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National Family Planning Program  
Ministry of Health, Thailand

A DESIGN AND AN IMPLEMENTATION PLAN  
FOR A COMPUTERIZED LOGISTICS  
AND INVENTORY CONTROL SYSTEM

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Ministry of Health, Thailand

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FOR A COMPUTERIZED LOGISTICS  
AND INVENTORY CONTROL SYSTEM

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## PREFACE

This report details the results of a two-week consultancy, funded by the United States Agency for International Development (USAID), to assist the National Family Planning Program (NFPP) of the Ministry of Health (MOH) of Thailand. The purpose of this visit was to specify a preliminary design and implementation plan for an automated, micro-computer-based logistics and inventory monitoring system.

It is proposed that each component (i.e., logistics and inventory) of the monitoring system be implemented separately, with emphasis on the logistics component; that both components be designed to use the existing microcomputer resources of the NFPP (with certain additions); and that installation of the computerized monitoring system be coordinated with implementation of the overall logistics system.

The proposed automation should complement the operation of the entire logistics system, enabling management to evaluate the performance of the various outlets throughout the nation. The proposed system should facilitate the early detection of implementation problems, the timely detection of inadequacies of supplies, the prompt evaluation of strategies to resolve problems, and increasingly accurate forecasting.

It should be noted that the proposed computerized system is only a small segment of a comprehensive logistics system. Its functions are to aid management in monitoring the implementation of this comprehensive system, and to help identify problems and alternative strategies. It will not itself result in a more (or less) effective system. It is designed to help management identify the areas where effort should be concentrated to ensure the success of the overall system, and to evaluate current efforts in terms of their effect on total system performance. It will not be able to solve even a small proportion of the problems which will plague a logistics and supply system of this type, but it will, it is hoped, aid in their correction through timely identification and monitoring.

The consultant wishes to take this opportunity to thank all the people at the NFPP and USAID who contributed to and supported this effort. Staff of both these organizations were, without exception, cooperative and helpful in the extreme. Without their assistance, this effort would not have been possible.

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## I. INTRODUCTION

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This document suggests one solution to the problem of monitoring the newly implemented logistics system of the National Family Planning Program (NFPP) of Thailand. It is based on two weeks of discussions with NFPP personnel, local USAID personnel, and external logistics consultants. The proposed system attempts to provide accurate and timely monitoring information, with a minimum of input from the field, and to impose a minimum of extra tasks on central-office staff. It uses existing hardware wherever possible and the latest in structured software, which enables it to accommodate future alterations and advances in technology at minimum additional expense. The system, once it is fully implemented, will require no outside assistance for operation; future enhancements can be performed at the users' discretion either by in-house or contract personnel.

## II. TECHNICAL SPECIFICATIONS

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### Hardware

The system will be designed to operate on an Apple II+ microcomputer with 48K of main memory. In addition to the Apple II+, the system will require:

- An Apple Pascal Language Card, which will provide an extra 16K of main memory and permit use of the Apple Pascal Language System (see next section on software).
- At least one Apple II floppy disk, for loading and storage of programs.
- A Corvus 10M-byte hard disk, to store the large amounts of data the system will require. This disk should be equipped with the Corvus Mirror backup system so that the contents of the disk can be copied to and from video tape.
- A video cassette recorder, to back up the hard disk. This equipment does not have to be available constantly, but it should be available on demand. Routine backups should occur at least weekly, with unscheduled restores as needed.
- A printer, to print reports and diagnostics.

### Software

The system will require the Apple Pascal Language System. This combined operating and programming language system will permit structured system design and facilitate efficient use of the hard disk. The language system includes all the functions necessary to support the operation of the logistics system, including an editor, a compiler, an assembler, and utilities for printing, moving, and saving files.

To ease the forecasting tasks associated with the overall supply system (i.e., those not performed by the proposed monitoring system), it is recommended that the VisiCalc package be acquired. VisiCalc is an electronic spread sheet which facilitates rapid analysis of changes in demand, supply, delivery schedules, cost, etc. Although VisiCalc cannot directly use the data stored in the computer, software to provide aggregate data in a format suitable for VisiCalc can be added easily to the system.

