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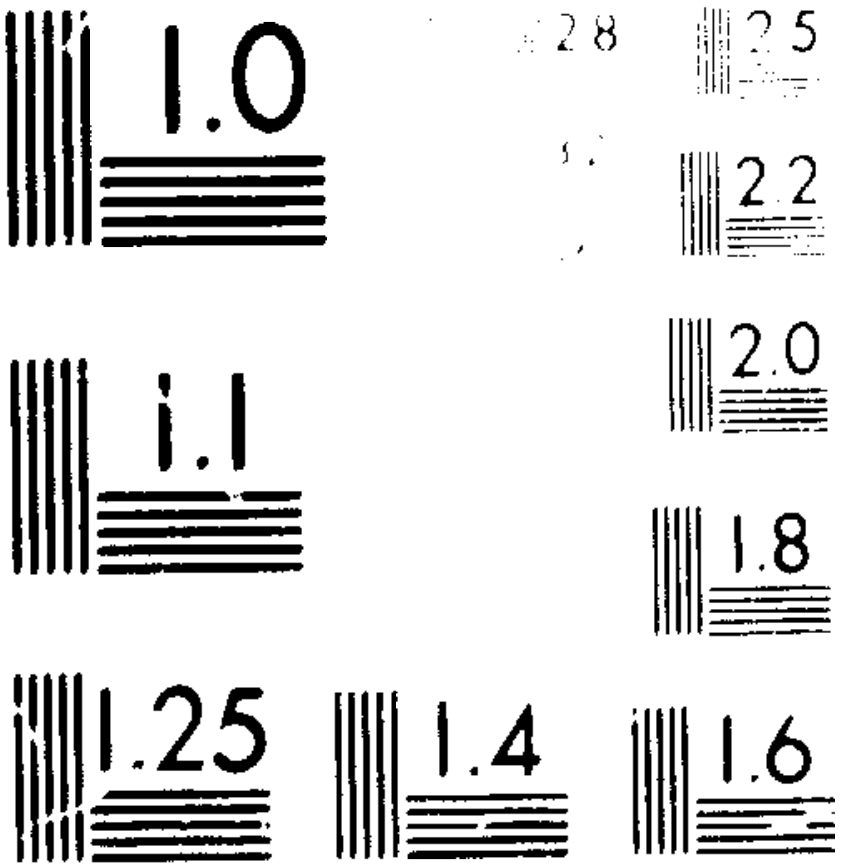
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STUDY AND REPORT ON THE COST EFFECTIVENESS AND MANAGEMENT IMPLICATIONS OF CARRYING OUT, USING IN-HOUSE STAFF, SOME OR ALL OF THE FUNCTIONS PRESENTLY CARRIED OUT UNDER THE VIC OPERATION AND MAINTENANCE CONTRACT.

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VIENNA 1981.05.15

CONTENTS

1 BACKGROUND

The VIC is a complex of office buildings built by the Austrian Federal Government and the Municipality of Vienna to provide permanent headquarters for the International Atomic Energy Agency (IAEA), the United Nations Industrial Development Organization (UNIDO), as well as offices of several other United Nations organizations and units.

The building is owned by the Austrian state and the Municipality of Vienna, and the United Nations at present pay a symbolic rent of AS 1/year. Maintenance and operating costs are taken care of by the United Nations organizations. The relations between the "owner" and the "tenant" have been regulated in a special agreement between the U.N. organizations and the Austrian state. A fund has been created for major repairs to which fund the Austrian government, IAEA, and the UNIDO contribute in equal shares up to a limit of US $ 225.000 per year each for IAEA and UNIDO.

The organizational responsibility for operating the buildings is places with UNIDO.

Within UNIDO, the responsibility for the buildings management is placed with the Head General Services. The work is performed using in-house staff as well as contractors. The number of contractors is approximately 30.

