A and Sample B were united to form a single group of satellite schools. As a result, the focus of this research shifted to the difference in the performance between satellite and self-contained elementary schools within a major city child nutrition program. White (1984) suggested that the type of system would have an impact on productivity.

Satellite versus Self-contained Units

Satellite and self-contained elementary schools were quite different when institutional characteristics were used as a comparison. Ten cost and six productivity measures for the two research groups were compared monthly, by semester, and overall for the two calender years of the study. A nonparametric ANOVA was used to reveal any significant differences in these measures. Total meals/month and the ADP values for satellite and self-contained units were tracked over the two calender years (1987 and 1988).

Performance Measures

Cost by Month. Significant differences in monthly cost measures when satellite and self-contained units were compared over two years were found in Tables XIV. Cost measures, from the five cost categories, which experienced the greatest amount of variation over two years will be discussed.

The greatest variations were with paper costs as a percent of revenue in 16 out of 18 months, as illustrated in Figure 5 (p. 59), and as a cost/meal in 12 out of 18 months (see Figure 6, p. 59). At the time of the study, dishmachines were found in the majority (64.3%) of the self-contained units, consequently, this would explain a significantly lower paper cost. Use of disposable serviceware in these units was considerably less than in the satellite units. Only 13.9% of the satellite schools used dishmachines to sanitize their reusable serviceware, thus explaining the increase in paper costs for the satellite units.

Paper costs per meal were significantly different for eight of the nine months in the first year of data collection. This variance diminished to four months the second year (Table XIV, p. 57). Several dishmachines were shut

down in the self-contained schools, which resulted in the daily use of disposable serviceware and an increase in paper costs.

Figure 7 (p. 60) revealed the variation of the market value of commodities as a cost/meal in 14 out of 18 months of the study. Each of the nine months, during the first year of the study, there was a significant variation in the market value of commodities used per meal. This cost measure revealed differences between satellite and self-contained units in only five of the nine months during the second year (Table XIV). The market value of commodities to total revenue (Figure #14, Appendix F) only revealed three months with a significant difference, twice before the intervention and once during it's occurance.

Initially it would be likely that the use of commodities would vary when comparing these two groups of schools. A large amount of the commodities were utilized at the bake center, thus lowering the amount utilized by the satellite units. With the self-contained units preparing all menu items on-site, a higher amount of commodities would be utilized. Changes in the type and amount of commodities used each year might continue to explain the variation, particularly since the fourth semester revealed no significant differences.

Food costs as a percent of total revenue (Figure 8, p.60) were significantly different in five out of the 18 months. Interestingly enough, these differences were not during the first and final semester, but during the two semesters in which the intervention occurred. While the variatance in food cost/meal was only twice during the study (Figure 13 , Appendix F), once again, the time was during the intervention. With the satellite schools preparing fewer menu items, it seems only reasonable that the food cost would be lower. This would suggest that these schools be billed for the menu items received from the bake center.

Since groceries are purchased annually through a formal bidding system unit prices on items were consistent over the course of an academic year. The same five week menu is offered in each of elementary schools. Some cost variation may be attributed to the differences in the four dietitians who rotate the responsibility of writing the five week cycle menu. Each cycle is reviewed by the Director of Foodservice to minimize variations from organizational standards.

Cleaning costs as a percent of total revenue (Figure 15, Appendix F) was significantly different for the month of April in the first semester. Cleaning costs as a part of the cost/meal (Figure 16, Appendix F) were significantly different for only three months throughout the study. Two of the three months were in April of each year. While no contributing factor was identified, spring cleaning efforts might account for the difference.

Labor costs as a percent of revenue and as a cost/meal ((Figure 17 & 18, Appendix F) for the satellite schools, while still greater than in the self-contained schools, appeared more in line with the self-contained schools after the bake center was implemented (Table XIV). There was no variation in labor costs in the second year of data collection.

A new cost accounting system for Fall 1988 contributed to a rise in labor costs as a percent of revenue for satellite units. Each unit was arbitrarily assessed a standard labor cost/100 servings furnished by the bake center. The self-contained units continued to be more efficient in labor usage, when using these two perofrmance measures.

TABLE XIV

SIGNIFICANT DIFFERENCES IN COST MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED BY MONTH OVER TWO YEARS

	Spring 1987				
Cost Measures	JAN	FEB	MAR	APR	MAY
Food/Revenue	0.9297	0.1385	0.3051	0.4047	0.0889
Commodity/Revenue	0.1379	0.2482	0.1929	0.0112*	0.0398*
Paper/Revenue	0.0004***	0.0010**	0.0004***	0.0001***	0.0034**
Cleaning/Revenue	0.7552	0.3228	0.0830	0.0107*	0.1596
Labor/Revenue	0.0168*	0.7979	0.7956	0.5153	0.2457
Food/Meal	0.0695	0.5285	0.1748	0.1582	0.5420
Commodity/Meal	0.0176*	0.0243*	0.0030**	0.0006**	0.0009**
Paper/Meal	0.0044**	0.0065*	0.0054*	0.0001***	0.0521
Cleaning/Meal	0.9827	0.1694	0.0305*	0.0072*	0.0851
Labor/Meal	0.0003***	0.0841	0.0095*	0.1955	0.0190*

	Fall 1987			
Measures	SEPT	OCT	NOV	DEC
Food/Revenue	0.5616	0.8133	0.0001***	0.0721
Commodity/Revenue	0.0904	0.2404	0.4142	0.6091
Paper/Revenue	0.0095*	0.0028**	0.0001***	0.0021**
Cleaning/Revenue	0.9571	0.7811	0.4284	0.2501
Labor/Revenue	0.1923	0.0732	0.0001***	0.0004**
Food/Meal	0.8721	0.0185*	0.5135	0.5342
Commodity/Meal	0.0250*	0.0004**	0.0095*	0.0362*
Paper/Meal	0.0090**	0.0449*	0.0010*	0.0262*
Cleaning/Meal	0.9262	0.3849	0.2948	0.1473
Labor/Meal	0.0170*	0.1988	0.0981	0.3210

TABLE XIV (Continued)

	Spring 1988				
Cost Measures	JAN	FEB	MAR	APR	MAY
Food/Revenue	0.0092*	0.0001***	0.0004***	0.5874	0.0001***
Commodity/Revenue	0.8722	0.1586	0.7040	0.0144*	0.6441
Paper/Revenue	0.0003***	0.0001***	0.1289	0.0037**	0.0051*
Cleaning/Revenue	0.2370	0.3677	0.9468	0.0520	0.7882
Labor/Revenue	0.7687	0.0001***	0.0001***	0.0901	0.1189
Food/Meal	0.3457	0.5904	0.8384	0.0272*	0.0956
Commodity/Meal	0.0651	0.0028**	0.0198**	0.0012**	0.0047**
Paper/Meal	0.0097*	0.0028**	0.5744	0.1317	0.1491
Cleaning/Meal	0.4236	0.2722	0.7812	0.0229*	0.2902
Labor/Meal	0.0507	0.0688	0.0858	0.4735	0.5252

	Fall 1988			
Measures	SEPT	OCT	NOV	DEC
Food/Revenue	0.4903	0.6659	0.2551	0.0704
Commodity/Revenue	0.8074	0.8127	0.5053	0.6091
Paper/Revenue	0.0025**	0.0001***	0.0054*	0.1091
Cleaning/Revenue	0.7709	0.9277	0.8159	0.1663
Labor/Revenue	0.0517	0.0059*	0.0013**	0.0390*
Food/Meal	0.7730	0.1816	0.1689	0.6096
Commodity/Meal	0.2637	0.0809	0.2784	0.0490*
Paper/Meal	0.0031**	0.0131*	0.0502	0.2454
Cleaning/Meal	0.8066	0.6801	0.9931	0.0932
Labor/Meal	0.0886	0.5562	0.1675	0.9669

Note: *$p \leq .05$, **$p \leq .001$, ***$p \leq .0001$.

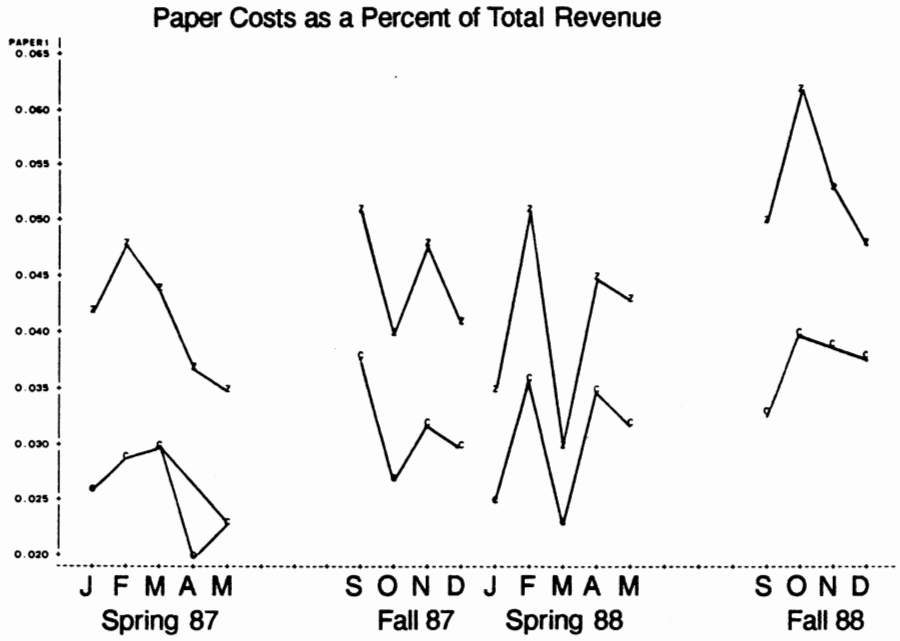

Figure 5. Paper costs as a percent of total revenue for satellite (z) versus self-contained (c) units over two calender years.

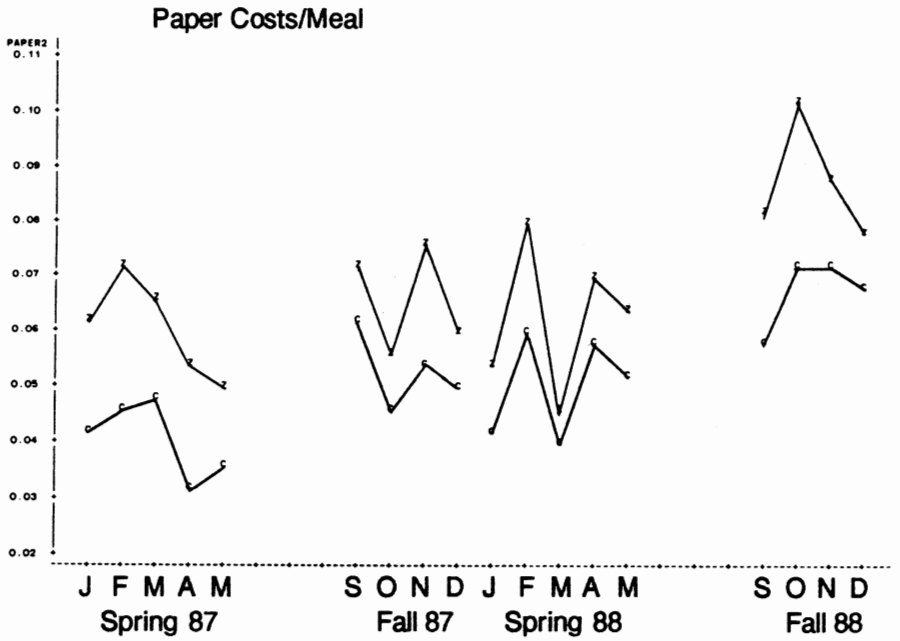

Figure 6. Paper costs/meal for satellite (z) and self-contained (c) units over two calender years.

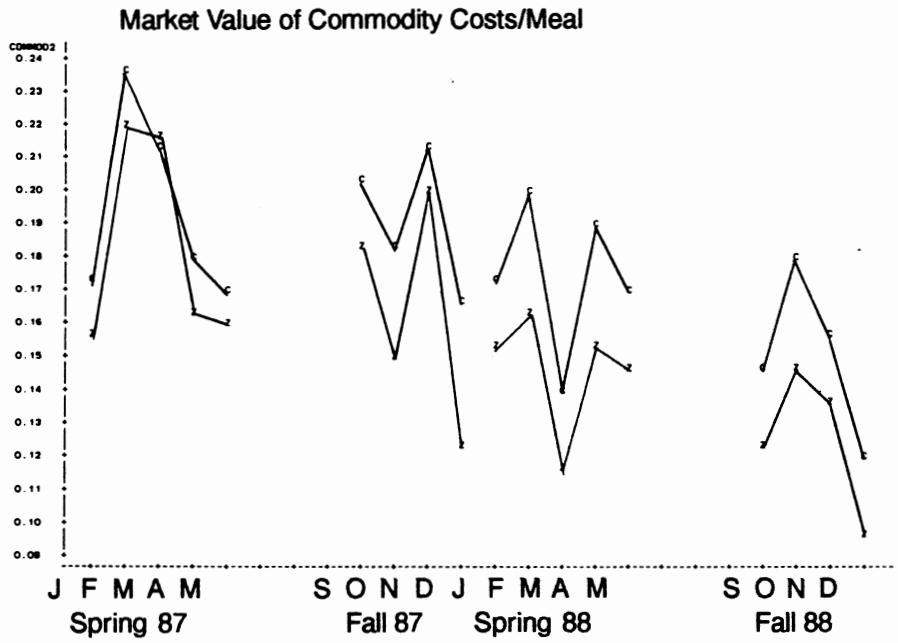

Figure 7. The market value of commodities as a cost/meal for satellite (c) and self-contained (z) units over two calender years.

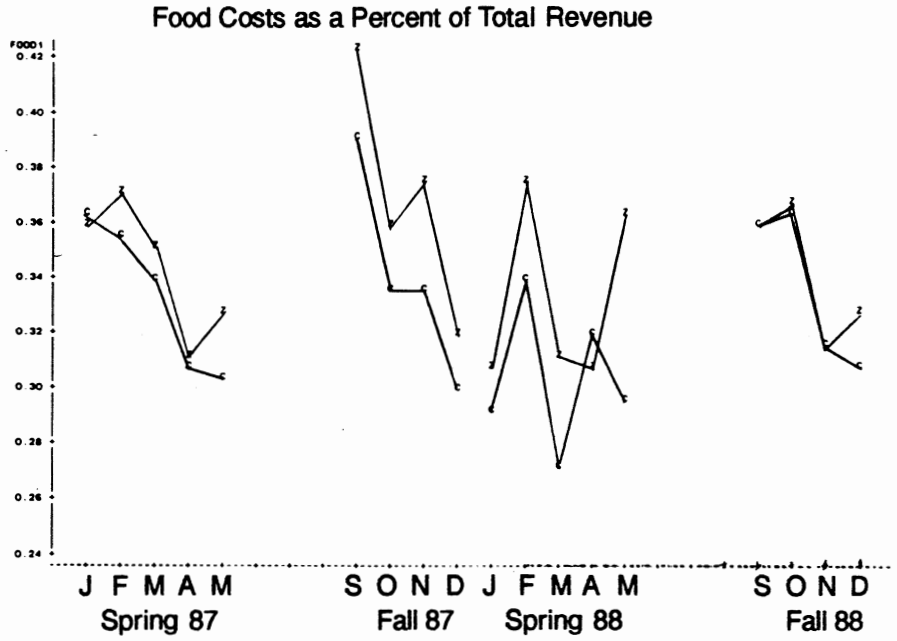

Figure 8. Food costs as a percent of total revenue for satellite (z) and self-contained (c) units over two calender years.

Cost by Semester. Results of the semester comparison were summarized in Table XV. The greatest cost variance was found in paper costs, as a percent of revenue and in the market value of commodities as a cost/meal Both were significantly different at the $p \leq .0001$ level for three of the four semesters of the study. This supported the findings in the monthly comparisons (Table XIV).