### Existing Capacity and Additional Requirements

The NFPP now owns an Apple II+ microcomputer with 48K of main memory, two floppy disk drives, and an IDS 560 printer. Currently, requirements on the Apple are sufficiently small to enable it to perform its present tasks and run the envisioned system with no significant problems. Thus, the only additional equipment required for the system is the Apple Pascal Language Card and System (hardware and software), and the Corvus disk. In addition, pending the availability of video cassette recorders within the NFPP, a separate video cassette recorder may be required.

### III. THE MONITORING SYSTEM

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#### System Components

The computerized monitoring system is designed to assist NFPP personnel in managing the new logistics system at several levels. At outlets, it will provide program personnel with guidelines on inventory levels, pointing out significant over- and under-stocking. Regionally, it will determine stocking levels for the regional warehouses, as well as indicate potential trouble spots within the region. For central planning staff, it will forecast demand for the entire nation, as well as each individual region, province, and outlet; identify those outlets which may require assistance; pinpoint areas of over- and under-stocking, allowing limited resources to be shifted from areas of low utilization to areas of high demand; and provide the data needed to forecast long-range demand and coordinate resource acquisition.

The system is made up of three components: input, data management, and output. The three components combine to provide a comprehensive system for data entry, storage, and retrieval in any form which management may desire. Initially, the system will produce a fixed series of reports; however, it will be possible to change at will the format, number, and content of all reports.

#### Input

The system will require the following files for proper operation:

- A province file, containing the names and numbers of all provinces.
- A region file, containing the names and numbers of all regions, in addition to the provinces they embrace.
- An outlet file, containing the names and numbers of all outlets. With this file, the software can be used to identify the province where any outlet is located, as well as minimum and maximum supply levels for any products available at that outlet which are exempt from the standard calculation.
- A product file, containing the names and numbers of all supplies tracked by the system.
- The main data base, an historical collection of use data for all outlets. This data base will not exist when the system is first implemented, but it will grow as the system operates.

The input module will contain procedures for the addition, deletion, and correction of all entries in each of the above files, but the major focus of the module will be the main data base.

The single form which drives the entire system is Form 06 (see Exhibit III-1). Each outlet will be required to submit a copy of this to the central office each month, regardless of the supplies ordered. This will allow the system to keep track of supply utilization routinely, rather than only as supplies are ordered. The data on Form 06 will be entered using a screen-formatted entry procedure, which will validate data as data are entered. Data for all supplies will be checked to ensure proper ranges, consistency with earlier data, and other special cases. The system will request that any inaccurate data be verified. Outlets with inconsistent data will be flagged, and lists of all outlets which currently have suspicious entries, as well as the historical record of individual outlets, will be available on demand. The system will have the capability to change, delete, or add data at any time; all transactions will be subject to the same edit-testing.

Data which are unavailable, for whatever reasons, will be approximated; these approximations will be based on past data, and, consequently will increase in accuracy as more data are collected. Approximated data will be used in addition to actual data to compute usage levels and supply requirements, but approximate and actual data will always be differentiated within the system, and warnings will be raised when levels of approximated data threaten to reduce the statistical accuracy of associated predictions.

### Data Management

After processing by the input module, data will be stored on the hard disk. The functions of data storage and retrieval will be handled by the data management module. All data will be stored at their most disaggregate level to provide maximum flexibility in reporting. By storing disaggregate data, reports will be limited only by the data collected and will be subject to no additional limitations of the storage software. Although the initial reports will be fixed, any (or at least most) conceivable combinations of entered data will be available for reporting.