IAKW is the major contractor, and is responsible for the operation and maintenance of several major functions, for instance heating, ventilation, cooling and high voltage. The owners of VIC also own IAKW. IAKW consequently plays a double role being the representative of the owners as well as being the major contractor.

Experience over the past sixteen months has shown that the maintenance and operating costs at the new complex are considerably higher than anticipated and are higher than in the organizations' former quarters. The organizations are concerned because of these adverse budgetary implications and are exploring ways to reduce the operating costs.

2 SCOPE OF STUDY

The scope of study is described in detail in the TERMS OF REFERENCE for the study and can be summarized as follows:

"The consultant is required to make an in-depth study of the contractual services included in the present contract versus services provided by in-house staff and to advise the organizations on the financial and managerial implications of the two approaches.

Furthermore, the work load arising after the expiry of the warranties should be identified and documented.

The long term implications of the trade-off between an in-house arrangement and external contractor must be identified and elaborated. It is suggested that a matrix comparing costs per function for time periods of one, two and five years be developed for inclusion in the final report. Finally, the maintenance functions for some of the systems and installations can be very similar, thus allowing a certain "economy of scale" when maintenance of each of these systems is performed by the same contractor (or BMS unit as the case may be). The consultant should recommend appropriate "mixes" of systems and installations in order to achieve any such economies of scale.

The consultant's report must set out cost comparisons for each activity studied, showing the related salary costs, including any amounts required to be contributed by the organizations for such items as retirement, health benefits, etc, together with position descriptions and titles where in-house staffing is recommended."

The study has been carried through by the following lines of procedure:

- interviews and discussions with the staff of the Building Management and General Services
- interview with the management of IAKW
- studying and analysing available documents, i e previous reports, invitations to bid, proposals, budgets, expenditure plans, staff costs, and operational reports
- inspection of the premises and collection of own data

The following persons have participated in the work:

Håkan Bertilsson	team leader
Sören Nordström	
Göran Sandberg	
H-E Forsell	
K-E Gudmundsson	
Peter Adams	

Mr. Egil Herdan from UNIDO has been the liason officer.

3 DESCRIBING THE PRESENT SITUATION

3.1 Purpose

The description of the present situation is a survey of work being done, which is the basis for the prososals in section 4. Besides collected facts, the following report also provides some comments on present conditions.

3.2 IAKW´s tasks

3.2.1 Introduction

This paragraph is a summary of the survey of IAKW and IAKW´s work within the VIC. The survey comprises interviews with Mr Glittenberg, Mr Jaros, Mr Herdan and others from UNIDO - and also an extensive interview with representatives of IAKW and its sub-contractor Allplan. The meeting was held on April 9, 1981 and IAKW was repesented by Mr Schütz. This interview provided valuable information on IAKW´s relationship to Allplan in the first place, and to other contractors engaged in the operation and maintenance work within the VIC, and also IAKW´s opinion on this cooperation. Valuable information on IAKW was also obtained during many conversations held with the BM staff that daily works together with staff from IAKW or staff engaged by IAKW.

3.2.2 The company IAKW

IAKW was formed to administer the planning, projecting and construction of the VIC, and the Austrian conference centre planned in connection with the VIC. Staff was recruited to IAKW in the same proportions as the VIC had been financed, viz, 1/3 from Gemeinde Stadt Wien and 2/3 from the Austrian state. IAKW should be in charge of the construction of the VIC as well as being the state's representative as owner of the buildings, and in this capacity take care of the financial administration, amortizations to lenders, etc. In this respect, there are still tasks for IAKW for an additional 30 years. When the company was formed, the idea was however not that IAKW should also manage the operation and maintenance of the buildings. This idea appeared when the occupancy had to begin although a substantial period of the building constructing time remained. However, it appears as if this arrangement turned out well.

