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COMPUTERIZATION OF VAT IN INDONESIA

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ABSTRACT

The paper deals with an approach to computerization of tax administration in Indonesia which spans more than just the computerization of a VAT. The background for the Indonesian computerization is provided, highlighting the preparation procedure (taxpayer ID number, hardware/software acquisition and software design). The implementation of the computerization strategies is then outlined. The question of human resource management and the phasing question is examined. Finally, the authors list the pitfalls in computerization for the VAT, and provide a summary of the principles applied. This paper was prepared for the Conference on Value Added Taxation in Developing Countries, sponsored by the Public Economics Division, Development Research Department, The World Bank.
# Computerization of VAT in Indonesia

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I. Introduction

This paper deals with an approach to computerization of tax administration in Indonesia which spans more than just the computerization of a value-added tax (VAT). It is based on the experiences of the authors in dealing with major income tax reform and a new value-added tax. The effective use of computers in support of tax administration can help to make such tax reform and new taxes successful.

Computerization within the Department of Finance of Indonesia encompassed the areas of tax, customs, and the treasury. It was approached not by just looking at tax applications, but by taking into consideration all needs within the Department.

While there was a computer system (Univac 1106) in existence within the Department of Finance, it was six years old at the time planning for computerization of tax applications began in 1982. This computer system was not considered to be a part of future computerization for tax administration. It should be pointed out that no tax applications had been computerized previously, other than for gathering statistical data.

It was assumed that computerization would make tax administration easier for tax personnel and provide more timely, more accurate, and additional valuable information than manual processing. If it didn't,
then the computer would be of no value to tax administrators. One major problem in determining this is that if computerization is new, tax administrators are often skeptical of computerization and certainly do not know what a computer can do for them or what to ask for in the process of computerization. Without asking the right questions, computerization of tax applications is sure to fall short of requirements.

II. Preparing for VAT Computerization

Importance of Tax Payer ID Number

Computerization of VAT was to take place along with the computerization of other tax reform. Each tax could not be computerized in a vacuum. There had to be a coordinated effort in computerizing all taxes under the Director General of Taxes. In that all existing taxes were processed manually, it would be a difficult task to get all the planning and coordination completed in a timely manner so that computerization could be completed when it was needed to implement income tax reform and the new value added tax.

One major issue was that there had to be developed an identification number for both corporations and individuals, that could serve as a unique identification number for all taxes. The NPWP as it is called, is the number which evolved out of years of effort which began in 1982. It is a nine digit number complete with check digit and district code which provides for unique identification of both individual and corporate taxpayers for income tax and and the value added tax.

The primary reason it took so long to agree on a numbering system was that the Treasury's cash registers being used at the time only accepted seven digit numbers. When the Treasury decided to move to new cash registers which could handle seventeen digit numbers, the
numbering system was finally agreed upon and put into practice.

The assigned NPWP number is used for all aspects of taxes and payments in Indonesia including income tax, value added tax, customs, and payments to the Treasury. This allows a unique identification of each taxpayer and will eventually allow movement of data to the central government's mainframe computer where master records of all taxpayers will be maintained.

As will be seen later, one of the first computerization efforts was to provide a computer system which could assign these NPWPs in a controlled manner. The system as developed not only controls the numbers, but provides a means of printing and issuing NPWP identification cards for the taxpayers.

One problem that always exists is the possibility of assigning more than one number to the same taxpayer. While computer checks for this can be implemented, taxpayers who wish to have two such numbers for a variety of reasons can often avoid detection of these checks by using different addresses, reversing the order of first and middle names, etc. In such cases, similar names, addresses, etc. can be checked by the computer, but final decisions on a taxpayer having more than one number must be made by tax officials. Checking for such cases can be very time-consuming.

III. Considerations in Hardware/Software Acquisition

There was obviously a need for computerization of tax administration in the Department of Finance of Indonesia. The question is how does one go about acquiring the necessary hardware and software in such a developing country? One must recognize up front that computerization is not a miracle cure for the problems of tax administration. Furthermore, it certainly will not make a poor manual system work!
The needs for tax administration must be clearly defined. It is almost certain that such software will have to be customized for the specific tax needs of a given country as was the case in Indonesia. Software development tools, system software, and computer hardware had to be carefully analyzed to determine what computer system and vendor best met the requirements of the Department of Finance.

There are many issues to be considered in selecting computer systems for tax administration or for any other application. They include

a) Previous record of the vendor.
b) Availability of user and technical training.
c) Capabilities of the computer hardware and software.
d) Maintenance, both hardware and software. This includes an evaluation of the quality of customer engineering and systems engineering support.
e) Computing power.
f) Expansion/growth capability.
g) Ease of Use.
h) Documentation available.
i) Compatibility of equipment with equipment used in other big financial institutions.
j) Compatibility of equipment with equipment from the same and other vendors.
k) Software available, including operating systems and software development tools.