The data management module also will be able to schedule and enforce routine backup of the disk, control restores, maintain audit trails of all changes, remove non-current data from the disk to secondary storage (floppy disks), recover these data when necessary, and perform similar tasks. The data management software will be structured along strict functional lines, both to allow future modifications to easily augment or replace existing functions, and to provide a standard interface to the various functions (e.g., storage, retrieval, etc.) for

Exhibit III-1

(Form FP 06)

ORDER FOR FAMILY PLANNING SUPPLIES

Unit \_\_\_\_\_

District \_\_\_\_\_ Province \_\_\_\_\_

Serial No.	Description	Stock No.	Unit	Used	On Hand	Quantity Requested	Quantity Supplied	Remarks
1	Noriday		mc					
2	Norinyl		mc					
3	Ovostat		mc					
4	Ovral		mc					
5	Eugynon		mc					
6	Loop B		pc					
7	C		pc					
8	D		pc					
9	Insertor		pc					
10	Multi Load		pc					
11	Condom		pc					
12	D.M.P.A.		dose					
13								
14								
15								
16								
17								
18								
19								
20								

Requested By \_\_\_\_\_ Approved By \_\_\_\_\_

use by any additional software. Functions that are not part of the initial system, but which might benefit greatly from standardized interface, include the collection of aggregate data in a form that can be used by VisiCalc; VisiTrend (a trend analysis package) or VisiPlot (a plotting package); statistical analysis of use data, using techniques similar to those already in use at NFPP; and integration of supply data with other inventory control data.

### Reporting

The system will perform several reporting functions. It is designed to provide timely reports on the supply and use status of all outlets, as well as aggregate reports for each province and region, and nationwide. In addition, it will calculate suggested supply levels for all outlets, subject to general minimum and maximum supply criteria, alterable for specific outlets and products. These reports will, it is hoped, aid both central-office and outlet staff in the procurement of supplies. The system will also calculate the amounts of each supply to be shipped to each regional warehouse to ensure adequate distribution of all supplies throughout the nation.

Initial reporting layouts, designed in concert with NFPP personnel, are shown in Exhibits III-2 through III-6. The reports will be produced monthly, quarterly, semi-annually, or annually.

Specifically, five reports will be produced. These are:

- Status Report by Depot

A report of on-hand and dispensed units for each type of outlet within the reporting area (this report is available for a province, region, or the nation). Levels for each product supplied are displayed, as are the number of units in each category, the number of units reporting, and the percentage these figures represent. Two versions of this report will be available, one listing numbers of products dispensed, the other listing percentages of each product dispensed at each type of outlet.

- Aggregate Status Report

A report listing the units on hand and dispensed for each product, as well as the distribution of units within types (e.g., Noriday as a percentage of all pills). This report will provide aggregated totals for all outlets within the specified reporting area (province, region, or nation).

## Exhibit III-2

### STATUS REPORT BY DEPOT

Contra- ceptive Brand	<u>AT PCMO WISE</u>		<u>AT PHOSP</u>		<u>AT DIHOSP</u>		<u>AT COMBINED DHO</u>		<u>AT PCMO CLINIC</u>		<u>AT MCH</u>		<u>AT REGIONAL WISE</u>		<u>AT OTHER</u>	
	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>
NORIDAY																
NORINYL																
OVOSTAT																
OVRAL																
EUGYNON																
Total Pills																
DMPA																
LOOP B																
LOOP C																
LOOP D																
Total Loops																
MULTILOAD																
INSERTER																
CONDOM																
Number of Reporting Units																
Number of Total Units																
Percentage of Units Reporting																

Notes:

- This report will be available each month, quarterly, semi-annually, and annually.
- This report will be available for each province or region, or the entire nation.
- This report will be available for a number of units at each outlet, as well as for a percent of units at each outlet. Percentage figures will be the percent of that brand located or dispensed at that outlet.

Exhibit III-3

AGGREGATE STATUS REPORT

<u>Contraceptive Brand</u>	<u>TOTAL UNITS</u>		<u>PERCENT OF TYPE</u>	
	<u>On Hand</u>	<u>Dispensed</u>	<u>On Hand</u>	<u>Dispensed</u>
NORIDAY	100	200	10%	10%
NORINYL	200	300	20%	15%
OVOSTAT	50	100	5%	5%
OVRAL	500	300	50%	15%
EUGYNON	150	1,100	15%	55%
Total Pills	1,000	2,000	100%	100%
DMPA	200	200	100%	100%
LOOP B	100	50	17%	10%
LOOP C	200	400	33%	80%
LOOP D	300	50	50%	10%
Total Loops	600	500	100%	100%
MULTI LOAD	100	200	100%	100%
INSERTER	50	50	100%	100%
CONDOM	500	750	100%	100%

Notes:

- This report will be available monthly, quarterly, semi-annually, or annually.
- This report will be available for a province or region, or for the nation.
- The percent columns list the percentage of the specific brand in respect to the total number of brands of that type (i.e., the percent of Noriday compared to total pills). Consequently, they are meaningful only for pills and loops.