To build the VIC, IAKW engaged directly a great number of sub-contractors (some 500) - without employing a co-ordinating contractor gereral. Even though many of these sub-contractors were responsible for less important supplies, a co-ordinating task of this kind is very comprehensive and exacting to finalize. Consequently, IAKW needs a comparatively large administration to handle the contacts with these contractors,which contracts are not yet terminated by fulfilled warranty undertakings. One of the difficult things we find, is that the part of the contract sum that is not paid out until the warranty undertakings have been met with is only 3 per cent. For many of the companies concerned, it is probably advantageous not to fulfill their warranty undertakings and thus lose the 3 per cent. Based on experience it is also difficult to see whether a contractor has met with his obligations or not.

The company Allplan is an engineering firm with approximately 120 persons emplyed of which only 10 are so-called manual workers. Allplan was engaged with the construction of some of the installations.

The warranty agreements that exist between IAKW and the contractors do not contain any service undertakings that cease at the expiry of the warranty period. The warranties only relate to the responsibility for having performed the contract work in accordance with the agreement.

3.2.3 Operation and maintenance of the VIC

Apart from completing the buildings, IAKW's two main tasks are now (as being a contractor of UNIDO) the operation and maintenance of certain installations of the buildings and operation and maintenance of the so-called transfer station.

The present contract between UNIDO and IAKW is very extensive - as is the proposal of a new contract for which the bid evaluation now is going on. The contractors are to fulfil a number of undertakings without any limitations, such as for instance maintaining a certain climate indoors, attend to the maintenance without interrupting the operation, eliminate failures outside normal working hours, and supply tools and some spare parts - all at a fixed price. For this kind of job, where costs are difficult to assess a contractor will usually calculate with a high margin of safety. On the other hand, it is for the principal to check that the job has been carried out the way agreed upon. As shown below, IAKW interprets the contract in a different way than the buildings management.

IAKW states that the staff used is divided into three groups. One group is in charge of the administration - completing the buildings and managing purposes. The next group - the largest one - is in charge of operating the central control-and monitoring equipment, preventive maintenance and any other tasks that may arise. The third group is working wiht a computer programme for planning the preventive maintenace activities. In all, some 25 persons are engaged for the VIC.

With few exceptions, no staff has been recruited by IAKW for the sole purpose of the operations contract. The major part of this undertaking is bought from Allplan. This company has 10 so-called manual workers. However, none of these is at present working with the VIC. Both IAKW and Allplan have therefore engaged a number of persons employed by other companies, mainly those that were used for the major installations contract work, e g Kohrbau, Elin, Zenti, ITT, BBC, EPI and others. The short contract period have not motivated employing staff of their own.

IAKW and Allplan have a contract where Allplan assumes the function responsibility towards IAKW. We have however not been able to determine the exact contents of this contract. Other companies engaged are said not to have any clearly formulated responsibility towards IAKW or Allplan. It is then only a matter of buying hours from certain competent staff who participated in building the VIC.

3.2.4 IAKW's activities divided into functions

Based upon information received from different persons, we have tried to visualize in what way IAKW uses its staff for the various functions, and also the overhead cost for the administration. This distribution per function is shown in Annex 3:1. Twentyone manual workers are working within the buildings and eight persons have administrative tasks. There are additionally four persons who are working mainly with completing the buildings and two persons are handling the operation and maintenance of the transfer station. The functions used in this report is shown in annex 3:2.

During the interviews with personnal from IAKW and Allplan we also discussed maintenance intervals and their interpretation of the specifications on operation and maintenance included in the contract. (Annex B in the 1981 invitations to bid). There were some discrepancies between BM's interpretation and that of IAKW. For instance the annual cleaning of induction units listed in the specification is given the interpretation by IAKW that once every year a check shall be made whether cleaning must be performed. IAKW's interpretation quite obviously involves less work.