Paper costs/meal revealed quite a difference each semester, but with the same degree of variance seen with the two previously mentioned cost measures. Once again the use of disposable serviceware appears as an intervening variable when attempting to assess the impact the bake center may have on the 10 cost measures presented in this study.

The market value of commodities used per meal continued to be higher in the self-contained units since they were preparing all menu items for each meal served. A large percentage of government commodities were utilized to prepare bakery items at the bake center. The inventory level and usage for the satellite schools would be less than the usage of the self-contained schools.

Labor costs as a percent of total revenue experienced a greater variance in the fall semesters. Management reduced labor hours in each of the satellite schools following an assessment of operational costs incurred by the bake center. A variation in labor cost/meal became less significant over the four semesters, perhaps this was due to the new accounting procedures.

Of the remaining cost measures, most of the differences were noticeable during the first two semesters. Once all the schools were receiving menu items from the bake center, and being billed for them, there was less variation in all of the ten cost measures.

TABLE XV

SIGNIFICANT DIFFERENCES IN COST MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED BY SEMESTER

Cost Measures	Spring '87	Fall '87	Spring '88	Fall '88
Food/Revenue	0.0606	0.0092*	0.0001***	0.0921
Food/Meal	0.1499	0.2981	0.9879	0.3740
Commodity/Revenue	0.0067*	0.0293*	0.1439	0.9253
Commodity/Meal	0.0001***	0.0001***	0.0001***	0.0200*
Paper/Revenue	0.0001***	0.0001***	0.0002**	0.0001***
Paper/Meal	0.0001***	0.0002***	0.0311*	0.0008**
Cleaning/Revenue	0.0130*	0.0872	0.2415	0.3854
Cleaning/Meal	0.0063*	0.0234*	0.1331	0.3002
Labor/Revenue	0.6975	0.0085*	0.0109*	0.0087*
Labor/Meal	0.0103*	0.7444	0.8377	0.2994

Note: * $p \leq .05$, ** $p \leq .001$, *** $p \leq .0001$.

Cost Over Two Years. When cost measures for satellite and self-contained schools were compared over the two calender years, significant differences were identified for six out of the ten cost measures (Table XVI). The market value of commodities used per meal and paper costs as a percent of total revenue, continued to reveal the greatest differences between the two research groups ($p \leq .0001$).

By using the two organizational outputs, revenue and total meals, all of the five cost categories were shown to be significantly different when compared over the two calender years. As expected from monthly and semester comparisons, paper costs as a percent of revenue were greater in the satellite

units and the market value of commodities as a cost/meal was greater in the self-contained units.

The difference in food cost as a percent of revenue was not expected. As seen in the semester comparisons, the greatest difference occurred in the third semester. Satellite schools continued to pay more for food than their counterparts (Figure 8, p. 60). This may be attributed to two stage research intervention, which occurred in Fall 1987 and Spring 1988.

The price differences may also reflect differences in annual bids over the three (1986-1987, 1987-1988, 1988-1989) academic years of the study. The practice of rotating the menu writing responsibilities between four dietitians may also impact on the variation in food costs over the three years. What might be interesting to note with this measure is how similar it was for the two research groups once the new cost accounting system was implemented in the fourth semester.

TABLE XVI

SIGNIFICANT DIFFERENCES IN COST MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED OVER TWO YEARS

Percent of Revenue	P Value	Cost/Meal	P-Value
Food / Revenue	0.0005**	Food/Meal	0.2721
Commodity / Revenue	0.0458*	Commodity/Meal	0.0001***
Paper / Revenue	0.0001***	Paper/Meal	0.0009**
Cleaning / Revenue	0.0738	Cleaning/Meal	0.0170*
Labor / Revenue	0.0180*	Labor/Meal	0.5209

Note: * $p \leq .05$, ** $p \leq .001$, *** $p \leq .001$.

Productivity by Month. Results of the monthly comparison appear in Table XVII. Of the three denominators, expenses, labor hours, and ADP, the greatest difference was observed in labor hours. An increase in the amount of revenue generated per labor hour (Ratio 5) intensified for the satellite schools, once the bake center was implemented. This pattern is evident in Figure 9, p. 68.

Schools that took on additional meal service with the breakfast program, catered, and contract meals, without additional labor were assumed to be more productive, but were not, according to this measure. While revenue was higher, the number of labor hours was also higher. According to Sink (1985) productivity improvement will occur when output increases (ie, more revenue), but only when input increases at a lower rate (ie. labor).

Meals/labor hour (Ratio 6) continues to be the most commonly cited productivity measure (Lischke, 1986; Spears, 1991). This measure was significantly different at the $p \leq 0.0001$ level for each of the 18 months in the study. The trend for meals/labor hour is illustrated in Figure 10, p. 68.

The standard for school foodservice units remains 13-15 meals/labor hour (Van-Egmond Pannell, 1985). Results indicate that the self-contained are performing slightly under this standard, while satellite units averaged 19-20 meals/labor hour during the first semester and jumped to 28-30 meals/labor hour by the fourth semester.

These results would suggest a different productivity standard for satellite schools as the number of menu items which constitutes a meal would be less for the satellite units, suggesting a higher number of meals/labor hour. This would support the results of White's (1984) study in which the food production system affected overall productivity levels.

Both of the productivity measures previously discussed utilize the

number of labor hours, which were initially lower in the satellite units. It is important to note that the labor hours were reduced in the satellite school, following implementation of the bake center.

Total revenue generated per average daily participation (Ratio 7) was significantly greater for self-contained units in 11 out of the 18 months of the study (Figure 11, p. 69). As discussed earlier, percent participation for the 64 schools in the study was 67.53%. The self-contained units experienced a higher rate of 75 percent. This may account for the increase in revenue. A greater number of the self-contained units prepared breakfast, catered and contract meals, which would contribute to total revenue.

Meals per ADP (Ratio 8, Appendix F) suggested some discrepancy in interpreting the data. The monthly averages ranged from .9975 to 1.0055. Upon investigating the cause it was learned that total meals was limited to a lunch count and did not include additional meals. While the potential for this measure remains, it was not utilized effectively in this study.

When the total revenue generated to total expense (Ratio 3, Appendix F) was computed, a significant difference was observed in four out of five months from November 1987 to March 1988, with November, February, and March experiencing a variation of $p \leq .0001$.. This was during the actual intervention, although this trend was somewhat repeated during November and December of 1988, it was not quite as significant.

A new cost accountability system, instituted in the fall of 1988, relaxed the variation substantially. For the first time in two years, the costs of operating the satellite were nearly in line with those incurred by the self-contained units. This measure was of particular concern to the researcher as it was the inverse would coincide with the five cost measures evaluated earlier. It has some similarities

to the acid test ratio performed on an organization's balance sheet (Sneed, 1988). It illustrates a relationship between what is owned (assets compared to revenue) with what is owed (liabilities compared to expenses). This might suggest that the ratio could be used to determine the solvency of an operation.

The variance in the number of meals produced per total expenses (Ratio 4, Appendix F) for satellite and self-contained units became smaller once the bake center was operational in the fourth semester of this study. The variation observed in four out of nine months in the first year, was found only once in the second year of data. It is postulated that a bake center servicing the majority of these school units assisted in the stabilization of operational expenses.

TABLE XVII

SIGNIFICANT DIFFERENCES IN PRODUCTIVITY MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED BY MONTH OVER TWO YEARS

		Spring 1987				
No.	Measures	JAN	FEB	MAR	APR	MAY
#3	Revenue/Expense	0.4394	0.4087	0.5358	0.4072	0.5613
#5	Rev./Labor hour	0.0104*	0.2308	0.1695	0.0732	0.0367*
#7	Revenue/ADP	0.0619	0.0732	0.0373*	0.1291	0.0510
#4	Meals/Expense	0.0139*	0.1496	0.0173*	0.1006	0.0234*
#6	Meals/Labor hour	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
#8	Meals/ADP	0.6440	0.1007	0.9302	0.3478	0.1403

TABLE XVII (Continued)

No.	Measures	Fall 1987 SEPT	OCT	NOV	DEC
#3	Revenue/Expense	0.8997	0.3517	0.0001***	0.0057*
#5	Revenue/Labor hour	0.0001***	0.0130*	0.0005**	0.0045**
#7	Revenue/ADP	0.2305	0.0217*	0.0263*	0.0141*
#4	Meals/Expense	0.2359	0.0077**	0.4424	0.6702
#6	Meals/Labor hour	0.0001***	0.0001***	0.0001***	0.0001***
#8	Meals/ADP	0.5157	0.3239	0.7215	0.0263*

No.	Measures	Spring 1988 JAN	FEB	MAR	APR	MAY
#3	Revenue/Expense	0.3324	0.0001***	0.0001***	0.4887	0.0084*
#5	Rev./Labor hour	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
#7	Revenue/ADP	0.0234*	0.0315*	0.0143*	0.0369*	0.0178*
#4	Meals/Expense	0.1079	0.5165	0.4808	0.0427*	0.6246
#6	Meals/Labor hour	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
#8	Meals/ADP	0.8482	0.5362	0.4422	0.0828*	0.0071*

No.	Measures	Fall 1988 SEPT	OCT	NOV	DEC
#3	Revenue/Expense	0.1500	0.0730	0.0040**	0.0276*
#5	Revenue/Labor hour	0.0001***	0.0025**	0.0009**	0.0004***
#7	Revenue/ADP	0.2236	0.0207*	0.0301*	0.0977
#4	Meals/Expense	0.7062	0.4036	0.7727	0.4122
#6	Meals/Labor hour	0.0001***	0.0001***	0.0001***	0.0001***
#8	Meals/ADP	0.1232	0.9871	0.5141	0.0371*

Note: *$p \leq .05$, **$p \leq .001$, ***$p \leq .0001$. No. - ratio number.

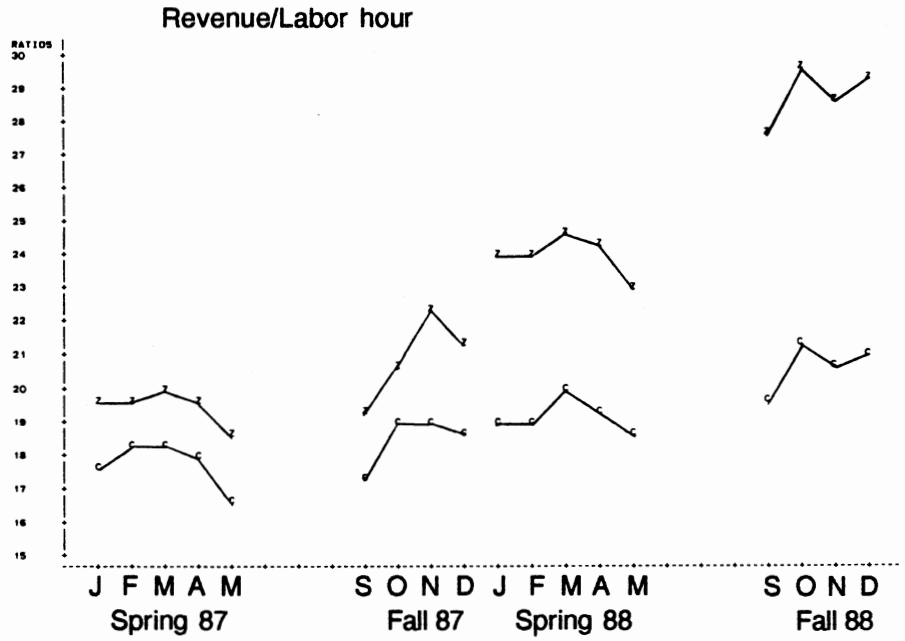

Figure 9. Revenue/labor hour (Ratio 5) for the satellite (z) and self-contained (c) units over two calender years.

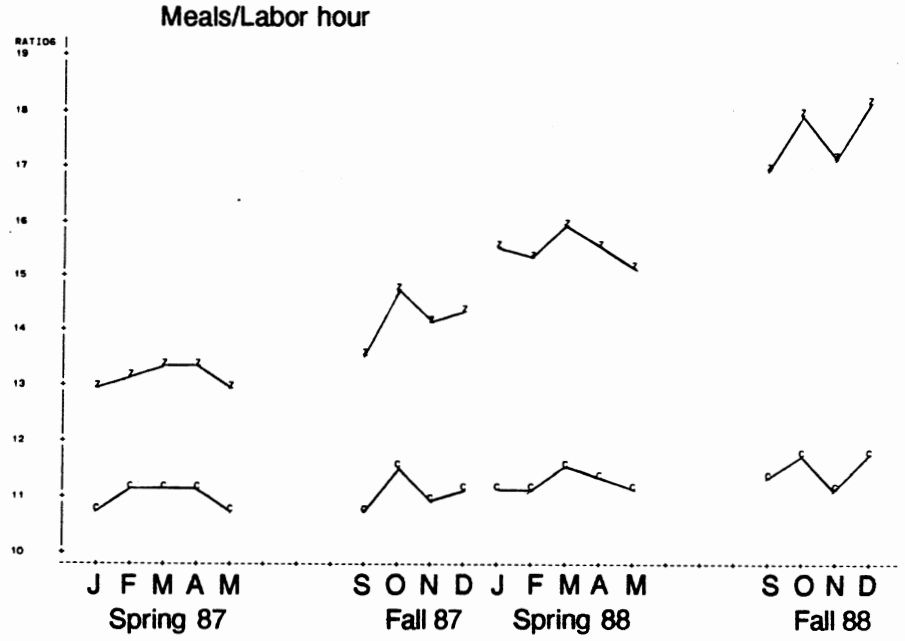

Figure 10. Meals/labor hour (Ratio 6) for satellite (z) and self-contained (c) units over two calender years.

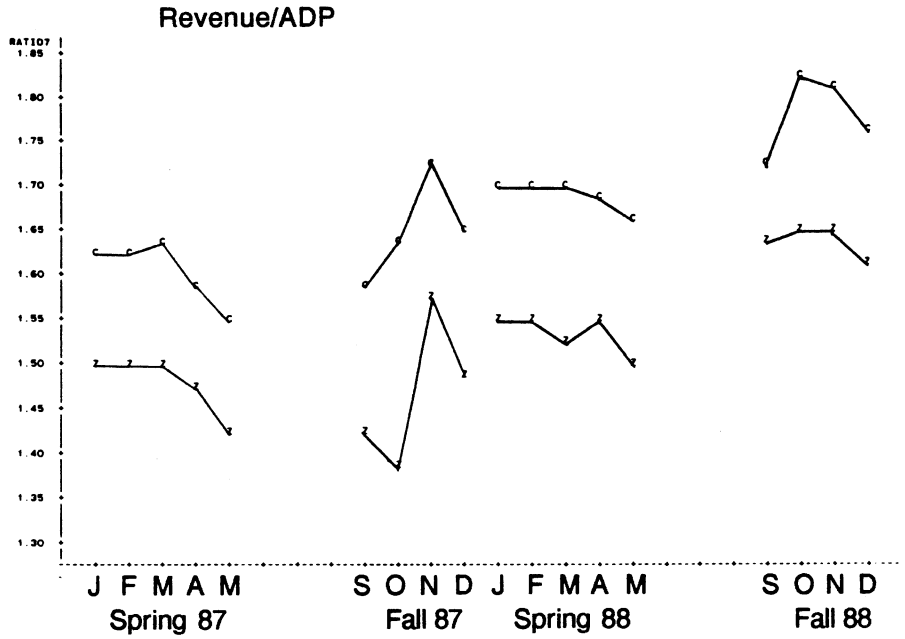

Figure 11. Revenue/ADP (Ratio 7) for satellite (z) and self-contained (c) units over two calender years..