In Indonesia, the single most important consideration was the support capability of the vendor, both for hardware and software. This capability was determined by analysis of the previous performance of the vendor in other installations. It is likely that this consideration will be the most important one in most all developing countries.
Management must be very careful in evaluating vendor claims about their products. The vendor should not be expected to tell the user how to computerize an application. The needs for tax applications must be outlined in requirements documents provided to vendors so that they can recommend appropriate equipment and guarantee that the proposed equipment will meet the needs for computerization of taxes. The proposed equipment should be observed in a production environment prior to selecting a vendor.

Just how much computing power is required can often be difficult to determine. It is very easy to purchase too little computing power, particularly if cost is a major consideration. The choices of approaches for equipment is one or more of the following:

a) microcomputers
b) minicomputers (medium-scale) business computers
c) mainframe computers
d) networking using one or more of a), b) and c)

While the power of each of the options above is changing constantly, it is wise to avoid the use of an unproven system, i.e., avoid being first with new equipment or software. Since it is very easy to underestimate the computing power required, the expansion and growth capability of equipment is extremely important. In using a variety of equipment, e.g., microcomputers, minicomputers, and mainframes with or without networking, there is a danger that a given application will outgrow the specific hardware on which it was developed. In such cases, it is critical to know if the application can easily be moved to the next larger equipment, e.g., can the software on a microcomputer be moved easily to the minicomputer. Often it cannot and it is best to know this in advance.
In installing computer systems for new users, it is very critical that they be easy to use (human engineering) and that documentation be readily available and complete. Another question is whether the documentation must be translated into the language of the country in which it will be used. The availability of local support personnel for technical assistance and education is also a very important consideration. If such support is available, it should be guaranteed in writing in advance.

In selecting hardware, there are many considerations. The choice of a vendor is very critical in a developing country. Maintenance of hardware and software is crucial, and it must be clear that a vendor has the capability to provide this maintenance. If such maintenance support is not available, it will be necessary to develop this capability in-house. For small microcomputer systems, this is realistic, but this must be avoided for large mainframe computers.

Perhaps the simplest approach is to centralize everything at one location on a mainframe computer, bringing all tax documents to this site for data entry and processing. While this provides optimal control, it is not practical in organizations like the Department of Finance which controls many different activities (Customs, Tax, Treasury, etc.) or in a large country like Indonesia which spans a large geographic area and is separated with its many islands, particularly if tax documents must remain in a district office. The solution here was to use a variety of equipment, at the mainframe, minicomputer, and microcomputer levels, to accomplish the tasks of data entry and processing. A basic principle in this case was to provide for data entry at the source, i.e., the sixty-nine district tax offices, via microcomputers. Ideally, communications links in a network could provide data transfer between microcomputers and the
regional computers or the mainframe computers at the central facility. Because of the lack of communications links, data is currently transferred by a magnetic media (floppy disk or magnetic tape) for processing at the regional and central facilities.

The needs for each application must be carefully studied, outlined and written into a requirements document. Many questions are asked during this period of application definition. One of the major questions is who will develop the computer programs for the tax applications. If software development is to be in-house, are technical personnel available? It must be made clear to tax administrators very early in this process that it is not possible to implement software "overnight" and that last minute changes are usually very difficult to implement by the time the features are required by the user.

Users must be involved in defining each application. Those involved in defining an application include both tax application experts and data processing staff. It is difficult to transform data processing staff (systems analysts and programmers) into tax experts and vice versa. The obvious solution is to develop user/application teams which will study requirements, develop the requirements documents and review all changes and implementation progress as well as provide a means for accepting software.

The Keep It Simple ("stupid") or KISS principle as it is known has great merit in most any computer application, particularly when use of computers is new to an organization. Each application must be completely defined and all applications cannot be developed at the same time. Priorities must be established and applications should be done in phases. Ideally, a long-range plan for data processing needs should be developed and then reviewed and updated on a regular basis. Finally, all applications must be documented completely and
It should be recognized that all applications are changing while software is being developed. One should accept the existence of and the need for such change and plan for it. While it may seem obvious that such change always exists and hence would automatically be assumed, many computer software implementations have failed because no planning was done to manage such change in requirements.