Exhibit III-4

OUT-OF-COMPLIANCE PRODUCTS  
AS OF END OF MONTH

PROVINCE OF: \_\_\_\_\_

<u>Contra- ceptive Brand</u>		<u>PCMO WHSE</u>	<u>PHOSP</u>	<u>DHOSP</u>	<u>DHO</u>	<u>PCMO CLINIC</u>	<u>MCH</u>	<u>REGIONAL WHSE</u>
NORIDAY	Cycles on Hand	500	450	600	200	300	50	1,000
	Average Monthly Use	250	50	150	75	75	10	750
	Months on Hand	2	9	4	2.67	4	5	2.33
	Over/Under	---	+++		---			---
NORINYL	Cycles On Hand							
	Average Monthly Use							
	Months On Hand							
	Over/Under							
OVOSTAT	Cycles On Hand							
	Average Monthly Use							
	Months on Hand							
	Over/Under							
LOOP D	Pieces On Hand							
	Average Monthly Use							
	Months On Hand							
	Over/Under							
CONDOM	Pieces On Hand							
	Average Monthly Use							
	Months On Hand							
	Over/Under							

Notes:

- This report provides a snapshot of all products which are not properly stocked at some level. It can be run at the end of any month. It is available only for specific provinces.
- The "over/under" column highlights which outlets are out-of-compliance for that product. "---" indicates that the outlet is undersupplied, and "+++" indicates an oversupply.
- Only products which are out-of-compliance at some level are listed (i.e., the fact that EUGYNON, LOOP B, and others are not listed on this sample page indicates that all outlets in the province are properly supplied).

Exhibit III-5

OUT-OF-COMPLIANCE OUTLETS  
AS OF END OF MONTH

PROVINCE OF: \_\_\_\_\_

<u>Outlet</u>	<u>Product</u>	<u>Units on Hand</u>	<u>Average Monthly Use</u>	<u>Months' Supply</u>	<u>Over/Under</u>
PCMO WHSE	Noriday	50	25	2	-
	Loop B	5,000	500	10	-
	Condom	1,000	500	2	-
DHOSP	DMPA				
	Loop C				
	Condom				
DHO 1	Eugynon				
DHO 2	Norinyl				
	Loop D				
	Condom				

Notes:

- This report provides a snapshot of all outlets out-of-compliance, and the products out-of-compliance at those outlets. It can be run at the end of any month. It is valid for specific provinces only.
- Only outlets out-of-compliance for at least one product are listed (i.e., the fact that the PHOSP for this province is not listed indicates that it is in compliance for all products).
- For each outlet listed, only those products for which that outlet is out-of-compliance are listed.

Exhibit III-6

SUGGESTED SHIPMENTS TO REGIONAL WAREHOUSE  
AS OF END OF MONTH

REGION OF: \_\_\_\_\_

<u>Contra- ceptive Brand</u>	<u>Units On Hand</u>	<u>Average Monthly Use</u>	<u>Maximum Months - Supply</u>	<u>Difference (ship)</u>	
Noriday	5,500	1,200	8	9,600	4,100
Norinyl	8,800	1,100	8	8,800	0
Ovostat	10,000	1,000	8	8,000	----
Ovral	2,000	400	6	2,400	400
Eugynon	150,000	30,000	6	180,000	30,000
DMPA	5,000	1,000	5	5,000	0
Loop B	110,000	30,000	8	240,000	130,000
Loop C	4,500	360	8	2,880	----
Loop D	2,700	300	6	1,800	----
Multiload	6,500	1,100	3	3,300	----
Inserter	3,300	1,100	8	8,800	5,500
Condom	500,000	125,000	5	625,000	125,000

Notes:

- This report gives suggestions for shipments for regional warehouses, based on use within the region and suggested supply levels.
- Supply levels can vary from product to product.