Productivity by Semester. When productivity measures were compared by semesters, results from the monthly comparison appeared to be validated. As illustrated in Table XVIII, the greatest variation was in the measures with labor hours in the denominator. Both revenue/labor hour (Ratio 5) and meals/labor hour (Ratio 6) were significantly different for the two research groups ($p \leq .0001$) . With the satellite schools operating with less labor than the self-contained units their output per labor hour was higher.

There was a significant difference observed in the amount of revenue generated per customer (Ratio 7), with the self-contained units receiving more revenue/customer than the satellite schools. With less revenue generated per customer, alternatives such as the bake center can be used to maximize resources. A significant difference in the revenue/expenses (Ratio 3) for three

of the four semesters was not expected. Once again the self-contained units were more cost-efficient when compared to the satellite units.

TABLE XVIII

SIGNIFICANT DIFFERENCES IN PRODUCTIVITY MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED BY SEMESTERS

No.	Productivity Measure	Spring '87	Fall '87	Spring '88	Fall '88
#3	Revenue/Expenses	0.7215	0.0111*	0.0011**	0.0218*
#5	Revenue/Labor hour	0.0001***	0.0001***	0.0001***	0.0001***
#7	Revenue/ADP	0.0001***	0.0001***	0.0001***	0.0002**
#4	Meals/Expenses	0.0104*	0.3113	0.8306	0.5793
#6	Meals/Labor hour	0.0001***	0.0001***	0.0001***	0.0001***
#8	Meals/ADP	0.2391	0.8862	0.5775	0.0626

Note: *$p \leq .05$, **$p \leq .001$, ***$p \leq .0001$; No. - ratio number.

Productivity Over Two Years. Results of the figures collected over a two year period were summarized in Table XIX. Revenue generated per labor hour (Ratio 5) revealed the greatest significance among the three productivity measures calculated from the amount of revenue generated by the school cafeterias. While both research groups experienced an increase in this measure, the reduction in labor hours for the satellite schools beginning Fall 1988 widened the variance.

Revenue/expenses (Ratio 3) and revenue/ADP (Ratio 7) showed a significant difference as well, although these differences were not as

pronounced. The self-contained schools were slightly more productive than the satellite schools. This may suggest further analysis into the activity which generated the revenue.

Meals/labor hour (Ratio 6) was the only productivity measure using data on total meals to be significantly different between the two groups. This ratio may need to be redefined according to the type of production and service system within the foodservice operation (White, 1984).

Summary

The foodservice industry has joined the ranks with other industries. Cost control and productivity enhancement have become critical elements of every manager's job. Results suggested similar outcomes for performance measures when monitored by month, by semester, and over two years. Summaries of analysis of variance may be found in Tables XXV, XXVI, XXVII, Appendix E.

TABLE XIX

SIGNIFICANT DIFFERENCES IN PRODUCTIVITY MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED OVER TWO YEARS

Ratio No.	Productivity Measure	P Value
Ratio #3	Revenue / Expenses	0.0082*
Ratio #5	Revenue / Labor hour	0.0001***
Ratio #7	Revenue / ADP	0.0170*
Ratio #4	Meals / Expenses	0.2197
Ratio #6	Meals / Labor hour	0.0001***
Ratio #8	Meals / ADP	0.3413

Note: *$p \leq .05$, **$p \leq .001$, ***$p \leq .0001$..

Institutional Characteristics

Size of the School

Tracking the rate of participation in the school lunch program is of particular interest to the foodservice manager. Figure 3 (p. 39) revealed a comparison of monthly averages for the two research groups. With consistent differences in satellite and self-contained schools, additional variables which may affect performance should be monitored.

The rate of participation peaked during October and March of each year in all schools. In November, lower participation occurred, but not as low as in September and May, which are the first and final months of the school year. These trends were similar regardless of the size of the school. Total meals remained steady throughout the two years, however, a slight increase was observed in the fourth semester.

Production Parameters

Performance measures influenced by various production activities were analyzed using Wilcoxon's Rank Sum of Squares. Results are listed in Table XX, p.74. Six out of the original 10 cost measures were significantly different when the schools participated in the National Breakfast Program. The greatest differences were in cost/meal with food cost, the market value of commodities used, and in cleaning supplies. The cost of labor, food, and paper were significantly different when viewed as a percent of total revenue. While schools offering breakfast exhibited higher expenses, they generated additional meals and revenue.

Operation of a salad bar during lunch service resulted in a significant

difference in five of the 10 cost measures. Four of these were as costs/meal: labor, market value of commodities used, cleaning supplies, and food cost. Cleaning costs were also significantly different as a percent of revenue. Food cost/meal was the only cost measure which revealed a significant difference for schools providing contract meals.

Two out of six productivity measures also had a significant impact on schools offering reimbursable breakfasts, salad bars, or contract meals. These schools produced a significantly more meals for the amount of operational expense incurred. Productivity in terms of the amount of revenue generated per customer was enhanced by these strategies. Total meals/labor hour as a productivity measure was increased through a breakfast service at $p < 0.0005$ and through the use of contract meals ($p < 0.10$) and salad bars ($p < 0.10$).

A fourth production parameter was sack lunches. This activity did not have a significant impact on the performance measures, therefore, it was not included in the table.

Service Parameters

The four cost measures pertaining to the use of paper and cleaning supplies as a percent of total revenue and as a cost/meal were significantly different in the schools which operated a dishmachine as well as those schools which used disposable serviceware on a daily basis. Commodities as a cost/meal was also significantly different (Table XXI, p. 76).

This supports the premise that the use of dishmachines was dominate in the self-contained units and that the use of disposable serviceware was prevalent in the satellite units. In addition, the use of commodities would be greater in the self-contained units, since all menu items were prepared on-site.

TABLE XX

PERFORMANCE MEASURES IMPACTED BY A BREAKFAST PROGRAM, SALAD BAR SERVICE OR PROVISION OF CONTRACT MEALS

Measures	Breakfast	Salad Bar	Contract Meals
Food/Revenue	0.0041**	0.5755	0.4810
Food /Meal	0.0001***	0.0102*	0.0400*
Commodities/Revenue	0.2320	0.2406	0.1458
Commodities/Meal	0.0006**	0.0005**	0.2245
Paper/Revenue	0.0345*	0.4852	0.4810
Paper/Meal	0.6102	0.6509	0.7190
Cleaning/Revenue	0.6578	0.0178*	0.8572
Cleaning/Meal	0.0423*	0.0026**	0.5191
Labor/Revenue	0.0024**	0.5046	0.4625
Labor/Meal	0.0898	0.0002**	0.0991
Revenue/Expenses	0.0017**	0.5144	0.3526
Revenue/Labor hour	0.5199	0.9939	0.7078
Revenue/ADP	0.0001***	0.0437*	0.0275*
Meals/Expenses	0.0015**	0.0004**	0.0400*
Meals/Labor hour	0.0004	0.0901	0.0651
Meals/ADP	0.5869	0.8841	0.5094

Note: *p < .05, **p < .001, ***p < .0001.

As a productivity measure, meals/labor hour was significantly different when compared against three out of the four parameters: number of service lines, the use of a dishmachine and the use of disposables. Two other productivity measures, revenue/expenses and revenue/labor hours, showed a

significant difference with schools using two point of sale terminals and dish-machines, as well as with schools operating two service lines and dish-machines, respectively.

The decision to operate a dishmachine was contingent upon the size of the school and the amount of revenue generated to support the labor required to operate the machines. Collectively, these factors described the self-contained units. Of the four service parameters, use of the dishmachines as opposed to the use of disposable serviceware on a daily basis, surfaced as the service parameter with the greatest impact on the performance measures.

Summary

With the bake center as a research intervention, differences were assumed to be directly related to its implementation. Results were inconclusive, although significant differences between self-contained and satellite were observed. Institutional variables appeared to have the greatest impact on these results. Operation of a dishmachine as opposed to the use of disposables revealed the greatest variation in cost and productivity. Summaries of the statistical analyses using Wilcoxon's Rank Sum of Squares and Kruskal-Wallis' test for performance performances appear in Tables XXVIII AND XXIV, Appendix E. Means of monthly performance measures appear in Table XXX.

TABLE XXI

PERFORMANCE MEASURES IMPACTED BY SERVICE PARAMETERS

	Service Lines	POS	Dishmachines	Disposables
Food/Revenue	0.2007	0.0025**	0.1457	0.1540
Food/Meal	0.4731	0.8369	0.1135	0.1240
Commodity/Revenue	0.2223	0.0100*	0.0732	0.3700
Commodity/Meal	0.0214*	0.1604	0.0027**	0.0048**
Paper/Revenue	0.0061*	0.0163*	0.0001***	0.0001***
Paper/Meal	0.0066*	0.0563	0.0001***	0.0001***
Cleaning/Revenue	0.0991	0.1495	0.0037**	0.0024**
Cleaning/Meal	0.0613	0.4302	0.0008**	0.0008**
Labor/Revenue	0.3039	0.0050*	0.0271*	0.1272
Labor/Meal	0.5995	0.0225*	0.2409	0.2615
Revenue/Expenses	0.2769	0.0020**	0.0147*	0.0666
Revenue/Labor hour	0.0138*	0.0749	0.0140*	0.0782
Revenue/ADP	0.3109	0.3156	0.0363*	0.0540
Meals/Expenses	0.3476	0.1672	0.2108	0.2064
Meals/Labor hour	0.0025**	0.4070	0.0003**	0.0004**
Meals/ADP	0.0122*	0.1197	0.3150	0.3904

Note: *$p \leq .05$, **$p \leq .001$, ***$p \leq .0001$.

Hypotheses Testing

Due to the multiplicity of the variables under each hypothesis, the researcher chose to reject the hypothesis where there were significant differences in any of the 10 cost or six productivity measures when comparing

the performance of the satellite and self-contained units. The same rationale was used with the final hypothesis concerning the 10 cost and six productivity measures relative to four production and four service parameters. The six research hypothesis, accompanied by the appropriate conclusions are presented below:

H_1 - There are no significant differences in cost of food, commodities (market value), cleaning supplies, paper or labor as a percent of total revenue for satellite units before and after implementation of the bake center. Based on the results, the researcher rejected this hypothesis. See Table XII, where four out of five costs were significantly different.

H_2 - There are no significant differences in the cost of food, commodities (market value), cleaning supplies, paper, or labor in relation to total meals for satellite units before and after implementation of the bake center. Based on the results, the researcher rejected this hypothesis. See Table XII, where three out of five were significantly different.

H_3 - There are no significant differences in the three productivity measures relative to total revenue, as listed in Chapter I, for the satellite units before and after implementation of the bake center: Based on the results, the researcher rejected this hypothesis. Two out of three were significantly different.

H_4 - There are no significant differences in the three productivity measures relative to total meals, as listed in Chapter I, for the satellite units before and after implementation of the bake center..Based on the results, the researcher failed to reject this hypothesis. The differences were significant, but at $p > .05$.

H_5 - There are no significant differences in the cost and productivity measures listed in H_1, H_2, H_3, and H_4 for the satellite versus the self-contained

units when contrasted by month, by semester, and over the two calender years of the study. Based on the results, the researcher rejected this hypothesis. See Tables XIV, XV, XVI, XVII, XVIII, and XIX for significant differences.

H_6 - There are no significant differences in the cost and productivity measures listed in H_1, H_2, H_3, and H_4 for the satellite and the self-contained units based on four production parameters and four service parameters:

Breakfast program: Based on the results, the researcher rejected this hypothesis. See Table XX where six out of 10 cost and four out of six productivity measures were significantly different for satellite and self-contained units.

Sack lunch: Based on the results, the researcher failed to reject this hypothesis. The differences were significant, but at $p > .05$.

Salad bar: Based on the results, the researcher rejected this hypothesis. See Table XX, where five out of 10 cost and two out of six productivity measures were significantly different for satellite and self-contained units.

Contract meals: Based on the results, the researcher rejected this hypothesis. See Table XX, where one out of 10 cost and two out of six productivity measures were significantly different for satellite and self-contained units.

Number of serving lines: Based on the results, the researcher rejected this hypothesis. See Table XXI, where three out of 10 cost and three out of six productivity measures were significantly different for the satellite and self-contained units.

Number of POS terminals: Based on the results, the researcher rejected this hypothesis. See Table XXI, where, three out of 10 cost and one out

of six productivity measures, were significantly different for the satellite and self-contained units.

Use of dishmachines: Based on the results, the researcher rejected this hypothesis. See Table XXI, where, six out of 10 cost and four out of six productivity were significantly different for the satellite and self-contained units.

Use of disposables: Based on the results, the researcher rejected this hypothesis. See Table XXI, where, five out of 10 cost and one out of six productivity were significantly different for the satellite and self-contained units.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Accountability is becoming increasingly important in today's fast paced, information age (Owen, 1984). For many foodservice operations, the challenge of doing more with less has triggered alternative strategies for accomplishing organizational goals (Stankard, 1986). Foodservice directors are evaluating their existing system and considering viable alternatives. The foodservice industry is characterized by constant change in response to market demands, financial constraints, and technological advancements (Spears, 1991).

School food service is described as a simplified system. As a Monday through Friday operation serving a single meal, the stresses are inherent in multi-unit operations. The systems are more complex for a major city child nutrition program operating 87 schools. Typical offerings are not limited to a lunch tray; sack lunches, salad bars, catered or contract meals provide additional challenges to the foodservice team. Participation in the breakfast program is yet another challenge. As resources for the existing production, distribution, and service systems become outdated, administration needs to examine options to continue to maximize organizational resources.

The purpose of this research was to assess the impact of an innovative bake center on selected performance measures in a major city child nutrition program. Cost and productivity measures for 64 satellite and self-contained elementary schools foodservice units were calculated and compared. Any differences in the two groups were assumed to be the result of the bake center.

Research Population

All elementary school foodservice units within a major city child nutrition program were included in the study. Nearly half (n=28) of the schools prepared all menu items on-site using a self-contained production system. These schools comprised the control group. Thirty-six schools which were the recipients of the items furnished by the bake center, were called satellite units and constituted the experimental group.

Several differences existed between the two sets of schools. Results indicated that the self-contained schools were larger, had more labor hours, experienced a greater rate of participation at lunch, offered breakfast, provided more contract meals, and operated a dishmachine. The satellite schools were more likely to initiate a new program such as the salad bar service. Sack lunches and salad bars were more common in the satellite units while breakfast and contract meals were more prevalent in the self-contained units.

The satellite schools originated from two sample groups (A and B), each containing four subgroups. Implementation of the bake center occurred in two stages, hence the two samples. Each phase included a school which previously served as a cluster bake site, elementary schools serviced by one of two bake sites, and schools which were previously self-contained.

Initially, performance measures from the satellite schools were analyzed for differences before and after implementation of the bake center. The results indicated that the only significant difference was found within the subgroups of satellite schools. Because of these results, the analysis was redirected to compare cost and productivity measures of the satellite schools with those from the self-contained units.

Performance Measures

Ten cost measures were computed from the operational data. Five cost categories: food, market value of commodities, paper, cleaning supplies, and labor served as numerators with revenue and total meals as their denominators. These figures were compared by month, by semester, and over the two calender years of the study.

Seven out of the 10 cost measures were significantly different when compared over the course of the two years. Food cost as a percent of total revenue and paper cost as a percent of total revenue and as a cost/meal were significantly higher in the satellite units and the market value of commodities as a cost/meal was significantly higher in the self-contained units.

Six productivity measures were computed using revenue and total meals as numerators and total expenses, labor hours, and average daily participation as denominators. These figures were compared by month, by semester, and over the two calender years of the study.

Four of the six productivity measures were significantly different when compared over the course of the two years. Self-contained units continued to be more productive in terms of revenue generated per expense and average daily attendance. The satellite units were more productive according to revenue generated per labor hour and meals/labor hour.

Institutional Characteristics

The first institutional characteristic was size of the school. The rate of participation was higher in the self-contained schools although both research

groups followed nearly identical fluctuations throughout the two years. Production activities such as the breakfast program, provision of a salad bar and contract meals had an impact on the performance measures.