Software is built according to specifications. Changing the software without planning and without modification to the specifications can be an often is disastrous. A good analogy in engineering was the 1981 disaster in a St. Louis hotel caused by the collapse of a concrete walkway. This walkway collapsed because modifications made during construction were not checked and accepted by the design engineers. Similarly, software requirements must be revised upon such change. Change is best controlled via formal requests and written acceptance. This is true both during software development and after production begins. Finally, realistic deadlines must be set and revisions to such deadlines should be made when necessary.

IV. Background for the Indonesian Computerization

From 1976 until November of 1983, a Univac 1106 computer system was used for all processing that was done for the Department of Finance. This computer was used as a batch system ¹ with data entry being accomplished utilizing a variety of key entry devices.

¹ A batch system is one in which a collection (i.e., a "batch") of data records is entered into a computer system and stored on a media which can be read later by the computer system. Early batch systems used keypunches and cards. Later systems used CRT terminals to store data on tape and/or disk. The batch operation in this case used key-to-tape devices with data being stored on magnetic tape. These batches were later read from tape into the Univac 1106 system.
Data was batched using these data entry machines with only the traditional data entry verification. Validation was done on the Univac system wherever possible. Most of the information collected was more for statistical purposes, i.e., for generating reports.

The New Environment

The beginning of a new era for computer technology and support began for the Department of Finance and in fact the entire country when approval was given in September 1983 for the acquisition of a number of new computer systems. Because of their ability to support a wide variety of computers and to provide maintenance for both hardware and software and their willingness and ability to provide technical assistance and education on site, IBM was selected as the vendor to provide the computer hardware and operating systems software. The acquisition was indeed very forward-looking. Included in this initial acquisition were three medium-scale mainframe computers: two IBM 4331s and one IBM 4341; six minicomputers: System/36s; and one hundred and sixty IBM personal computers. Figure 1 illustrates the basic concept underlying utilization of all of these computer systems.

Software was developed by Department of Finance technical personnel in Pusat Analisa Informasi Keuangan (PAIK as it is known). Being that the PAIK staff only had experience on Univac equipment, an awesome task lay before them. It was critical to have equipment delivered in a timely manner so the learning could proceed and the development could begin.

Oversights in equipment needs could not be remedied quickly because of lead times required for ordering and receiving equipment. This can be avoided by a careful study of all needs and a cooperative effort for selecting and ordering equipment on the part of the vendor and the government.
Figure 1. Computer Network Overview for the Department of Finance
The lack of enough technical personnel to support all of these computers was certain to become a major obstacle to the effective utilization of all this computer hardware. Another problem was the availability and quality of telephone communications links which would be required for a network such as envisaged for the eventual utilization of this hardware.

There was a difficult task to perform. Limited personnel resources had to be used to support all this new computer equipment. Hence, a large amount of training in extremely complex areas had to be accomplished in a short amount of time. There were four new hardware architectures which had to be mastered: the mainframes, the minicomputers, a communications controller, and the microcomputers. There were two new mainframe operating systems which had to be supported. Other new concepts for on-line programming, new program development environments, and data communications concepts also had to be learned. All of this would be difficult to absorb, even if the programmers and system programmers had been experienced with new vendor’s systems.

Minicomputers and microcomputers also had to be supported. While these systems are not as complex as the mainframe environments, there were many new concepts for the technical staff to learn.

From the very beginning of the acquisition of the new hardware, there was much discussion about transmitting data from one computer system to another. Yet no one had the time to give much thought to the problems of doing this. Distributing data in a modern network requires careful planning. It rapidly became obvious that a full network implementation of the original idea for computerization of the Department of Finance would have to evolve over a period of time. It could not happen overnight.

Immediate goals were developed, the primary goal being to develop
applications software to support VAT and income tax returns processing required after 1984. Secondary goals included the beginning of computer processing in a pilot project for customs as well as related computer projects for the treasury.

The user requirements for income tax return processing and VAT should have been determined by the Tax Directorate in early 1984. This proved to be impossible. For a variety of reasons, the implementation of VAT was postponed until April 1985, allowing computerization efforts to concentrate on income tax return processing. The advantage of this to VAT computerization was that VAT applications could be designed and implemented more easily because of the wealth of experience gained in implementing income tax applications.

The Mainframes

Three medium scale mainframe computers were leased in the initial acquisition of IBM hardware, a 4341 and two 4331s with the IBM 4341 being the center of the network, an IBM 4331 being installed in the Tax Directorate (DJP) and a second installed in the Customs Directorate (DJBC). Direct communications between the 4341 and the two 4331s plus a 4331 at the Treasury was initially planned. Delays in getting communications links installed made the initial use of the communications facility as part of the implementation of tax reform software on the central computer at PAIK impossible.