3.2.5 Transfer station

The so-called 'transfer station' transfers district heating, electricity and water from the municipality to the VIC. The station has also been planned for the new Austrian conference centre. The station also produces compressed air and cooled water. The station is placed outside the international compound and costs for the station are regulated by a special contract. A new contract has been drafted and is being discussed now. Operating the station as a whole is offered at an annual cost of AS 5.5 million or alternatively AS 3.9 million if IAKW also is awarded the operation and maintenance

contract. Roughly 80 per cent of AS 5.5 and 3.9 million respectively are staff costs. For the cooling production only staff cost are estimated at AS 1.4 million.

During the meeting with IAKW, they were very secret about giving information on the transfer station and its staff. According to information, two persons are working in the station. Based on our experience this is sufficient. As for staff costs for repairs and maintenance of the refrigerating equipment it should definitely be possible to include those in the staff costs portion for cooled water. In our opinion, the IAKW offer of February 24, 1981 contains unreasonably high costs for the administration and operation of the station. Also the cost difference related to whether IAKW gets the operation responsibility for the rest of the VIC seems difficult to justify.

The operation of the transfer station should be co-ordinated with the operation of the VIC. For instance, it should be possible to reduce the amount of work for supervising the cooling equipment substantially if this could be connected to the central monitoring system of the VIC. Even if this is a delicate issue, we would suggest the alternative that the operation of the transfer station is also included when (and if) taking over the operation of the VIC. In all events, IAKW should be requisted to give a detailed account of the costs for the transfer station before further negociations.

3.3 BUILDINGS MANAGEMENT

3.3.1 BM's organization, staff and tasks

BM is part of UNIDO. The official description of BM's tasks is as follows: "Buildings Management is responsible to the Head, General Services, for the management of the Vienna International Centre buildings including spaceplanning and allocation, maintenance, operation and repairs of the equipment and furnishings. The annual operating cost of the Vienna International complex is estimated to be in excess of 150 million Austrian schillings per year."

At present, BM has 93 employees (the post requirements for 1981 shows 94) organized as shown in Annex 3:3.
The following are placed immediately under the Chief of BM:

- central coordination office
- electronic engineer
- operating engineer
- electrical engineer

A description of the organization is shown in annex 3:4.

The break-down of BM staff on functions is shown in annex 3:5.

3.3.2 Documentation

The documentation on the VIC and its installations is insufficient; at least this applies to the documentation that BM has received.

There are architectural drawings of all floors. One set of these is used for marking out the position of walls in connection with partition moving. Building construction drawings are totally missing.

When it comes to heating, ventilation and cooling, there is a relatively complete set of construction drawings, descriptions and operating instructions as well as control diagrams for building A. Thereare only isolated drawings for building B and no drawings at all for the other buildings.

As regards sanitation (water and sewerage), there are construction drawings for building A, B, C, D och E and for the parking decks P1 and P2.

For the refrigerating plants serving the kitchen and commissary, there are construction drawings as well as descriptions and operating and maintenance instructions. There is corresponding documentation for the air conditioning plant for the computer. Basic diagrams on all ventilation and air conditioning plant of buildings A, B, D and E - and some of these of building F - have been affixed out in the plants.

The same applies to the heat exchanger plant and heat distribution plant of building C. All buildings contain diagrams on the pressure rise plant, water supply and water heating plants.

A basic diagram is affixed in building F, on the cooling water plant for the air-conditioning plant of the data centre.

There are construction drawings for the high voltage of all buildings and diagrams of all power plants. The construction drawings are however large, so BM has decided to mark out the positions of the light fittings, wall sockets, switches, power plants, etc on transparent copies of the architectural drawings to get a size easier to handle.

In the same way, the electronic installations are to be documented, for instance computer cables (coax), loud-speakers, fire alarm, the epuipment for simultaneous interpretation, etc. Telephones have already been marked out on this type of transparent architectural drawings. Documentation has been collected in the electronics workshop on for instance the following equipment:

- telephones
- simultaneous interpretation equipment
- telecommunications installations
- loudspeaker systems
- intercom systems
- conference room listening devices

This documentation varies somewhat with the kind of equipment, but it consists mostly of descriptions as well as diagrams, and trouble-shooting instructions and operation and maintenance instructions.