Eight of the 10 cost measures and three of the six productivity measures were affected by one or more of these activities. Food cost/meal and number of meals/total expenses were impacted by each of the three production activities. The use of dishmachines and the use of disposable serviceware were the two most influential service parameters. Each of these service activities affected four cost measures concerning paper and cleaning costs and the productivity measure, meals/labor hour.

Conclusions

Performance measures can be used as key indicators for organizational performance. Their value increases when tracked over a period of time. Standards exist for some of these measures with respect to various segments of the foodservice industry such as indices for resource allocation, productivity, and cost accountability which are available in the literature.

Lundberg and Armatas (1980) proposed standards for commercial establishments based on the number of expected clients per day. Fairbrook (1979) composed a manual from which college and university foodservice managers could plan appropriate strategies. Stokes (1980) provided an operational equation to determine standards of performance for operating a health care facility. Puckett and Miller offered alternatives for foodservice managers in The American Hospital Association's (1988) Manual for Foodservice Operator's. Van-Egmond Pannell (1985) reviewed guidelines for

efficient and effective management of school foodservice programs.

While there are several methods to measure labor productivity, meals/labor hour continues to dominate. Results from this study suggest that the standard of 13 to 15 meals per labor hour for school foodservice can be achieved. Satellite units were more productive than self-contained units, although the components which constituted a single meal were fewer in this research group. With the differences between the satellite and self-contained schools, attention should be directed to the type of production and service system used in the facility, as satellite units generate a higher number of meals/labor hour.

Several tools exist for analyzing financial data. Ratio and trend analyses were monitored to provide accountability for costs incurred in operating a foodservice system. Costs as a percent of revenue and as a part of the cost/meal provided different results when satellite units were compared to self-contained units. Although attention was initially directed to the bake center, other factors impacted the various cost measures throughout this study.

With the availability of numerous software packages, as well as data base management programs, no foodservice manager should be without a computer. The 10 cost and six productivity measures could easily be programmed for a foodservice operation, using the appropriate software. The ability to track operational information, monthly, quarterly, by semester, or annually, would keep managers in touch with their units. An opportunity to compare actual performance with predetermined standards would assist foodservice directors in selecting the most suitable alternative for resource allocation and other operational decisions. An indepth analysis for a given situation would be the result of pertinent, up-to-date information.

In conclusion, one might consider the words of McConnell (1986):

> Reasonable standards and a productivity monitoring system are only the beginning. Control, one of the supervisor's basic management functions, consists of information and action. Standards and the monitoring system provide the information; the supervisor must act on that information to maintain output in an efficient relationship to input.

Recommendations

1. Dietitians and foodservice directors need to be trained to develop a performance management system to monitor critical controls affecting organizational performance.

2. Existing data on organizational inputs and outputs needs to be defined and incorporated into performance ratios to maximize results.

3. Unit managers should take special interest in increasing participation during the low months and try to identify factors which support the increase during months with higher participation.

4. Financial information needs to be shared with front line supervisors responsible for individual units within a foodservice system.

5. Input for total revenue and all costs which are used to compile expenses should be entered in the computer and tracked over time.

6. Outputs for a foodservice unit need to be equivalent; snacks or a breakfast selection need to be formulated to equal a lunch, so total meals suggest an equal unit of measure.

7. Any data that would provide information on organizational and individual performance should be entered in the computer and tracked over time. Performance data should be accessible for forecasting, operational analysis, and general reporting.

8. Application of these standards in individual foodservice units needs to be encouraged to provide an opportunity for their validation, specific to the characteristics of the institutions.

9. A central information center for the major city child nutrition program should incorporate data from all units to provide a comprehensive data base.

10. A centralized commissary, such as the bake center, may be used to consolidate resources and increase organizational productivity.

11. A centralized commissary, such as the bake center, may be used to maximize skilled labor within a multi-unit foodservice system..

12. Based on research findings, a data base of comparable information from all segments of the foodservice industry could be compiled. As an outcome, industry standards could be formulated.

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APPENDICES

APPENDIX A

RESEARCH POPULATION

RESEARCH POPULATION BY EXPERIMENTAL DESIGN GROUPS

Obs.	School Name	Control	Treatment "A"	Treatment "B"	Comments:
01	Addams	O			
02	Alcott	O			Satellite F'88
03	Barnard	O			
04	Bryant		A-2		Self-contained F'88
05	Bunche		A-2		Population changed F'88
06	Burbank			B-3	Population changed F'88
07	Burroughs	O			
08	Carnegie			B-2	
09	C. Clinton		A-2		
10	Cherokee	O			
11	Chouteau	O			
12	Columbus			B-3	
13	Cooper	O			
14	Disney	O			
15	Eisenhower		A-3		Closed F'88
16	Eliot			B-2	
17	Emerson	O			
18	Eugene Field	O			
19	Franklin			B-3	Population changed F'88
20	Frost		A-4		Closed F'88
21	Fulton		A-3		Closed F'88
22	Greeley	O			
23	Grimes			B-2	
24	Grissom		A-3		
25	Hawthorne	O			
26	Patrick Henry			B-2	
27	Hoover		A-4		Self-contained F'88
28	Houston	O			
29	Jackson	O			
30	Kendall	O			
31	Kerr			B-3	
32	Key		A-3		
33	Lanier			B-2	
34	Lee			B-2	
35	Lincoln			B-2	
36	Lindberg			B-4	
37	Lindsey		A-4		
38	Lowell (ECDC)		A-4		Closed F'88
39	MacArthur	O			
40	Marshall	O			

Obs.	School Name	Control	Treatment "A"	Treatment "B"	Comments:
41	Mayo			B-3	Closed F'88
42	McClure			B-2	
43	McKinley		A-4		
44	Mitchell	O			
45	Owen		A-1		Closed F'88
46	Park	O			
47	Peary			B-3	
48	Penn	O			
49	Phillips		A-3		
50	Reed			B-3	Closed F'88
51	Remington	O			
52	Riley	O			Closed F'88
53	Robertson	O			
54	Roosevelt	O			
55	Salk		A-3		
56	Sandburg	O			
57	Sequoyah		A-2		
58	Springdale			B-4	
59	Stevenson		A-3		County program
60	Mark Twain	O			
61	Whitman	O			
62	Whittier			B-4	
63	Woods	O			Population changed F'88
64	Wright			B-1	
TOTALS		28	17	19	

APPENDIX B

DATA CODE SHEETS

INSTITUTIONAL DATA CODE SHEET

1. Elementary school code (3 digits)
2. Control or experimental group (2 digits)
3. Annual supervising dietitian (3 digits)
4. Production demands (5 digits)
5. Number of serving lines, point of sale terminals (2 digits)
6. Use of dishmachine and disposables (2 digits)
7. Number of positions, changes (4 digits)
8. On-site labor hours, changes (4 digits)

OPERATIONAL DATA CODE SHEET

1. Elementary school code (3 digits)
2. Food cost (8 digits)
3. Market value of commodities used (8 digits)
4. Paper cost (8 digits)
5. Cleaning cost (6 digits)
6. Cost of other (6 digits)
7. Labor and subs (8 digits)
8. Cash receipts (8 digits)
9. Reimbursements (8 digits)
10. Additional income (8 digits)
11. Total meals (4 digits)
12. "ADA" average daily attendance (4 digits)
13. "ADP" average daily participation (4 digits)
14. Operational days (2 digits)
15. Date - month and year (5 digits)

SCHOOL CODE SHEET FOR HYPOTHESES 1, 2, 3, and 4

TREATMENT A, where N = 16 (17 - 1)*
Time frame: Before (Spring 1987) & After (Fall 1987, Spring 1988)

A-1 (345)

A-2 120 125 145 405

A-3 170 195 255 365 402 417 449

A-4 193 215 280 295 325

*Schools in parentheses were deleted because:
345 was previously a cluster bake site

TREATMENT B, where N =15 (19 - 1 - 2 - 1)*
Time frame: Before (Fall 1987) & After (Spring 1988, Fall 1988)

B-1 (444)

B-2 140 175 199 205 260 265 270 320

B-3 130 156 190 252 (315) 351 (377)

B-4 (275) 415 440

*These schools were deleted because:
444 was previously a cluster bake site,
315 and 377 were closed Fall 1988, and
275 received the research intervention late in the semester

TREATMENT TIME (Trttime) denotes time of bake center implementation.
A - F'87; B - S'88; C - no intervention.

SUBGROUP - 1, 2, 3, 4; original status
1 - previously a cluster bake site,
2 - satellite from "O" or "W" (A and B, respectively)
3 - satellite from "S" or "EC" (A and B, respectively)
4 - previously self-contained

CODE - 1, 2; denotes status throughout the study
1 - equivalent data, complete and consistent
2 - not equivalent data, incomplete or inconsistent; deleted

SCHOOL CODE SHEET FOR HYPOTHESES 5 and 6

TREATMENT Z, where N = 52 [64 -12]); all schools throughout the study
Time frame: Spring 1987 through Fall 1988

105	(110)	115	(120)	125	130	135	140	145	150	155
156	158	170	175	180	185	190	(193)	195	197	199
200	205	(215)	220	230	250	252	255	260	265	270
(275)	(280)	(295)	305	310	315	320	(325)	330	(345)	350
351	355	365	377	378	385	395	397	402	403	405
(415)	417	425	435	(440)	443	(444)	447	449		

*Schools in parentheses were deleted because:

1. A shift in status:
   110 shifted from self-contained to satellite,
   120 and 215 shifted from satellite to self-contained,

2. Timing was off:
   275 received the research intervention late in the semester,

3. Previously cluster bake sites:
   345 and 444

4. Previously self-contained:
   193, 215, 280, 295, and 325 (Sample A)
   275, 415, and 440 (Sample B)

Purpose: To compare satellite and self-contained units

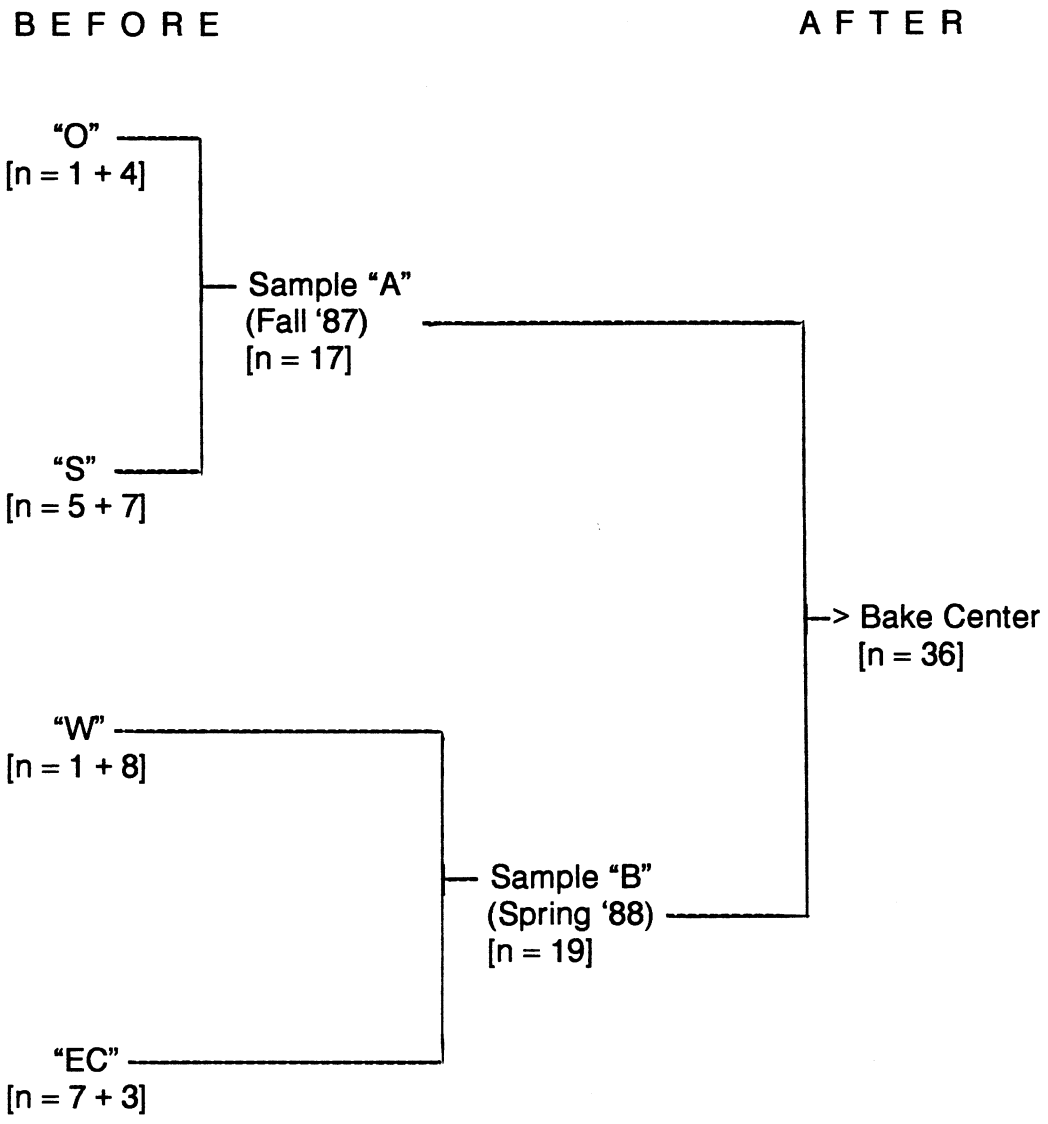
CODE - Z, C; denotes school as satellite or self-contained

APPENDIX C

FLOW CHART OF THE FEASIBILITY STUDY

FEASIBILITY STUDY

Four Cluster Bake Sites — Implementation of the Bake Center



"O" "S" "W" "EC" - four cluster bake sites; "O" and "W" remained in the study; "S" and "EC" were secondary schools and therefore were deleted from the study.