It was originally thought that the mainframes located in the Directorates of Tax and Customs would be used to process their respective applications. However, due to communications problems, the potential size of files to be processed, and the difficulty of distributing data without careful planning, all production processing was initially done on the larger, more powerful mainframe at PAIK. This eliminated problems with disk file storage space and data integrity (in a
distributed environment). Data for reporting purposes could be moved to the mainframes at the Directorates of Customs and Tax as necessary.

The Minicomputers

One of the primary purposes for the acquisition of minicomputers was to provide a smooth transition from key to tape devices and to provide a certain amount of processing power to regional offices in various directorates in the Department of Finance. Data stored at the regional sites can be transferred to the central system using magnetic media (diskettes or tape). Reports generated from the mainframe system at PAIK can be sent on diskette to the regional sites for printing thus reducing mailing costs. The minicomputers provide for multiple terminals sharing common data (particularly important for lookup type verification).

The Microcomputers

One acquisition which was certain to revolutionize and modernize the operation of the Indonesian government quickly was the widespread installation of IBM personal (micro) computers in district offices throughout the country. Each district tax office, a variety of customs offices and other offices within the Department of Finance would eventually utilize these computers as an integral part of their operation. Without effective training of all the individuals who will use or be responsible for these microcomputers, they could not be successful.

One of the major functions for these systems was for data entry at the source of the information. A general rule in data processing is to gather information as close to the source as possible, thus eliminating errors which arise in data transcription before it gets into the computer system. Also, by capturing the data at the source,
there is also earlier control on documents (for customs, tax, treasury, etc.). Once a document is entered into a computer system, changes can be audited and monitored from the very beginning of the government revenue cycles.

Problems are inevitable in a system of sixty-nine microcomputers running a variety of software. It was likely that many of these problems would be caused by operators not following the procedures of using the computer. A carefully planned back-up mechanism to prevent the loss of taxpayer data was developed and implemented. That is, if the only copy of information is electronically recorded on a floppy disk and that floppy disk is somehow destroyed or lost, the information is lost permanently.

Such careful planning is necessary in every application. This is particularly true at remote sites where users operate the computer without the daily aid from PAIK technical personnel.

The Network Environment

There are literally hundreds of computers in the Indonesian Department of Finance computerization effort, from mainframes to microcomputers. It was not likely that all of these computers would be linked together in a network in the near future. In fact the only initial communications was via the System 36 minicomputer at PAIK was directly connected to the communications controller attached to the IBM 4341.

The implementation of the required tax reform software concentrated on remote data collection and limited processing at these remote sites. Collected data would be copied to diskettes and physically sent to regional terminals for concentration and regional processing and then out to the PAIK mainframe for "final" processing and eventual "permanent" storage on this system.
Technical Support

Until November 1983, PAIK was essentially a batch operation running on a decade-old Univac 1106 computer system. The acquisition of so many new computers forced PAIK personnel to learn rapidly. While there are certain advantages to putting such pressure on an organization, care must be taken that the pressure and the work is not so great that the entire effort fails because too much is being undertaken in too short a period of time. Prevention of system failure due to overload of staff consumed a large share of the time of top management.

Necessity for Rapid Change

In the acquisition of the hardware, PAIK secured a commitment from the supplier to provide for the installation of the major software systems on the mainframe and minicomputers and in the communications controller. The commitment was sought in order to allow PAIK personnel to observe the process, ask questions, take notes, save printed results of system generations and other types of systems support so that they might be able to begin supporting the installation themselves. In addition, training was provided by the supplier both at PAIK and at the supplier's office in Jakarta to complement this on-the-job training that would be done by the their technical staff.

One of the major problems that faced PAIK at the outset was the shortage of personnel available to undertake the variety of new tasks associated with the installation of the new computers at PAIK and at remote locations, primarily in tax offices. The result was that many key individuals in PAIK had to assume multiple roles and responsibilities.
The Need to Become Self-Supporting

Technical assistance to PAIK from the supplier has continued through 1986. It was, however, recognized that the IBM could not be relied on indefinitely for solving day-to-day problems. As rapidly as possible, centers of expertise were built up within PAIK so that PAIK personnel would know who within the PAIK organization are the experts on certain systems. It was extremely important that PAIK utilize and trust their own expertise first before going to the supplier's technical staff with questions or problems.

Applications support teams were necessary to provide support for each of the Directorates General of the Department of Finance. A group under each of the Directorates General was required to liaise with the appropriate PAIK Application Support Team. The members of these groups had to be knowledgeable about the application of computers to their areas, i.e., tax people must know the tax applications and needs and be able to understand enough about computers to communicate effectively with the Tax Applications Support Team. The same was true for the Treasury, Customs, and other areas within the Department.