- Out-of-Compliance Products

A monthly report indicating all products which are out-of-compliance somewhere within the reporting area. This report will be available only for a province. Outlet types with over- or under-stocking will be indicated by pluses (+) or minuses (-).

- Out-of-Compliance Outlets

A monthly report indicating all outlets within a province which are out of compliance with one or more products. Each product which is not within predetermined stocking levels will be flagged.

- Suggested Shipments to Regional Warehouses

A monthly report indicating the suggested shipments of each product to all regional warehouses, based on the predetermined stocking criteria.

These reports represent the initial universe of reports; additional reports can be programmed at any time. The use of the Pascal Language and Operating System will greatly facilitate the development of additional reports and the modifications of existing reports. Through intelligent use of the structured features of the language, data retrieval and formatting will be as standardized as possible, thus making it possible to use newly developed software to take advantage of existing procedures for many of the reporting functions.

#### IV. INSTALLATION AND TRAINING

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Complete user and technical documentation will be included with the software. User documentation is designed to allow someone with a minimum of familiarity with the proposed task, and a minimum of exposure to the computer hardware, to perform all the tasks necessary for correct system operation. Sections describing installation, initialization, operation of the various modules, correction of errors, and special situations will educate the user in all areas of system operations, including recovery from potentially disastrous system malfunctions.

Accompanying the user documentation will be detailed technical documentation on all facets of the system. Technical documentation is designed to allow someone with a working knowledge of the software and hardware, and some familiarity with the proposed task, to understand the detailed operation of the system. Sections covering the inner workings of all modules, the relationship of one module to all other modules, and the design assumptions implicit in the system will greatly facilitate any in-house modification of the system. In addition to detailed descriptions of the operation of each section of code, all conventions and procedures which may be used by persons seeking to modify the system will be described in full.

As an adjunct to the actual documentation, it is envisioned that the installation of the system will be accompanied by on-site training of both operating and development personnel. On-site training is essential to the development of any system, because interaction between the user and the system greatly augments information contained in any documentation; it also highlights certain interactions which may have escaped the attention of the designers.

## V. IMPLEMENTATION SCHEDULE

## V. IMPLEMENTATION SCHEDULE

Complete implementation of the system, including development, testing, installation, and training, will require approximately 10 weeks of personnel time, distributed as follows:

- Six weeks for development and initial testing;
- Two weeks on-site for installation and initial training; and
- Two weeks on-site for a review of system operation and features to take place from three months to six months after the system is installed.

In addition to the personnel directly involved in the development effort, approximately one week of support effort will be required for production and editing of documentation.

In developing any system of this kind, it is necessary to acquire appropriate hardware during the development phase. The total budget for equipment for a project of this kind can be expected to account for approximately 10 percent of total project costs.

Should USAID elect to pursue this activity, JSI would be happy to provide detailed cost estimates for all aspects of system development.

VI. ADDITIONS: INVENTORY CONTROL

## VI. ADDITIONS: INVENTORY CONTROL

In addition to the computerized logistics monitoring system described above, the NFPP and USAID personnel expressed an interest in developing a computerized system to monitor the inventory of the NFPP's central warehouse. This system is best considered as separate from, although related to, the logistics monitoring system. To avoid overlapping functions, simplify development efforts, and expend available resources as efficiently as possible, it is suggested that implementation of any inventory control system be postponed until the logistics system has been implemented successfully. This will enable all parties to evaluate the logistics system, determine what interfaces, if any, to an inventory control system would be desirable, and isolate additional inventory information which may be of use but cannot be obtained from the logistics monitoring system. Successful implementation of the logistics monitoring system will also make it possible to evaluate in depth the amount of computer resources remaining in the NFPP's existing Apple II+ system, which will, in turn, lead to more detailed and less speculative estimation than is possible at this time of any additional resources required to perform the inventory control function.

Preliminary estimates of the development effort required for an inventory control system, based on the functions performed by the current manual system, and excluding any additions in software or hardware which the extra system load would require, indicate that such a system can be developed for one-third to one-half of the cost of the logistics monitoring system.