APPENDIX D

RESEARCH INSTRUMENT

VARIABLES FOR SCHOOL FOOD SERVICE PERFORMANCE MEASURES
(reflects 1986-87 through 1988-89 school years)

___ ___ ___ 1. Elementary school code

_____ 2. Control (self-contained) = 0
Experimental (satellite) = A-1, A-2, A-3, A-4 or B-1, B-2, B-3, B-4

___ ___ ___ 3. Annual supervising dietitian
(KEY: 1 - Ann, 2 - Janet, 3 - Lisa, 4 - Dolores, 5 - Libby, 6 - Della)

PRODUCTION DEMANDS

4. Does this school food service unit provide any of these services?

NO	YES	
0	1	Breakfast
0	1	Sack Lunch
0	1	Salad Bar
0	1	Contract Meals
0	1	New Program Initiated

LABOR ANALYSIS:

5. Circle the appropriate number of:

1	2	Serving Lines
1	2	Point of Sale Terminals

6. How does this school food service unit handle clean-up?

NO	YES	SOME	
0	1	2	Dishmachine used for all items (Some - pots, pans, & trays, only)
0	1	2	Disposables used for daily service (Some - on occasion, emergency)

STAFFING FOR 1987-1988 SCHOOL YEAR

_____ 7. Number of positions, changes & reason?
_____ 8. On-site labor hours, changes & reason?

THANK YOU FOR VERIFYING THIS INFORMATION PRIOR TO DATA ANALYSIS

APPENDIX E

SUPPLEMENTAL TABLES

TABLE XXII

AVERAGE DAILY ATTENDANCE (ADA) AND PARTICIPATION (ADP) BY RESEARCH GROUP TO INDICATE PRODUCTION LEVELS

Control Group (N=28)

ID#	ADA	ADP	%	LEVEL	ID#	ADA	ADP	%	LEVEL
56	181.83	113.06	62.26	125	11	274.06	175.06	63.91	200
51	255.33	188.28	73.79	200	52*	203.50	171.43	84.06	200
03	443.56	217.61	49.08	225	18	271.50	217.39	80.26	225
22	265.11	214.00	80.76	225	30	294.67	203.61	69.30	225
44	340.44	220.22	64.66	225	46	288.00	202.06	70.43	225
60	273.61	220.67	81.11	225	63*	224.71	219.50	98.00	225
01	289.67	242.50	83.73	250	29	296.78	234.00	78.89	250
28	334.67	267.50	79.91	275					
02	323.61	288.33	89.24	300	10	362.78	299.28	82.53	300
39	425.33	281.67	66.22	300	40	386.06	286.94	74.34	300
61	383.61	277.44	72.38	300					
07	372.28	304.67	82.30	325	17	509.94	306.67	60.14	325
25	383.72	326.78	85.16	350	48	377.28	338.44	94.36	350
53	511.33	339.83	66.48	350	13	582.83	361.89	62.12	375
54	548.44	473.28	86.37	475	14	746.83	460.72	58.95	475

Experimental Group: Sample "A"

ID#	ADA	ADP	%	LEVEL	ID#	ADA	ADP	%	LEVEL
59	------	60.17	------	75					
21*	293.50	139.29	47.57	150	49	228.61	134.72	58.88	150
24	337.28	137.89	40.95	150	45*	256.71	171.71	66.94	175
32	361.00	162.39	44.96	175	38	------	164.00	------	175
04	254.11	190.56	75.15	200	05	239.50*	184.56	77.06	200
15*	274.93	178.21	64.84	200	20*	226.50	195.21	86.48	200
37	228.78	182.72	79.89	200					
09	266.44	217.89	81.73	225	57	311.89	232.78	74.98	250
55	396.22	229.44	57.88	250	27	375.17	232.89	62.02	250
43	401.61	240.33	59.89	250					

TABLE XXII (Continued)

Experimental Group: Sample "B"									
ID#	ADA	ADP	%	LEVEL	ID#	ADA	ADP	%	LEVEL
06	231.67	114.94	50.00	125	19	225.12**	124.11	55.13	125
41*	223.64	117.93	52.73	125					
33	282.72	172.06	61.01	175	34	303.39	156.22	51.58	175
12	296.06**	151.89	51.47	175	47	272.44	173.17	63.74	175
64	276.78	200.50	72.45	225	50*	323.50	210.50	65.10	225
08	375.06	180.28	48.37	200	16	498.61	198.00	39.34	200
23	317.17	198.11	62.46	200	35	221.22	175.11	79.27	200
42	271.67	184.61	68.15	200	31	284.28	197.56	70.03	200
26	428.28	235.22	54.88	250	62	297.11	233.28	78.53	250
58	299.22	268.33	94.66	275	36	474.50	292.22	61.63	300
Averages for each research group									
	362.55	266.17	75.03	300	Control Group				
	296.82	179.69	60.54	200	Sample "A"				
	310.65	188.63	60.72	200	Sample"B"				

Notes: Collection points - 18 monthly averages unless noted otherwise.
*School was closed F'88, collection points limited to 14.
**Incomplete data, collection points less than 18.
Production levels were rounded up to a multiple of 25.

TABLE XXIII

SUMMARY OF CONOVER AND IMAN'S ANALYSIS OF VARIANCE FOR PERFORMANCE MEASURES BEFORE AND AFTER IMPLEMENTATION OF THE BAKE CENTER

Measures	DF	ANOVA SS	F Value	PR > F
Ratio 5 Revenue/Labor hour				
Trttime	1	537402	0.32	0.6032
Subgroup (Trttime)	4	6770011	4.80	0.0052
School (Trttime x School)	25	8816321	14.36	0.0001
Type	1	7094459	50.36	0.0021
Trttime x Type	1	0	0.00	1.0000
Type x Subgroup (Trttime)	4	563466	5.74	0.0002
Error	380	9329878	26.83	0.0000
Ratio 7 Revenue/ADP				
Trttime	1	212278	18.84	0.0001
Subgroup (Trttime)	4	5725802	1.50	0.2325
School (Trttime x School)	25	23864367	84.72	0.0000
Type	1	70551	1.17	0.3398
Trttime x Type	1	14991	0.25	0.6439
Type x Subgroup (Trttime)	4	240715	5.34	0.0003
Error	380	4281567	74.28	0.0000
Ratio 6 Meals/Labor				
Trttime	1	673539	1.03	0.3682
Subgroup (Trttime)	4	2623592	1.24	0.3194
School (Trttime x School)	25	13219679	29.86	0.0001
Type	1	3472549	47.62	0.0023
Trttime x Type	1	0	0.00	1.0000
Type x Subgroup (Trttime)	4	291681	4.12	0.0028
Error	382	6764525	31.63	0.0000
Ratio 8 Meals/ADP				
Trttime	1	55283	2.00	0.2305
Subgroup (Trttime)	4	110723	0.42	0.7959
School (Trttime x School)	25	1665784	0.59	0.9442
Type	1	1948963	197.97	0.0001
Trttime x Type	1	142784	14.50	0.0190
Type x Subgroup (Trttime)	4	39378	0.09	0.9864
Error	382	43214292	0.97	0.5167

TABLE XXIV

ANALYSIS OF RAW RATIOS ASSUMING NORMAL DISTRIBUTION (ANOVA) FOR PERFORMANCE MEASURES BEFORE AND AFTER IMPLEMENTATION OF THE BAKE CENTER

Measures	DF	ANOVA SS	F Value	PR > F
Food 1: Food / Revenue				
Trttime	1	0.00104468	0.19	0.6848
Subgroup (Trttime)	4	0.02190717	3.53	0.0205
School (Trttime x School)	25	0.03881616	4.84	0.0001
Type	1	0.00020832	0.60	0.4804
Trttime x Type	1	0.00236277	6.85	0.0589
Type x Subgroup (Trttime)	4	0.00137893	1.08	0.3895
Error	25	0.00801175	5.70	0.0001
Food 2: Food / Meal				
Trttime	1	0.00052674	0.03	0.8700
Subgroup (Trttime)	4	0.06927786	1.25	0.3147
School (Trttime x School)	25	0.34567692	8.15	0.0001
Type	1	0.00266180	1.56	0.2793
Trttime x Type	1	0.00700950	4.12	0.1123
Type x Subgroup (Trttime)	4	0.00680987	1.00	0.4242
Error	25	0.04240078	7.07	0.0001
Commodity 1: Comm / Revenue				
Trttime	1	0.00127145	0.51	0.5153
Subgroup (Trttime)	4	0.01000529	4.73	0.0056
School (Trttime x School)	25	0.01321546	4.18	0.0003
Type	1	0.00310365	10.08	0.0337
Trttime x Type	1	0.00000018	0.00	0.9817
Type x Subgroup (Trttime)	4	0.00123159	4.73	0.0056
Error	25	0.00316202	6.33	0.0001
Commodity 2: Commodity / Meal				
Trttime	1	0.00509435	0.59	0.4866
Subgroup (Trttime)	4	0.03477476	5.38	0.0029
School (Trttime x School)	25	0.04038817	4.78	0.0001
Type	1	0.00637335	7.75	0.0496
Trttime x Type	1	0.00000000	0.00	0.9982
Type x Subgroup (Trttime)	4	0.00328983	5.38	0.0029
Error	25	0.00844148	7.40	0.0001

TABLE XXIV (Continued)

Measures	DF	ANOVA SS	F Value	PR > F
Paper 1: Paper / Revenue				
Trttime	1	0.00025311	0.81	0.4202
Subgroup (Trttime)	4	0.00125672	1.87	0.1476
School (Trttime x School)	25	0.00420550	4.15	0.0003
Type	1	0.00021886	2.34	0.2011
Trttime x Type	1	0.00002072	0.22	0.6627
Type x Subgroup (Trttime)	4	0.00037477	2.31	0.0855
Error	25	0.00101287	4.34	0.0001
Paper 2: Paper / Meal				
Trttime	1	0.00026005	0.94	0.3876
Subgroup (Trttime)	4	0.00110875	0.56	0.6923
School (Trttime x School)	25	0.01232880	4.97	0.0001
Type	1	0.00067334	2.33	0.2017
Trttime x Type	1	0.00007206	0.25	0.6438
Type x Subgroup (Trttime)	4	0.00115667	2.92	0.0415
Error	25	0.00247964	4.73	0.0001
Cleaning 1: Cleaning / Revenue				
Trttime	1	0.00002558	0.48	0.5268
Subgroup (Trttime)	4	0.00021342	4.85	0.0049
School (Trttime x School)	25	0.00027515	2.48	0.0136
Type	1	0.00000265	0.26	0.6356
Trttime x Type	1	0.00000475	0.47	0.5308
Type x Subgroup (Trttime)	4	0.00004045	2.28	0.0893
Error	25	0.00011103	3.52	0.0008
Cleaning 2: Cleaning / Meals				
Trttime	1	0.00010468	0.60	0.4835
Subgroup (Trttime)	4	0.00070367	4.42	0.0077
School (Trttime x School)	25	0.00099457	3.19	0.0026
Type	1	0.00000923	0.38	0.5700
Trttime x Type	1	0.00001538	0.64	0.4695
Type x Subgroup (Trttime)	4	0.00009660	1.94	0.1351
Error	25	0.00031130	4.29	0.0002

TABLE XXIV (Continued)

Measures	DF	ANOVA SS	F Value	PR > F
Labor 1: Labor / Revenue				
Trttime	1	0.04622034	1.48	0.2900
Subgroup (Trttime)	4	0.12450320	5.88	0.0018
School (Trttime x School)	25	0.13242385	2.17	0.0291
Type	1	0.00237972	0.37	0.5758
Trttime x Type	1	0.01996238	3.10	0.1529
Type x Subgroup (Trttime)	4	0.02571961	2.63	0.0580
Error	25	0.06102690	4.00	0.0003
Labor 2: Labor / Meal				
Trttime	1	0.16313029	2.04	0.2262
Subgroup (Trttime)	4	0.31957656	5.11	0.0038
School (Trttime x School)	25	0.39066802	3.15	0.0028
Type	1	0.00783936	0.46	0.5340
Trttime x Type	1	0.04696149	2.77	0.1715
Type x Subgroup (Trttime)	4	0.06787464	3.42	0.0231
Error	25	0.12394303	5.58	0.0001
Ratio 3: Revenue / Expenses				
Trttime	1	0.06438712	0.35	0.5845
Subgroup (Trttime)	4	0.73015466	7.79	0.0003
School (Trttime x School)	25	0.58560263	3.56	0.0012
Type	1	0.00140868	0.07	0.8071
Trttime x Type	1	0.00535678	0.26	0.6378
Type x Subgroup (Trttime)	4	0.08285838	3.15	0.0317
Error	25	0.16461384	6.20	0.0001
Ratio 4: Meals / Expenses				
Trttime	1	0.05863973	0.81	0.4190
Subgroup (Trttime)	4	0.28957713	3.45	0.0224
School (Trttime x School)	25	0.52498995	5.90	0.0001
Type	1	0.00612339	0.65	0.4668
Trttime x Type	1	0.00469079	0.49	0.5207
Type x Subgroup (Trttime)	4	0.03794536	2.66	0.0560
Error	25	0.08905173	7.19	0.0001

TABLE XXV

SUMMARY OF ANALYSIS OF VARIANCE FOR PERFORMANCE MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED BY MONTH OVER TWO YEARS*

	January '87				January '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	349	44397	0.01	0.9297	243199	33119	7.34	0.0092
Food/Meal	156230	45401	3.44	0.0695	58173	64202	0.91	0.3457
Commodity/Revenue	135692	59685	2.27	0.1379	1456	55697	0.03	0.8722
Commodity/Meal	338266	56110	6.03	0.0176	214329	60270	3.56	0.0651
Paper/Revenue	787258	53463	14.73	0.0004	553462	36102	15.33	0.0003
Paper/Meal	549411	61876	8.88	0.0044	331336	45778	7.24	0.0097
Cleaning/Revenue	24	50367	0.00	0.9827	105515	73658	1.43	0.2370
Cleaning/Meal	4913	49994	0.10	0.7552	50775	77996	0.65	0.4236
Labor/Revenue	118967	19445	6.12	0.0168	2813	32169	0.09	0.7687
Labor/Meal	335466	22260	15.07	0.0003	131378	32785	4.01	0.0507
Revenue/Expenses	18626	30658	0.61	0.4394	33550	35016	0.96	0.3324
Revenue/Labor hour	335472	47265	7.10	0.0104	1322286	37765	35.01	0.0001
Revenue/ADP	206141	56531	3.65	0.0619	347770	63556	5.47	0.0234
Meal/Expenses	324970	49973	6.50	0.0139	127091	47436	2.68	0.1079
Meal/Labor hour	1031480	39295	26.25	0.0001	2246112	34238	65.60	0.0001
Meal/ADP	10998	50877	0.22	0.6440	1510	40778	0.04	0.8482

	February '87				February '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	90822	40078	2.27	0.1385	627956	32684	19.21	0.0001
Food/Meal	23005	57093	0.40	0.5285	16050	54677	0.29	0.5904
Commodity/Revenue	79173	58002	1.37	0.2482	91699	44779	2.05	0.1586
Commodity/Meal	261253	48415	5.40	0.0243	509248	51693	9.85	0.0028
Paper/Revenue	922441	74903	12.32	0.0010	862614	45321	19.03	0.0001
Paper/Meal	588941	73008	8.07	0.0065	499687	50735	9.85	0.0028
Cleaning/Revenue	59272	59427	1.00	0.3228	55947	67704	0.83	0.3677
Cleaning/Meal	110773	56984	1.94	0.1694	82978	67320	1.23	0.2722
Labor/Revenue	2073	31277	0.07	0.7979	468189	23028	20.33	0.0001
Labor/Meal	100344	32304	3.11	0.0841	97297	28131	3.46	0.0688
Revenue/Expenses	27522	39649	0.69	0.4087	676679	32504	20.82	0.0001
Revenue/Labor hour	86211	58590	1.47	0.2308	1267876	42405	29.90	0.0001
Revenue/ADP	227545	67958	3.35	0.0732	343533	70172	4.90	0.0315
Meal/Expenses	103785	48466	2.14	0.1496	20192	47299	0.43	0.5165
Meal/Labor hour	705583	38590	18.28	0.0001	2261369	36243	62.40	0.0001
Meal/ADP	110443	39495	2.80	0.1007	16659	42935	0.39	0.5362

TABLE XXV (Continued)

	March '87				March '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	50180	46730	1.07	0.3051	699855	47948	14.60	0.004
Food/Meal	106687	56318	1.89	0.1748	2541	60462	0.04	0.8384
Commodity/Revenue	84989	48800	1.74	0.1929	6741	46183	0.15	0.7040
Commodity/Meal	398654	41026	9.72	0.0030	251958	43460	5.80	0.0198
Paper/Revenue	480714	58196	14.45	0.0004	106478	44676	2.38	0.1289
Paper/Meal	499876	59061	8.46	0.0054	12961	40565	0.32	0.5744
Cleaning/Revenue	150872	48224	3.13	0.0830	283	63132	0.00	0.9468
Cleaning/Meal	217663	43876	4.96	0.0305	5152	64782	0.08	0.7812
Labor/Revenue	1893	27918	0.07	0.7956	195446	8810	22.18	0.0001
Labor/Meal	206572	28430	7.27	0.0095	37485	12201	3.07	0.0858
Revenue/Expenses	14388	37016	0.39	0.5358	1089665	44051	24.74	0.0001
Revenue/Labor hour	108838	56001	1.94	0.1695	934879	43917	21.28	0.0001
Revenue/ADP	270622	59131	4.58	0.0373	457152	71009	6.44	0.0143
Meal/Expenses	247668	40841	6.06	0.0173	28845	57168	0.50	0.4808
Meal/Labor hour	826804	36147	22.87	0.0001	2039478	31161	65.45	0.0001
Meal/ADP	393	50711	0.01	0.9302	16619	27702	0.60	0.4422