A strong systems programming staff is necessary for any successful installation. It helps to prevent problems from happening and should a major failure occur, enables easy recovery of data and programs so that production can begin again after as short a period of down time as possible.

In Indonesia, the responsibilities for all systems programming, hardware/software acquisition, maintenance contracts, in-house maintenance of microcomputers, and hardware upgrades was placed in one section. There was an effort made to cross-train personnel within the section so that the systems programmers could back up each other,
i.e., no one part of the system should be supported by only one person.

**Education and Training Issues**

Successful implementation of the computerization effort in the Department of Finance required adequate numbers of technical personnel with the correct training, education and experience, the education of the tax administrators on the effective use of computers, and careful coordination and planning. Provision of an adequate level of manpower required not only training of existing personnel, but the recruitment of new personnel.

Three approaches to training were used: 1) supplier's classes, both on-site and at their various centers, and 2) training classes taught by PAIK staff, 3) on-the-job training within PAIK.

Numerous heads of PAIK personnel sections had to learn new software and hardware. Because of the limited number of personnel that could be included in the formal vendor-provided classes, PAIK had to train programmers to use and write programs. PAIK staff also translated many user manuals for microcomputers and minicomputers to the Indonesian language to facilitate this training.

Much of this training was for entry-level technical personnel. While productivity at the entry level is usually low and does resolve the shortage of technical personnel in the short term, today's training aids tomorrow's software development when these individuals are experienced. Trainees must be taught basic concepts and be given time to apply the principles in both classroom and real application environments. Because of the shortage of personnel, there is always a danger of moving trainees too quickly, whereby they miss the valuable experience required at different levels to truly become effective as programmers and systems analysts. This will remain a problem for
quite some time; one deals with the problem as best one can. On the other side of the argument, trainees who exhibit outstanding (natural) abilities in data processing can be promoted to more important jobs so they can learn at a rate more suited to their capabilities.

A disadvantage of provision of introductory level courses was that in order for them to be truly effective, PAIK had to use experienced personnel. Such teaching duties add to the burdens of the staff and subtract from the amount of time that these individuals have to spend on analysis and development of critical applications. The solution to this was that remuneration was provided to staff for their teaching. Such remuneration helped to counteract the low salaries of technical personnel (when compared to salaries of technical personnel in industry in Indonesia).

V. Software Design and Implementation Strategies

The amount of software implemented and scheduled for implementation by PAIK for the Department of Finance over a three to five year period is quite large, far larger than the amount that was implemented on the Univac system from 1976 to 1984. What initially is a monumental software development problem may be expected to become a monumental software maintenance problem in three to five years or less.

The procedures and principles now being used to implement software will determine whether this software will be maintainable in the future. It is a fact that the majority of software costs over the life of a system is in software maintenance.\(^1\) This is not just for corrective maintenance (fixing errors), but for adaptive maintenance (modifying the software to meet changing requirements, e.g., a change

in a tax law). Poorly designed, poorly documented programs make software maintenance costs soar, and also result in unreliable, often unchangeable software. The nature of current software development will determine how maintainable the software will be three to five years from now. Standards and policies for software design, implementation, documentation, and maintenance have been recommended and will be followed in the future.

VI. The Implementation

The plan was to collect data at district and regional offices and forward this data to the central PAIK facility in Jakarta through Regional Terminals (System 36s). Program development proceeded in parallel to support all aspects of income tax processing. A similar technique is planned for the implementation of VAT tax processing.

The Taxpayer ID System

The Taxpayer ID computer system consists of programs on the mainframe at PAIK, the minicomputers, and the microcomputers. NPWP numbers are generated and assigned to specific district offices, with these assigned numbers being transmitted to the district offices on diskette. As numbers are assigned, information is keyed into the computer on the microcomputers at the district offices. Once taxpayer information is entered, appropriate documents are printed using a microcomputer. These documents serve as temporary taxpayer ID records until the permanent NPWP card is issued. Information on the taxpayers is forwarded on diskette to the central computer site for processing on the PAIK mainframe system where master file records for

each tax payer are created and stored on-line. Periodic updates of the district local master files is done via diskettes sent from the central facility.

The District Office Taxpayer ID System runs "standalone"\(^1\) on an IBM PC under the operating system DOS 2.0. It was implemented in IBM BASIC complete with security codes. The training of District Office officials was done by the PAIK staff at regional sites. Documentation for the system was prepared prior to this training. Instruction on the general use of the microcomputers was also provided by PAIK staff.

**The Tax Return System**

Early plans for Tax return data entry called for data entry of both income tax and VAT to be done on the microcomputers at the District Office. As was stated previously, it is easy to underestimate the needs for a given application. In this case, one microcomputer console (video display and keyboard) was not sufficient to support the Taxpayer ID System, income tax return data entry, and VAT data entry. Expanding to a minicomputer in sixty-nine district offices would be too expensive.