Diagrams for the elevators and escalators have been put in the engine-rooms. As regards the document conveyor, there is a general diagram on the whole equipment and circuit diagrams for the stations as well as trouble-shooting instructions. There are some drawings for the kitchen conveyor.

The garbage compactor and the disposal units have construction and basic diagram as well as operating instructions.
There are also spare parts lists for all transportation devices.

BM has, as far as we know, not received any documentation on the remaining installations. They are however counting on getting a complete documentation by and by for most of the installations. The conclusion is that the documentation must be supplimented. This also refers to operations and maintenance instructions.

3.3.3 BM's workshops and stores

BM is well-supplied in workshops. There are premises and equipment for the following:

- electronics
- key service
- plumber and locksmiths
- carpenters
- upholsterers
- painters
- ventilation, air conditioning, cooling and refrigeration
- partitioning and service
- garbage and road and park deck cleaning
- lifts and conveyors
- electricians

BM also has a laundry of its own. The premises seem ample for their purposes. The general impression was that most machinery, tools and instruments thatmay be needed are at hand.

The heating and ventilation part is possible undersized when it comes to tools; this is in a way natural, as the major part of the responsibility has been put on an outside contractor (IAKW).

As regards the stores, BM has small stores in the workshops, and also a somewhat larger, although limited, store in the central store.

Here it would be necessary to arrange a suitable store containing the most sensitive spare parts and parts of high frequency. It should be mentioned that a number of the ventilation units have DC motors that are not kept in store by any supplier in Austria. In the present situation, it might take very long to get a new motor in the case of a failure.

We should also point out that the present procedure to get a spare part is very long-winded and time-consuming even if out-side supplier keeps it in his store.This is most irrational and should be altered.

3.4 Other contracts

Apart from the two contracts with IAKW, there are contracts planned or in existance with some 30 companies. The major contracts are about cleaning and the contractors ISS and Marischka, and Neue Raumpflege respectively. A rough estimate and comparison with Swedish conditions show that the costs for cleaning are reasonable and indeed, compared to Swedish conditions, seem low. Many contracts are inevitable - they can hardly be replaced by own services. This applies to for instance the telephone system. Several other contracts involve very low costs.

For a more comprehensive analysis the service contracts for elevators have been selected. Characteristic of this contract, just as for the contract with IAKW, is that it is comprehensive and places the total responsibility on the contractor with very few limitations and restrictions. A comparison with a corresponding contract for elevator service in a number of major Swedish public buildings shows this; For the Swedish buildings we have calculated the costs per elevator and stop level (floor) and they turned out to be surprisingly alike for the buildings studied. (An 8-storied house with 12 elevators has 8 x 12 = 96 stop levels). A comparison with the VIC shows costs that are 2 - 3 times higher per stop level than in Swedish buildings.

3.5 Market

3.5.1 General

A survey of the market for services that IAKW performs has been made. The market of possible companies is primary determined by the following three conditions:

a) The VIC is a building that demands a wide range of knowledge
b) Short period of contract, 1 year
c) Certain conditions pertaining to the installation techniques

Condition a) means that no company on the market can be expected to have specialists of their own employed that can handle all tasks. This is at least so in Vienna. Condition b) means that the companies cannot be expected to want to employ their own specialists - they would rather use sub-contractors. Condition a) also means that it would probably be very difficult to estimate the required amount of

work, and consequently to calculate a price to offer. There could be a desire to share the risks with one or several contractors.

Condition c) means that there are some installations in common with the planned Austrian conference centre. In practice, this means that IAKW has a monopoly with reference to the transfer station.

The contract discussed now implies that the contractor shall have the total responsibility for one or several functions, i. e. the responsibility also comprises operation management, administration and costs for spare parts.

Another type of contract could for instance comprise only work, that is you buy hours. IAKW does this to some extent.