	April '87				April '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	36101	51117	0.17	0.4047	12164	40776	0.30	0.5874
Food/Meal	110142	53659	2.05	0.1582	370425	71565	5.18	0.0272
Commodity/Revenue	301301	43421	6.94	0.0112	253369	39401	6.43	0.0144
Commodity/Meal	590105	44349	13.31	0.0006	631582	53121	11.89	0.0012
Paper/Revenue	1057160	34774	30.40	0.0001	419318	45240	9.27	0.0037
Paper/Meal	833135	35088	23.74	0.0001	137457	58538	2.35	0.1317
Cleaning/Revenue	340717	48520	7.02	0.0107	203975	51469	3.96	0.0520
Cleaning/Meal	376676	47985	7.85	0.0072	307763	55813	5.51	0.0229
Labor/Revenue	11221	26137	0.43	0.5153	81253	27204	2.99	0.0901
Labor/Meal	43743	25410	1.72	0.1955	13640	26151	0.52	0.4735
Revenue/Expenses	36573	52338	0.70	0.4072	17523	36015	0.49	0.4887
Revenue/Labor hour	1297618	40992	31.60	0.0001	1297618	40992	31.66	0.0001
Revenue/ADP	319341	69454	4.60	0.0369	319341	69454	4.60	0.0369
Meal/Expenses	119675	42755	2.80	0.1006	287522	66504	4.32	0.0427
Meal/Labor hour	2179017	32855	66.32	0.0001	2179017	32855	66.32	0.0001
Meal/ADP	93464	29819	3.13	0.0828	93464	29819	3.13	0.0828

TABLE XXV (Continued)

	May '87				May '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	174219	57888	3.01	0.0889	1987958	52711	37.71	0.0001
Food/Meal	17514	46454	0.38	0.5420	178036	61715	2.88	0.0956
Commodity/Revenue	207145	46499	4.45	0.0398	12556	58124	0.22	0.6441
Commodity/Meal	496546	39636	12.53	0.0009	337063	38471	8.76	0.0047
Paper/Revenue	407696	42979	9.49	0.0034	419532	48799	8.60	0.0051
Paper/Meal	140548	35485	3.96	0.0521	98154	45706	2.15	0.1491
Cleaning/Revenue	116681	57255	2.04	0.1596	3349	45911	0.07	0.7882
Cleaning/Meal	157546	51046	3.09	0.0851	49786	43567	1.14	0.2902
Labor/Revenue	10551	7648	1.38	0.2457	5713	2269	2.52	0.1189
Labor/Meal	54699	9308	5.88	0.0190	1263	3086	0.41	0.5252
Revenue/Expenses	11745	34344	0.34	0.5613	78104	10375	7.53	0.0084
Revenue/Labor hour	238302	51719	4.61	0.0367	1238181	39296	31.51	0.0001
Revenue/ADP	224545	56151	4.00	0.0510	412372	68643	6.01	0.0178
Meal/Expenses	217927	39824	5.47	0.0234	4648	19175	0.24	0.6246
Meal/Labor hour	1104940	32827	33.66	0.0001	2193373	33489	65.50	0.0001
Meal/ADP	110869	49380	2.25	0.1403	71378	9040	7.90	0.0071

	September '87				September '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	12723	37233	0.34	0.5616	23969	49537	0.48	0.4903
Food/Meal	1105	42214	0.03	0.8721	3342	39670	0.08	0.7730
Commodity/Revenue	185118	61985	2.99	0.0904	2855	47475	0.06	0.8074
Commodity/Meal	293552	54935	5.34	0.0250	65295	50951	1.28	0.2637
Paper/Revenue	501876	68644	7.31	0.0095	645576	62838	10.27	0.0025
Paper/Meal	506783	68641	7.38	0.0090	582314	59549	9.78	0.0031
Cleaning/Revenue	233	79479	0.00	0.9571	9372	109203	0.09	0.7709
Cleaning/Meal	687	79229	0.01	0.9262	6693	110302	0.06	0.8066
Labor/Revenue	38659	22111	1.75	0.1923	131944	33028	3.99	0.0517
Labor/Meal	162482	26635	6.10	0.0170	107465	35442	3.03	0.0886
Revenue/Expenses	963	59935	0.02	0.8997	120699	56278	2.14	0.1500
Revenue/Labor hour	997723	43644	22.86	0.0001	1138694	49749	22.89	0.0001
Revenue/ADP	65906	44687	1.47	0.2305	71249	46766	1.52	0.2236
Meal/Expenses	95026	66031	1.44	0.2359	9720	67533	0.14	0.7062
Meal/Labor hour	1310320	38240	34.27	0.0001	1443645	49142	29.38	0.0001
Meal/ADP	17799	41539	0.43	0.5157	116356	47103	2.47	0.1232

TABLE XXV (Continued)

	October '87				October '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	3036	53831	0.06	0.8133	11582	61309	0.19	0.6659
Food/Meal	429233	72352	5.93	0.0185	87936	47738	1.84	0.1816
Commodity/Revenue	79546	56290	1.41	0.2404	3607	63508	0.06	0.8127
Commodity/Meal	701848	48471	14.48	0.0004	181934	57007	3.19	0.0809
Paper/Revenue	474287	47875	9.91	0.0028	831236	46033	18.06	0.0001
Paper/Meal	224692	53098	4.23	0.0449	307672	45971	6.69	0.0131
Cleaning/Revenue	5617	71952	0.08	0.7811	859	103143	0.01	0.9277
Cleaning/Meal	52121	67826	0.77	0.3849	18049	104772	0.17	0.6801
Labor/Revenue	99911	29769	3.36	0.0732	310514	37107	8.37	0.0059
Labor/Meal	49273	29052	1.70	0.1988	13368	38008	0.35	0.5562
Revenue/Expenses	30952	34992	0.88	0.3517	198080	58772	3.37	0.0730
Revenue/Labor hour	349231	52425	6.66	0.0130	489314	47574	10.29	0.0025
Revenue/ADP	402123	71383	5.63	0.0217	356406	61879	5.76	0.0207
Meal/Expenses	417957	54194	7.71	0.0077	41787	58771	0.71	0.4036
Meal/Labor hour	1375003	36682	37.48	0.0001	1424865	51982	27.41	0.0001
Meal/ADP	31625	31856	0.99	0.3239	12	46585	0.00	0.9871

	November '87				November '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	850619	30282	28.09	0.0001	57413	43208	1.33	0.2551
Food/Meal	21778	50280	0.43	0.5135	118165	60405	1.96	0.1689
Commodity/Revenue	26279	38764	0.68	0.4142	26592	58966	0.45	0.5053
Commodity/Meal	301066	41392	7.27	0.0095	77427	64271	1.20	0.2784
Paper/Revenue	953738	46700	20.42	0.0001	569382	66540	8.56	0.0054
Paper/Meal	661581	54619	12.11	0.0010	268640	66258	4.05	0.0502
Cleaning/Revenue	39947	62660	0.64	0.4284	4858	88558	0.05	0.8159
Cleaning/Meal	71676	63944	1.12	0.2948	7	91373	0.00	0.9931
Labor/Revenue	446946	18522	24.13	0.0001	439773	37546	11.71	0.0013
Labor/Meal	94858	33380	2.84	0.0981	78390	39791	1.97	0.1675
Revenue/Expenses	716700	22911	31.28	0.0001	402314	43731	9.20	0.0040
Revenue/Labor hour	628413	45753	13.73	0.0005	657103	52297	12.56	0.0009
Revenue/ADP	335169	63900	5.25	0.0263	315307	62791	5.02	0.0301
Meal/Expenses	27628	46085	0.60	0.4424	6072	71875	0.08	0.7727
Meal/Labor hour	1448404	39573	36.60	0.0001	1478467	56452	26.19	0.0001
Meal/ADP	1072	8344	0.13	0.7215	14979	34622	0.43	0.5141

TABLE XXV (Continued)

	December '87				December '88			
Measures	Model SS	Error SS	F Value	PR>F	Model SS	Error SS	F Value	PR>F
Food/Revenue	280863	83207	3.38	0.0721	201556	58685	3.43	0.0704
Food/Meal	24612	62806	0.39	0.5342	16600	62758	0.26	0.6096
Commodity/Revenue	20596	77787	0.26	0.6091	13747	32523	0.42	0.5189
Commodity/Meal	364698	78706	4.63	0.0362	171376	41794	4.10	0.0490
Paper/Revenue	572113	54226	10.55	0.0021	172607	64606	2.67	0.1091
Paper/Meal	282166	53771	5.25	0.0262	97824	70575	1.39	0.2454
Cleaning/Revenue	109859	81146	1.35	0.2501	185307	93613	1.98	0.1663
Cleaning/Meal	16591	76225	2.17	0.1473	277931	94369	2.95	0.0932
Labor/Revenue	335078	22813	14.69	0.0004	140529	31086	4.52	0.0390
Labor/Meal	37825	37646	1.00	0.3210	78	44762	0.00	0.9669
Revenue/Expenses	477962	57185	8.36	0.0057	293548	56616	5.18	0.0276
Revenue/Labor hour	461225	52229	8.83	0.0045	643361	44028	14.61	0.0004
Revenue/ADP	449104	69452	6.47	0.0141	203444	71054	2.86	0.0977
Meal/Expenses	12482	67993	0.18	0.6702	46523	67909	0.69	0.4122
Meal/Labor hour	1344140	47046	28.57	0.0001	1318638	57460	22.95	0.0001
Meal/ADP	37056	7067	5.24	0.0263	163675	35431	4.62	0.0371

Note: *degree of freedom 1 and 50.

TABLE XXVI

SUMMARY OF ANALYSIS OF VARIANCE FOR PERFORMANCE MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED BY SEMESTER

	Semester 1			
Measures	Model SS	Error SS	F Value	PR >F
Food/Revenue	10259	2784	3.69	0.0606
Food/Meal	6628	3099	2.14	0.1499
Commodity/Revenue	17004	2120	8.02	0.0067
Commodity/Meal	49292	2001	24.63	0.0001
Paper/Revenue	58741	2477	23.72	0.0001
Paper/Meal	39791	2336	17.02	0.0001
Cleaning/Revenue	20596	3105	6.63	0.0130
Cleaning/Meal	24222	2974	8.14	0.0063
Labor/Revenue	338	2213	0.15	0.6975
Labor/Meal	15547	2187	7.11	0.0103
Revenue/Expenses	360	2801	0.13	0.7215
Revenue/Labor hour	904279	53391	16.94	0.0001
Revenue/ADP	1070747	59304	18.06	0.0001
Meal/Expenses	19703	2777	7.09	0.0104
Meal/Labor hour	4518818	35893	125.90	0.0001
Meal/ADP	68656	49307	1.39	0.2391

	Semester 2			
Measures	Model SS	Error SS	F Value	PR >F
Food/Revenue	18271	2492	7.33	0.0092
Food/Meal	3498	3163	1.11	0.2981
Commodity/Revenue	11960	2377	5.03	0.0293
Commodity/Meal	42822	2336	18.33	0.0001
Paper/Revenue	64717	1966	32.91	0.0001
Paper/Meal	37229	2371	15.70	0.0002
Cleaning/Revenue	8804	2893	3.04	0.0872
Cleaning/Meal	14543	2661	5.47	0.0234
Labor/Revenue	18066	2405	7.51	0.0085
Labor/Meal	269	2500	0.11	0.7444
Revenue/Expenses	18991	2728	6.96	0.0111
Revenue/Labor hour	2341425	48474	48.30	0.0001
Revenue/ADP	1148248	61756	18.59	0.0001
Meal/Expenses	3581	3423	1.05	0.3113
Meal/Labor hour	5475984	40006	136.88	0.0001
Meal/ADP	1849	90065	0.02	0.8862

TABLE XXVI(Continued)

	Semester 3			
Measures	Model SS	Error SS	F Value	PR >F
Food/Revenue	78723	2442	32.23	0.0001
Food/Meal	1	3539	0.00	0.9879
Commodity/Revenue	5338	2422	2.20	0.1439
Commodity/Meal	46837	2285	20.50	0.0001
Paper/Revenue	26701	1617	16.51	0.0002
Paper/Meal	9968	2026	4.92	0.0311
Cleaning/Revenue	4507	3208	1.41	0.2415
Cleaning/Meal	7450	3196	2.33	0.1331
Labor/Revenue	9548	1366	6.99	0.0109
Labor/Meal	84	1991	0.04	0.8377
Revenue/Expenses	27002	2265	11.92	0.0011
Revenue/Labor hour	6038267	40294	149.86	0.0001
Revenue/ADP	1871781	66598	28.11	0.0001
Meal/Expenses	156	3368	0.05	0.8306
Meal/Labor hour	10915754	32816	332.63	0.0001
Meal/ADP	22498	72333	0.31	0.5775

	Semester 4			
Measures	Model SS	Error SS	F Value	PR >F
Food/Revenue	8229	2778	2.96	0.0921
Food/Meal	2292	2841	0.81	0.3740
Commodity/Revenue	17	1965	0.01	0.9253
Commodity/Meal	14730	2528	5.83	0.0200
Paper/Revenue	7009	2306	30.36	0.0001
Paper/Meal	32629	2527	12.91	0.0008
Cleaning/Revenue	2921	3802	0.77	0.3854
Cleaning/Meal	4087	3718	1.10	0.3002
Labor/Revenue	16308	2168	7.52	0.0087
Labor/Meal	2860	2593	1.10	0.2994
Revenue/Expenses	16914	2995	5.65	0.0218
Revenue/Labor hour	2854956	47938	59.56	0.0001
Revenue/ADP	880306	59093	14.90	0.0002
Meal/Expenses	1220	3912	0.31	0.5793
Meal/Labor hour	5663060	52341	108.19	0.0001
Meal/ADP	186866	53219	3.51	0.0626

Note: degrees of freedom 1 and 50.

TABLE XXVII

SUMMARY OF ANALYSIS OF VARIANCE FOR PERFORMANCE MEASURES WHEN SATELLITE AND SELF-CONTAINED UNITS WERE COMPARED OVER TWO YEARS

Measures	Model SS	Error SS	F Value	PR > F
Food/Revenue	2538	184	13.83	0.0005
Food/Meal	282	229	1.23	0.2721
Commodity/Revenue	907	216	4.20	0.0458
Commodity/Meal	3644	161	22.58	0.0001
Paper/Revenue	4309	148	29.10	0.0001
Paper/Meal	2346	187	12.52	0.0009
Cleaning/Revenue	732	220	3.33	0.0738
Cleaning/Meal	1272	209	6.07	0.0170
Labor/Revenue	1252	209	5.99	0.0180
Labor/Meal	97	232	0.42	0.5209
Revenue/Expense	1442	203	7.58	0.0082
Revenue/Labor hour	3414	166	20.56	0.0001
Revenue/ADP	1272	209	6.09	0.0170
Meals/Expense	351	227	1.54	0.2197
Meals/Labor hour	5637	122	46.38	0.0001
Meals/ADP	212	230	0.92	0.3413

Note: degrees of freedom 1 and 50.