A decision was made to evaluate possibilities for using the existing microcomputers (IBM PCs and IBM PC/XTs) in a multi-user mode using "dumb"\(^2\) terminals. In October 1984, a successful test of Digital Research's STARLINK operating system was done on a system with four such terminals attached to an IBM PC with 640K of memory, an expansion unit and a 10 megabyte hard disk.

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1 Standalone, in this case, refers to software which, while running, depends on no other software or data files and which uses the entire microcomputer system for a single application.

2 The term "dumb" here refers to terminals which are not programmable by the user.
Using STARLINK, the microcomputers could support multi-user environment for data entry. The major drawback of the system was that Digital Research's CBASIC had to be used for software development instead of IBM (Microsoft) BASICA. This would severely slow down development of applications because of the need to educate technical staff in the use of this language.

Development shifted to a STARLINK environment. In order to use this environment, the STARLINK systems with both software and a multi-port hardware board had to be in place in the District offices. Eventually, the STARLINK boards and software were installed in the District Offices on a second IBM PC/XT and the Taxpayer ID System remained as a standalone system on the IBM PC.

In the beginning of the third quarter of 1985, training on STARLINK was done for district office personnel at regional sites by PAIK personnel. Data entry software for income tax returns was implemented for the multi-user STARLINK environment in time for use by the fourth quarter of 1985. While this was later than initially desired, it was still in time to finish processing the 1984 returns. Training for the income tax return data entry system was done in the fourth quarter of 1985. Over 384,000 income tax returns were processed by the end of December using the data entry software on the microcomputers. Data was moved to the central office via diskettes. Balance checks and other validation was done on all returns.

The regional minicomputers perform intermediate processing of tax return data and then data files are transferred to the mainframe at the PAIK central facility for final processing. It is at the central site that final checks are done and where audit selection criteria can be applied. Such criteria can only be established after statistics for several tax years have been gathered and analyzed. Figure 2
presents an overview of the tax return processing in the Department of Finance.

![Diagram of Tax Return Processing]

Figure 2. Overview of Tax Return Processing
**VAT Return Processing**

VAT data entry began in May 1986. The VAT monthly returns are entered using microcomputers at the District Offices. In some cases, particularly in the larger offices, more than four dumb terminals eventually will be needed. The DRNET networking feature of STARLINK to allows up to five STARLINK-based microcomputers to share resources was tested but proved to be too slow because the link between systems is a serial STARLINK port running at 19,200 bits per second.

Other alternatives for supporting multiple users on microcomputers have been reviewed. It is now likely that a carefully planned shift to a more sophisticated multi-user operating system, specifically Compaq Computer Corporation's Xenix System V/286 which is a Unix-based (Unix is a trademark of AT & T) system developed by Microsoft Corporation will be undertaken in the future. Conversion and support of current applications and personnel training are extremely important considerations in such a decision to change operating systems. Networking of microcomputers is always a possibility, but in this case cost makes this prohibitive because of the number or work stations required.

Original discussions in computerizing VAT focused on cross-checking tax payments and credits of companies. Experience elsewhere indicates that total cross-checking is difficult and expensive to implement. Total cross-checking involves computer entry of all invoices from all firms and electronic verification of all VAT credits claimed by firms. For the time being, cross checking has been delayed. When a cross-check system is implemented, it will be limited to selective cross-checks. Such cross-checks will only be performed when certain conditions, primarily monetary thresholds, warrant such
checks. In general, total cross-checking is to be avoided; virtually no European VAT country has adopted it.¹

VII. Managing Human Resources

As one might imagine, there is in most settings resistance to computerization efforts, particularly those in tax applications. Before computerization in Indonesia, this resistance was perhaps the biggest problem to overcome. There was always a delicate balance between pushing tax administrators towards computerization and being sensitive to the resistance and concerns of these personnel. That is, there was a very careful plan to minimize friction between the tax personnel and the computer personnel.

While this sensitivity and "backing off" may have slowed down the computerization effort, it ultimately will play a major role in the success of the computerization. Because one individual (Dr. Hutabarat) was in charge of coordinating all applications within the Department of Finance, he was able to place the role of computer groups in the center of the organizations requiring computerization. This at least began to make it clear to the various users just how important the computer would become in their operations.

In the beginning it was impossible to require the approval of this central computer group for all that related to tax processing. Attempting to do this would have created more friction between the tax personnel and the computer personnel. However, as time passes, such approval is now accepted and in fact sought out by various groups within the Tax Directorate.

¹ A high-level team from the Indonesian Tax Directorate visited Seoul in 1982 to determine what lessons might be drawn from the Korean experience. The team concluded that total tracking of sales and purchases as well as cross-checking might be desirable for the Indonesian VAT. Ultimately, however, the Tax Directorate was persuaded that such tracking of every sale and purchase and total cross-checking was not only expensive, but unnecessary.
Parallel runs are traditionally used in implementing new computer software. This means that the existing system (manual or automated) and the new automated system are both used to process the same data. The results of both are then compared to find any discrepancies. Once the new automated system is verified to be performing correctly, use of the old system can be discontinued.

By using parallel runs of manual systems and computer systems, the activities of tax personnel can continue as before. In this case, however, the old system is a manual system. As the computer begins to function smoothly for the tax application, the manual system becomes far less efficient than the computerized system. This is when the users begin to finally accept the computer system as an important part of their applications.

Without the appropriate human resources, it is obvious that computerization of any application cannot succeed. In the case of the Department of Finance of Indonesia careful coordination of these resources and much in-house training to educate tax personnel and technical personnel proved to be the keys to success. All training was carefully planned. For tax personnel, extensive manuals describing the software and procedures were prepared. Formal regional classes were held. This approach proved to be quite successful. Future applications will follow the same model of training.

Gradually tax administrators have realized the importance of computing. A central data processing office in the Tax Directorate is now operating effectively and serves as a central office for coordinating and planning computer support for tax administration. Cooperating with the PAIK staff, needs can be determined and formally defined in a requirements document prior to the preparation of detailed specifications and implementation of the programs. All deci-
sions for tax form changes for income tax or VAT must be approved by the data processing office, thus avoiding unexpected problems in supporting data entry and tax return processing in the future.

Moving from a manual system to a computer system can be quite difficult. Now that computers are in place and initial data entry, while simple, has proved successful, tax administrators are now recognizing the importance of the computer system for planning, revenue projection, and audit selection. The computers are in their infancy in some ways, but the entire operation is maturing and soon will provide extremely important and timely information for tax administrators.

VIII. Changes in Hardware Requirements

The initial computer hardware acquisition was done with certain procedures in mind. Today's configuration represents an extension of those original ideas. The major change is at the microcomputer level. Had an operating system like STARLINK not been available, the cost of providing multiple workstations in the District Tax Offices would have been prohibitive. It was fortunate that such capability was available when needed. It would have been best to have known of this requirement from the beginning. However, such capability was not available when the equipment was acquired and it might have held up the progress in the computerization effort.

In this case, technology caught up to the needs of the user. This is not always the case. In fact, assumptions that products will be available when they are needed usually result in systems which fail.
IX. Checklist of Essential Measures Prior to Adoption of VAT

Computerization of tax applications in Indonesia was done by considering all needs within the Department of Finance. If a VAT is to be implemented in a country like Indonesia which had limited computer capabilities, certain measures should be taken prior to the adoption of VAT. The include:

1) Setting up of a central data processing office for tax applications which can define, coordinate and plan all data processing support for tax applications. Coordination with data processing staff is done at this level.

2) Clear definition of the tax and procedures for computing the tax which can be considered by data processing staff.

3) Careful specification of the VAT data processing needs prior to the acquisition of computer hardware and software. This must include estimates of computing power required, distribution of computers, and storage space requirements.

4) Determination of technical support available and how the VAT software will be implemented.

5) Directives from high-level tax officials that computerization is high priority and cooperation at all levels to accomplish it is mandatory.

6) Directives from data processing management that design, development, testing, training and implementation of tax administration software is of highest priority.

7) Coordination and planning of how computerization of VAT affects administration of existing taxes, whether computerized or not. If computerized, VAT software must be consistent with existing tax administration software.
8) A sensitivity to the resistance to computerization which exists and an awareness of when to push and when to "back off".

X. Pitfalls in Computerizing for the VAT

Overloading the System

In setting up the computers in Indonesia, initial configurations were less powerful than required. This was true at both the mainframe level where more memory and disk space was added very soon after equipment delivery and at the minicomputer level where systems were expanded. The microcomputers were the level at which the most changes occurred. Moving from a single user system to a multi-user system supporting a console plus four (dumb) terminals proved to be a dramatic change in capability in the District Offices. There are few installations which maximize the use of microcomputers as much as these offices do. The cost per workstation is quite low and the capability for data entry is very good.

Inappropriate Utilization of Computing Facilities

Trying to do too much at once can often spell doom for computerization effort for tax administration. A phased approach of implementation and a strategy to keep it simple made the initial use of computers for income tax return processing successful and should do the same for VAT return processing.