TABLE XXVIII

SUMMARY OF WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION) WITH CONTINUITY CORRECTION OF .5 FOR PERFORMANCE MEASURES OF FOUR PRODUCTION PARAMETERS

Breakfast Program			
Measures	S Value	Z Value	P > |z| Value
Food/Revenue	660.00	2.8668	0.0041
Food/Meal	247.00	-4.0203	0.0001
Commodities/Revenue	560.00	-1.1952	0.2320
Commodities/Meal	283.00	-3.4185	0.0006
Paper/Revenue	615.00	2.1146	0.0345
Paper/Meal	457.00	-0.5098	0.6102
Cleaning/Revenue	461.00	-0.4430	0.6578
Cleaning/Meal	366.00	2.0310	0.0423
Labor/Revenue	670.00	3.0340	0.0024
Labor/Meal	386.00	-1.6967	0.0898
Revenue/Expenses	300.00	-3.1343	0.0017
Revenue/Labor hour	449.00	-0.6436	0.5199
Revenue/ADP	204.00	-4.7391	0.0000
Meals/Expenses	678.00	3.1677	0.0015
Meals/Labor hour	700.00	3.5355	0.0004
Meals/ADP	455.00	-0.5433	0.5869

Salad Bar			
Measures	S Value	Z Value	P > |z| Value
Food/Revenue	634.00	-0.5599	0.5755
Food/Meal	503.00	-2.5694	0.0102
Commodities/Revenue	594.00	-1.1735	0.2406
Commodities/Meal	442.00	-3.5052	0.0005
Paper/Revenue	717.00	0.6980	0.4852
Paper/Meal	641.00	-0.4525	0.6509
Cleaning/Revenue	516.00	-2.3700	0.0178
Cleaning/Meal	474.00	-3.0143	0.0026
Labor/Revenue	627.00	-0.6673	0.5046
Labor/Meal	431.00	-3.6739	0.0002
Revenue/Expenses	714.00	0.6519	0.5144
Revenue/Labor hour	670.00	-0.0077	0.9939
Revenue/ADP	539.00	-2.0172	0.0437
Meals/Expenses	903.00	3.5512	0.0004
Meals/Labor hour	782.00	1.6951	0.0901
Meals/ADP	681.00	0.1457	0.8841

TABLE XXVIII (Continued)

Contract Meals			
Measures	S Value	Z Value	P > |z| Value
Food/Revenue	715.00	-0.7047	0.4810
Food/Meal	900.00	2.0542	0.0400
Commodities/Revenue	665.00	-1.4544	0.1458
Commodities/Meal	844.00	1.2145	0.2245
Paper/Revenue	715.00	-0.7047	0.4810
Paper/Meal	787.00	0.3599	0.7190
Cleaning/Revenue	750.00	-0.1799	0.8572
Cleaning/Meal	306.00	0.6447	0.5191
Labor/Revenue	713.00	-0.7347	0.4625
Labor/Meal	873.00	1.6494	0.0991
Revenue/Expenses	825.00	0.9296	0.3526
Revenue/Labor hour	788.00	0.3749	0.7078
Revenue/ADP	910.00	2.2041	0.0275
Meals/Expenses	625.00	-2.0542	0.0400
Meals/Labor hour	639.00	-1.8443	0.0651
Meals/ADP	718.00	-0.6597	0.5094

Sack Lunches			
Measures	S Value	Z Value	P > |z| Value
Food/Revenue	551.00	1.5877	0.1124
Food/Meal	418.00	-0.6658	0.5055
Commodities/Revenue	416.00	0.6999	0.4840
Commodities/Meal	391.00	-1.1267	0.2599
Paper/Revenue	553.00	1.6218	0.1048
Paper/Meal	507.00	0.8365	0.4029
Cleaning/Revenue	446.00	-0.1878	0.8510
Cleaning/Meal	415.00	-0.7170	0.4734
Labor/Revenue	542.00	1.4340	0.1516
Labor/Meal	468.00	0.1707	0.8644
Revenue/Expenses	371.00	-1.4682	0.1421
Revenue/Labor hour	476.00	-0.3073	0.7586
Revenue/ADP	386.00	-1.2121	0.2255
Meals/Expenses	468.00	0.1707	0.8644
Meals/Labor hour	506.00	0.8194	0.4125
Meals/ADP	374.00	-1.4169	0.1565

TABLE XXIX

SUMMARY OF KRUSKAL-WALLIS TEST (CHI SQUARE APPROXIMATION) FOR PERFORMANCE MEASURES OF FOUR SERVICE PARAMETERS

	No. of Serving Lines		No. of POS Terminals	
Measures	X^2	$P > X^2$	X^2	$P > X^2$
Food/Revenue	1.64	0.2007	11.99	0.0025
Food/Meal	0.51	0.4731	0.36	0.8369
Commodities/Revenue	1.49	0.2223	9.21	0.0100
Commodities/Meal	5.29	0.0214	3.66	0.1604
Paper/Revenue	7.53	0.0061	8.23	0.0163
Paper/Meal	7.37	0.0066	5.75	0.0563
Cleaning/Revenue	2.72	0.0991	3.80	0.1495
Cleaning/Meal	3.50	0.0613	1.69	0.4302
Labor/Revenue	1.06	0.3039	10.60	0.0050
Labor/Meal	0.28	0.5995	7.59	0.0225
Revenue/Expenses	1.18	0.2769	12.43	0.0020
Revenue/Labor hour	6.07	0.0138	5.18	0.0749
Revenue/ADP	1.03	0.3109	2.31	0.3156
Meals/Expenses	0.88	0.3476	3.58	0.1672
Meals/Labor hour	9.15	0.0025	1.80	0.4070
Meals/ADP	6.29	0.0122	4.25	0.1197

	Use of Dishmachines		Use of Disposables	
Measures	X^2	$P > X^2$	X^2	$P > X^2$
Food/Revenue	3.25	0.1457	3.74	0.1540
Food/Meal	4.35	0.1135	4.17	0.1240
Commodities/Revenue	5.23	0.0732	1.99	0.3700
Commodities/Meal	11.79	0.0027	10.69	0.0048
Paper/Revenue	34.09	0.0001	33.58	0.0001
Paper/Meal	31.27	0.0001	31.13	0.0001
Cleaning/Revenue	11.18	0.0037	12.07	0.0024
Cleaning/Meal	14.16	0.0008	14.32	0.0008
Labor/Revenue	7.21	0.0271	4.12	0.1272
Labor/Meal	2.85	0.2409	2.68	0.2615
Revenue/Expenses	8.43	0.0147	5.42	0.0666
Revenue/Labor hour	8.53	0.0140	5.10	0.0782
Revenue/ADP	2.50	0.2861	5.84	0.0540
Meals/Expenses	3.11	0.2108	3.16	0.2064
Meals/Labor hour	16.18	0.0003	15.76	0.0004
Meals/ADP	6.09	0.0476	1.88	0.3904

TABLE XXX

MEANS OF PERFORMANCE RATIOS BY MONTH FOR SATELLITE (Z) AND SELF-CONTAINED (C) UNITS OVER TWO YEARS

Measures	J'87	F'87	M'87	A'87	M'87	S'87	O'87	N'87	D'87
F1-C	.3621	.3562	.3417	.3078	.3056	.3925	.3378	.3368	.3011
F1-Z	.3613	.3733	.3532	.3112	.3292	.4252	.3611	.3755	.3180
C1-C	.1073	.1447	.1301	.1125	.1091	.1273	.1118	.1240	.1003
C1-Z	.1053	.1464	.1445	.1102	.1124	.1270	.1078	.1266	.0830
P1-C	.0257	.0288	.0299	.0202	.0230	.0385	.0275	.0316	.0304
P1-Z	.0418	.0483	.0439	.0369	.0345	.0509	.0403	.0482	.0406
N1-C	.0070	.0082	.0080	.0089	.0072	.0100	.0063	.0068	.0058
N1-2	.0060	.0083	.0065	.0070	.0056	.0103	.0059	.0055	.0050
L1-C	.2582	.3234	.3504	.3592	.5269	.2468	.2673	.3081	.3273
L1-Z	.2580	.3498	.3685	.3979	.6109	.2371	.2994	.3562	.3804
F2-C	.5869	.5797	.5576	.4896	.4747	.6250	.5553	.5796	.4968
F2-Z	.5424	.5607	.5278	.4570	.4686	.6096	.5033	.5898	.4730
C2-C	.1740	.2356	.2122	.1790	.1695	.2027	.1838	.2135	.1656
C2-Z	.1581	.2200	.2159	.1619	.1601	.1822	.1503	.1988	.1235
P2-C	.0416	.0726	.0487	.0321	.0358	.0613	.0451	.0544	.0503
P2-Z	.0628	.0488	.0655	.0541	.0492	.0729	.0561	.0756	.0604
N2-C	.0113	.0125	.0130	.0142	.0111	.0159	.0103	.0117	.0096
N2-Z	.0090	.0130	.0096	.0103	.0080	.0148	.0082	.0087	.0076
L2-C	.4185	.5253	.5717	.5714	.8184	.3930	.4395	.5303	.5401
L2-Z	.3873	.5717	.5506	.5843	.8698	.3400	.4172	.5595	.5657
R3-C	1.3150	1.1611	1.1628	1.2368	1.0291	1.2270	1.3329	1.2386	1.3071
R3-Z	1.2947	1.0797	1.0912	1.1585	.9151	1.1757	1.2278	1.09641	1.2090
R4-C	.8115	.7134	.7126	.7774	.6625	.7705	.8104	.7197	.7925
R4-Z	.86235	.7188	.7302	.7889	.6428	.8200	.8810	.6981	.8129
R5-C	17.6040	18.3162	18.3917	17.8821	16.7762	17.2833	18.9248	18.9518	18.5097
R5-Z	19.5003	19.7522	19.9927	19.5445	18.6385	19.3695	20.6011	22.2044	21.3102
R6-C	10.8616	11.2540	11.2715	11.2400	10.7999	10.8536	11.5115	11.0115	11.2172
R6-Z	12.9886	13.1498	13.3793	13.3098	13.0917	13.5097	14.7824	14.1381	14.3276
R7-C	1.6202	1.6271	1.6314	1.5907	1.5522	1.5895	1.6411	1.7244	1.6531
R7-Z	1.5009	1.5014	1.4945	1.4765	1.4222	1.4302	1.3906	1.5745	1.4910
R8-C	.9996	.9998	.9998	09999	.9993	.9982	.9982	1.0019	1.0018
R8-Z	.9997	.9995	1.0001	1.0055	.9989	.9975	.9978	1.0025	1.0025
R9-C	254.98	264.19	264.60	263.86	253.53	254.79	270.23	258.49	263.32
R9-Z	179.13	181.36	184.52	183.57	180.56	172.32	188.56	180.34	182.76
R10-C	.7032	.7282	.7345	.7282	.7032	.7095	.7500	.7032	.7157
R10-Z	.6281	.6407	.6500	.6438	.6250	.6032	.6563	.6157	.6250

TABLE XXX (Continued)

Measures	J'88	F'88	M'88	A'88	M'88	S'88	O'88	N'88	D'88
F1-C	.2909	.3381	.2723	.3204	.2975	.3597	.3640	.3147	.3090
F1-Z	.3061	.3774	.3130	.3062	.3633	.3593	.3666	.3163	.3274
C1-C	.1020	.1177	.0826	.1126	.1033	.0850	.0980	.0862	.0671
C1-Z	.0998	.1054	.0762	.1000	.0975	.0755	.0889	.0820	.0590
P1-C	.0249	.0356	.0230	.0347	.0316	.0331	.0400	.0391	.0384
P1-Z	.0354	.0509	.0300	.0452	.0429	.0501	.0624	.0529	.0478
N1-C	.0067	.0061	.0041	.0080	.0072	.0100	.0094	.0079	.0074
N1-Z	.0057	.0047	.0045	.0039	.0070	.0082	.0089	.0064	.0058
L1-C	.2452	.2904	.4043	.2481	.5689	.1973	.2776	.2478	.2987
L1-Z	.2234	.3470	.4932	.2663	.5981	.2047	.2948	.2736	.3103
F2-C	.4935	.5769	.4630	.5426	.4929	.6214	.6643	.5718	.5452
F2-Z	.4738	.5874	.4787	.4748	.5436	.5887	.6041	.5245	.5300
C2-C	.1731	.2009	.1405	.1906	.1712	.1468	.1788	.1566	.1184
C2-Z	.1545	.1641	.1166	.1544	.1459	.1236	.1464	.1359	.0955
P2-C	.0422	.0607	.0392	.0588	.0524	.0573	.0730	.0711	.0677
P2-Z	.0548	.0793	.0459	.0700	.0642	.0822	.1028	.0876	.0773
N2-C	.0113	.0105	.0070	.0135	.0119	.0173	.0172	.0143	.0130
N2-Z	.0088	.0073	.0070	.0061	.0104	.0135	.0147	.0106	.0093
L2-C	.4160	.4955	.5873	.4202	.9426	.3408	.5066	.4503	.5271
L2-Z	.3458	.5401	.7543	.4129	.8948	.3354	.4857	.4537	.5024
R3-C	1.4935	1.2690	1.2716	1.3817	.99155	1.4597	1.2676	1.4375	1.3877
R3-Z	1.4917	1.1293	1.0905	1.3867	.90198	1.4328	1.2171	1.3677	1.3329
R4-C	.8803	.7438	.7480	.8158	.5984	.8449	.6945	.7911	.7865
R4-Z	.9636	.7256	.7131	.8943	.6029	.8746	.7387	.8249	.8234
R5-C	19.0860	19.0156	19.8500	19.1962	18.5596	19.7207	21.3784	20.5315	20.8505
R5-Z	24.1440	23.8747	24.5319	24.2891	22.8794	27.8235	29.8113	28.5793	29.3368
R6-C	11.2498	11.1456	16.0422	11.3341	11.2008	11.4145	11.7133	11.2985	11.8180
R6-Z	15.5977	15.3396	1.5256	15.6649	15.2923	16.9840	18.0937	17.2360	18.1228
R7-C	1.6939	1.7029	1.6969	1.6907	1.6598	1.7282	1.8247	1.8145	1.7620
R7-Z	1.5444	1.5525	1.5256	1.5469	1.5010	1.6378	1.6476	1.655	1.6154
R8-C	.9984	.9981	.9981	.9982	1.002	1.0000	.9998	.9985	.9987
R8-Z	.9977	.9975	.9977	.99765	1.003	.9998	1.0000	.9982	.9979
R9-C	264.09	261.64	274.09	266.07	262.94	270.27	277.35	267.52	279.82
R9-Z	183.36	180.33	188.58	184.15	179.77	190.75	203.22	193.58	203.54
R10-C	.7188	.7390	.7656	.7438	.7344	.7656	.7876	.7032	.7329
R10-Z	.6281	.6438	.6688	.6532	.6344	.6500	.7188	.6250	.6532

APPENDIX F

SUPPLEMENTAL FIGURES

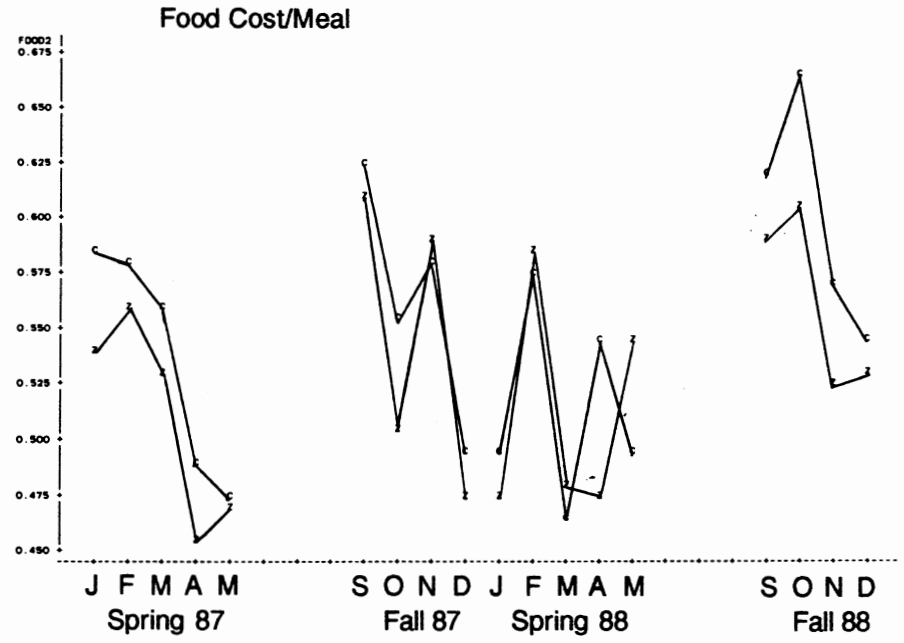


Figure 12. Food cost/meal for satellite (z) and self-contained (c) units over two calender years.

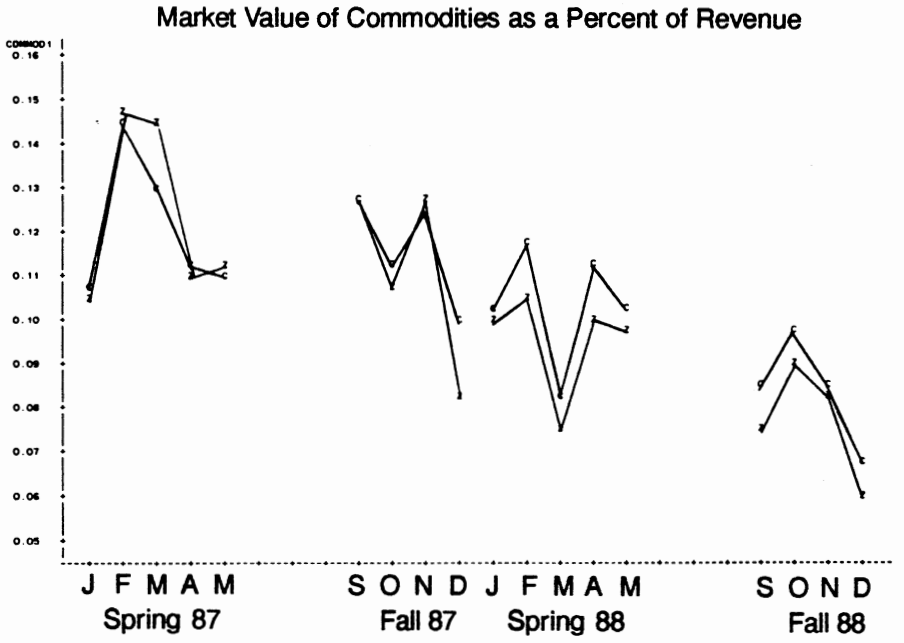


Figure 13. The market value of commodities as percent of total revenue for satellite (z) and self-contained (c) units over two calender years.

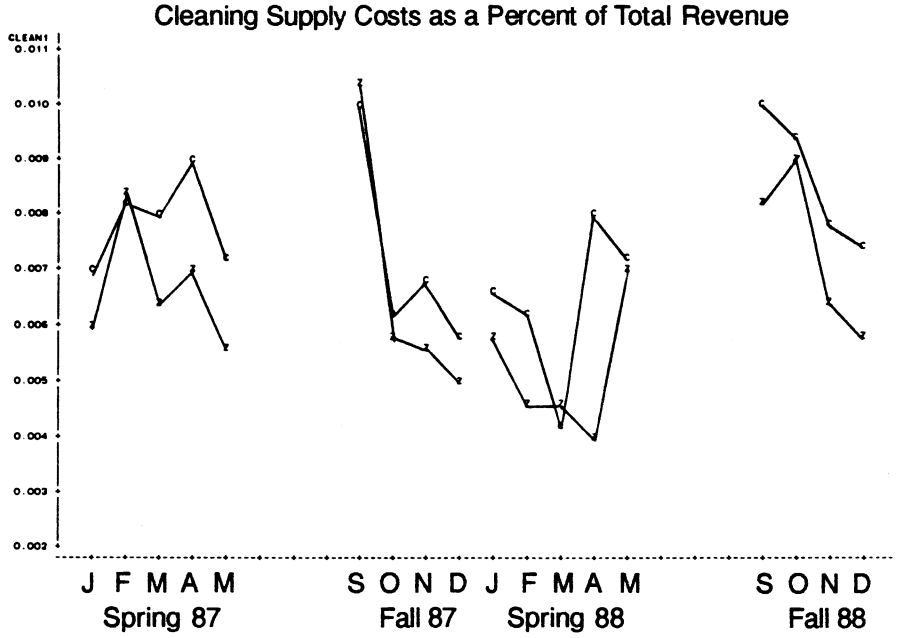


Figure 14. Cleaning supply costs as a percent of total revenue for satellite (z) and self-contained (c) units over two calender years.

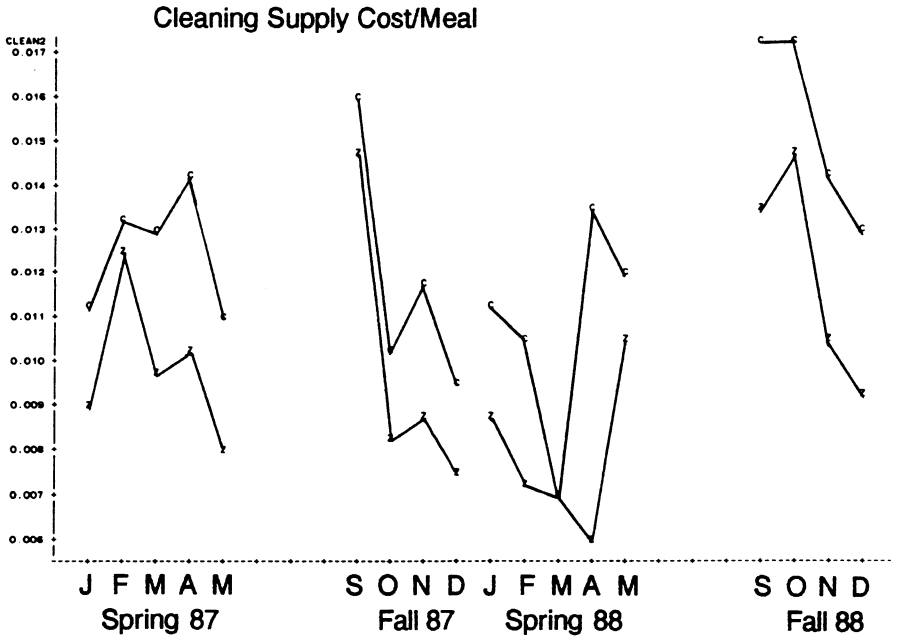


Figure 15. Cleaning supply cost/meal for satellite (z) and self-contained (c) units over two calender years.

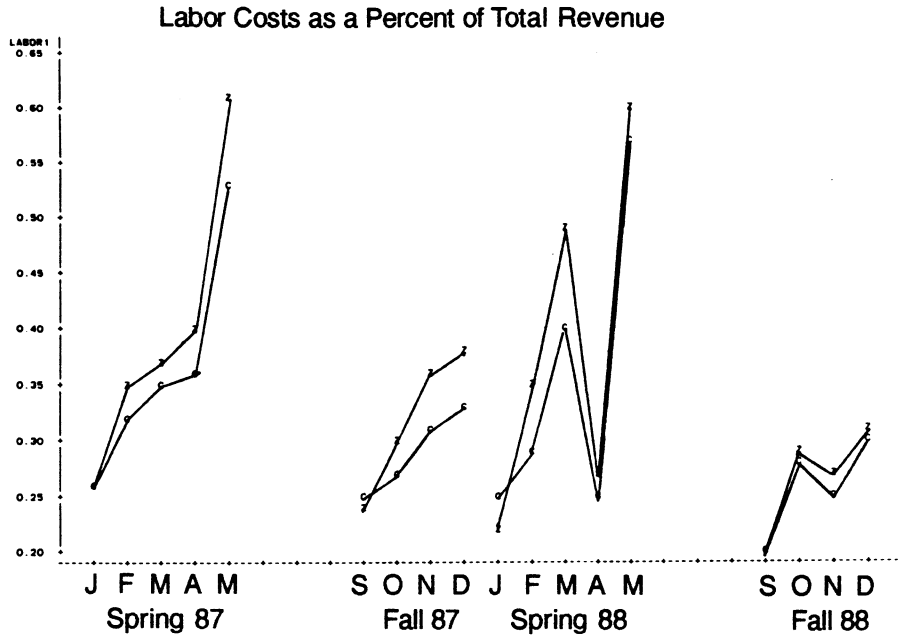


Figure 16. Labor costs as a percent of total revenue for satellite (z) and self-contained (c) units over two calender years.

Figure 17. Labor cost/meal for satellite (z) and self-contained (c) units over two calender years.

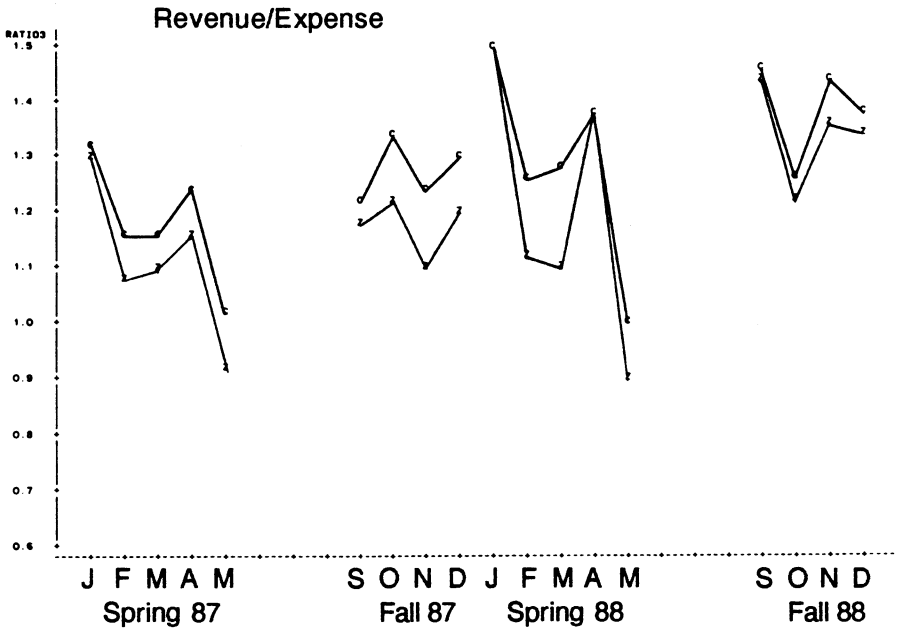


Figure 18. Revenue/expense for satellite (z) and self-contained (c) units over two calender years.

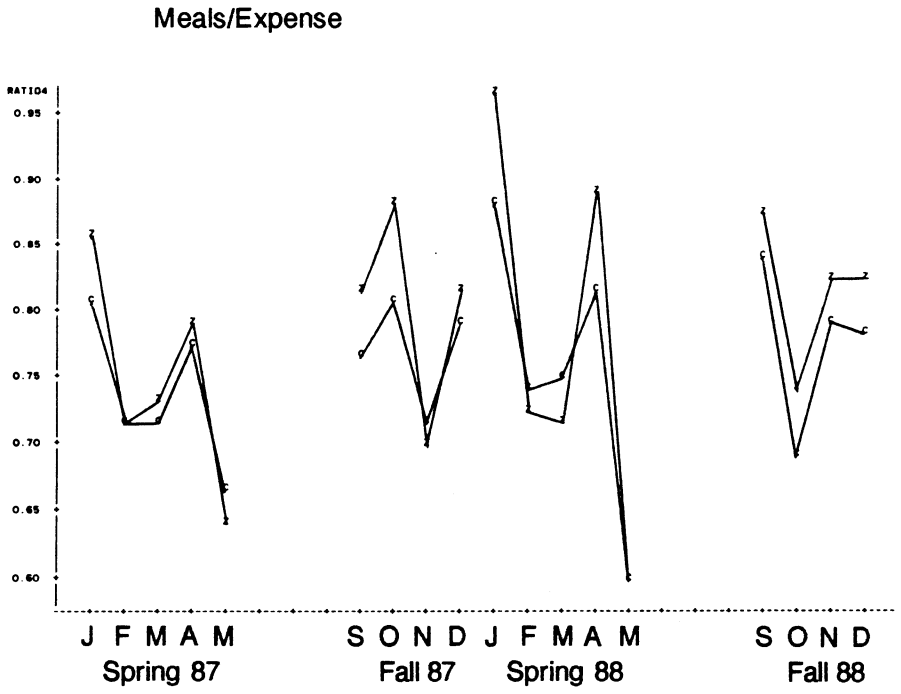


Figure 19. Meals/expense for satellite (z) and self-contained (c) units over two calender years.

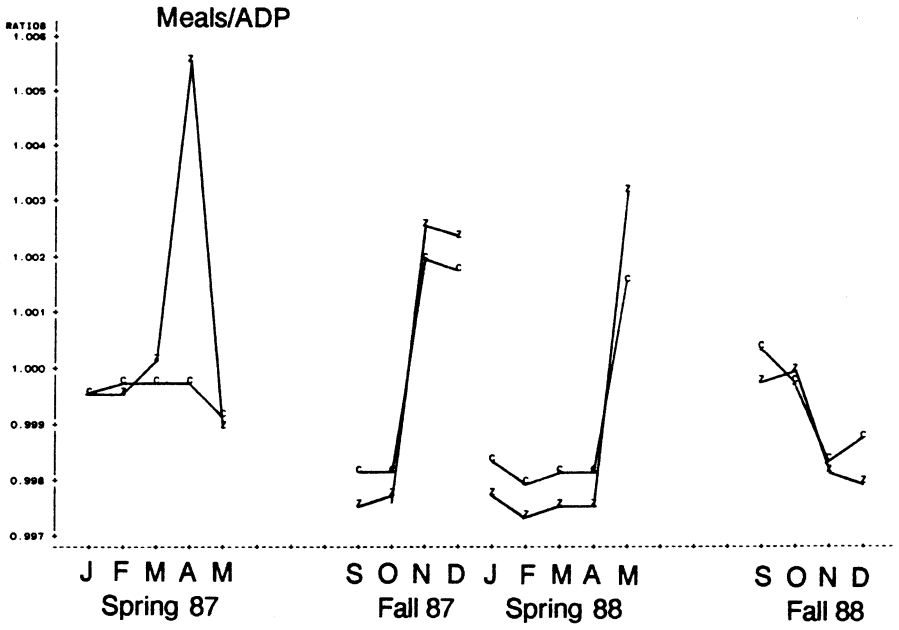


Figure 20. Meals/ADP for satellite (z) and self-contained (c) units over two calender years.

VITA

Susan Carol Linnenkohl

Candidate for the Degree of

Doctor of Philosophy

Thesis: PERFORMANCE MEASURES FOR SATELLITE AND SELF-CONTAINED ELEMENTARY SCHOOLS WITHIN A MAJOR CITY CHILD NUTRITION PROGRAM: IMPACT OF AN INNOVATIVE BAKE CENTER

Major Field: Home Economics - Foodservice Systems Management

Biographical:

Personal Data: Born in Albuquerque, New Mexico, February 8, 1954, the daughter of Henry C. and Julia R. Linnenkohl.

Education: Graduated from Wayne High School, Huber Heights, Ohio, on June 4, 1971; received Bachelor of Science in Dietetics from Eastern Kentucky University, Richmond, in May 1975 and Masters Degree in Institution Management from Kansas State University, Manhattan, in October 1980; completed requirements for a Doctor of Philosophy at Oklahoma State University, in December 1991.

Professional Experience: Dietetic Trainee (1 year), Dietitian & Consultant, ARA Services (2 years); Dietetic Consultant (8 years); Graduate Teaching Assistant at Kansas State University, Manhattan (2 years); Instructor and Assistant Professor at Eastern Kentucky University, Richmond (9.5 years); Teaching Associate at Oklahoma State University, Stillwater (1 year); Associate Professor at Marshall University, Huntington, West Virginia (Since December 1990).

Professional Organizations: Registered Dietitian; member of The American Dietetic Association, American School Food Service Association, National Restaurant Association, and Foodservice Systems Management Education Council; former member of The American Home Economics Association, The Society for Nutrition Education,

and Kentucky Nutrition Council; inducted into Phi Upsilon Omicron and Omicron Nu, National Honoraries in Home Economics.

Scholarship: The American Dietetic Association.