Microcomputers cannot do everything. Sometimes more is attempted at this level than should be and once capacity is reached, transition to larger systems can prove to be difficult. Networking will help to solve such problems.

The important thing is to match computer system capability and application needs. By careful evaluation of needs for each application, computing power will be there when it is needed.
Inconsistency of Tax Returns with Computerization

All planning and changes for tax forms and processing must involve the data processing office within the tax department. A simple form change can often result in difficult reprogramming for computers and can cause unreasonable delays in processing of tax returns.

Incompatible Systems

Efforts must be made to keep all systems within the tax department compatible. If equipment already exists, it should be considered in future computer acquisitions. If coordination and planning is done at a high level within the department, compatibility can be addressed and guaranteed.

XI. Summary of Principles Applied

Certain principles were applied in the computerization of tax applications within the Department of Finance of Indonesia whenever possible. They are outlined below.

Select an Established Vendor

The vendor selected in Indonesia was established and had a proven record of support in Jakarta and in other urban areas in the country. This principle was one of the most important ones applied in the computerization effort in Indonesia.

Establish Priorities

One of the most important principles applied in Department of Finance was the establishment of priorities for all computerization projects. Being that PAIK is a service organization to the various Directorates General within the Department, Director Generals were made aware of the fact that, with the limited number of technical personnel available, not all projects requiring software could be
implemented immediately!

Appropriate resources were then assigned to the critical projects so that they could be completed on schedule. Personnel within PAIK were dedicated to specific projects to eliminate the possibility of missing deadlines for critical projects because personnel were working on less important projects at the same time.

Keep It Simple

The critical projects were eventually well-defined. System Requirements were known before System Specifications were prepared. The "Keep It Simple" (KISS) principle was applied whenever possible in the design and implementation of the software. This helped to guarantee successful software which met the users' needs and which could be maintained in the future.

Implement User-Defined System

The systems which are defined, designed, and implemented were determined by the users' needs. To do this, the users had to react to requests for information in a timely manner. In initial stages, data processing staff must play a more major role in determining needs than will be necessary after the data processing office within the tax department becomes more experienced. The data processing organization is a service organization for computerizing the users needs, not determining them. After two years, tax users are much more capable of determining and specifying their own computer needs.

Apply Standards

Adopting minimum standards for all software projects as to what is required for 1) the Requirements Document; 2) the Specifications Document; 3) Programming Techniques; 4) Documentation; 5) Testing
and Implementation; and 6) Maintenance makes every computerization effort easier. Of course, unless adherence to these standards is required, they will be of no value.

**Coordinate All Applications**

There was, and is a great need to coordinate the needs of all applications within the Department and to help assign priorities for the various projects. The computer organization within the Department helps to coordinate needs across Directorates. Within the Directorates, the data processing office provides this coordination. One important principle in coordination was that there was always a sensitivity to the fears, resistance, and concerns of tax personnel. At times it was necessary to "back off" from deadlines and requirements to allow the users to understand just what was being done in the computerization effort. This has led to the acceptance of the computer system today.

**Plan Training**

Of all the aspects that affect computerization efforts of tax administration, human resources are indeed the most important. Training of personnel proved to be the key to successful implementation of tax administration software. Such training must be carefully planned and provided periodically. The experience in Indonesia proves the value of such training.

**XII. Importance of Microcomputers in Developing Countries**

Perhaps the most important lesson learned in the computerization efforts in Indonesia is that microcomputers are by far the easiest computer systems to master and use in a developing country where there is a shortage of technical personnel. The level of training required to support and the complexity of mainframe and even minicomputer
systems can often make it difficult if not impossible to develop applications for these systems in a reasonable amount of time.

When appropriate, microcomputer systems should be used for implementing tax applications in such countries. Using the KISS principle for software implemented on microcomputers can result in effective computerized systems for tax administration. Since many developing countries will not require large data files to support their tax applications, much of the computerization of tax administration can be done on new generations of microcomputers using the more powerful multiuser operating systems like Unix. Hence, the microcomputer may well be the most important development to date in the computer industry for improving tax administration in such countries.

XIII. Summary

While much of the computerization of the VAT in Indonesia will be in the future, the basic approach for computerization within the Department of Finance will remain the same. Some problems remain to be solved. They are:

1) The power and authority of the computer group within the tax organization must be strengthened.

2) All changes in forms and procedures must require the approval of this computer group.

3) Users must learn to rely more on information from the computer.

4) Once the computer system is proven and accepted, procedures can be simplified (i.e., manual procedures can be eliminated).

The discussions in this paper hopefully are valuable in considering various approaches for computerization of tax administration, particularly for VAT, in a developing country.
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