3.5.2 Companies

Invitations to bids were sent out to 10 companies from 10 European countries in April 1980. 5 companies replied to the invitation by sending in their bids.

In April this year 8 invitations to bids were sent out and 5 replied. All companies that responded to the invitation in 1980 have been included in this group of 8. Two companies have been added and four companies have been rejected.

The number of possible companies for this kind of services is limited and there is no reason to think th t a potential contractor has been cmitted this year, which could subs antially change the picture. The foreign companies that have handed in their bids have, or claim they intend to establish, cooperation or a subsidiary company in Austria.

3.5.3 Costs

The bids of 1980 and 1981 differ much as regards the total sum for contract work. Generally, this sum must be the product of an estimated or calculated quantity (work and spare parts) and a price per unit.

In the first place, the price per unit is of interest for the report at this stage - so we look at the staff costs per hour. The bids of 1981 and other collected data show the following:

STAFF COSTS PER HOUR (AS)

CATEGORY	Average salary excl social fees 1981	Market prices acc to our investig. 1981	Prices acc to bids of 1981				
			IAKW	SOGES-MAINT	FABRI-COM	CGCM	ALL-PLAN
Chief	300		400				
Technician,engineer	200		320	128		540	330
Specialized worker	130	250-300	300	99	410	380	330
Normal worker	110	230-250	250	76	320	290	295
Labourer	80		210	59	250	220	265

The figures of the first two colums are approximate.

The first column starts from normal 14 monthly salaries paid per year and an effective working time per year of 1750 hours.
The differences in prices per hour between the bids of 1981 (except Sogesmaint)and the average salaries per hour are probably due to the fact that the bids also comprise a large share of overhead costs and costs for team leaders. The price per hour to buy a "function" is approximately 30 per cent higher than when you buy hours.

3.6 Finance

The basic data for current cost have been collected from the expenditure plan 1981 for BM and General Services. Annex 3:6 gives a detailed report.

Annex 3:7 gives a detailed report of the costs per function, below is a summary.

SUMMARY OF CURRENT COST PER FUNCTION THOUSAND AS

FUNCTION	COST	
Heating, water, sewerage	23.300	15,5
Ventilation, air-conditioning	14.600	9,7
Cooling	700	0,5
Catering installations	600	0,4
Building control systems	800	0,5
Building monitoring	3.900	2,6
High voltage, emergency power	26.900	17,9
Electronics	11.800	7,8
Transportation	10.000	6,6
Garbage	1.600	1,0
House keeping	17.800	11,8
Cleaning	16.500	10,9
Transfer station	4.100	2,7
Management, planning	12.700	8,4
Other overhead costs	5.300	3,7
TOTAL	150.700	100,0

The above summary does not comprise all costs for the VIC - only costs that are budgetarily handled by UNIDO. Costs that have been excluded are for instance costs that IAKW charges IAEA directly, certain staff costs within IAEA and the cleaning contracts handled by IAEA.

4 PROPOSAL

4.1 Introduction

This study mainly deals with tasks that are entrusted to or have some connection to the present Operations and Maintenance Contract with IAKW. The proposal given here deals with these tasks based on the following two problems:

- what kind of organization should be in charge of these tasks?
- which is the best combination of in-house staff and contractors to achieve best financial results on the whole?

4.2 Tasks

The present Operations and Maintenance Contract comprises the following functions:

- heating, water and sewerage
- ventilation and air-conditioning
- building control systems
- building monitoring systems
- high voltage and emergency power

The tasks for each function or system are the following:

- operating, including small adjustments
- preventive maintenance
- repair and trouble-shooting
- development
- replacement and reconstruction

The service contract comprises the first three tasks. BM is consequently responsible for the last two tasks. They are at present not very extensive as the buildings are new. In the long run they will however grow more important.

4.3 Organizational structure

4.3.1 Principles

Generally, the organizational structure can be selected from ore of the following principles:

1 A "geographical" or premises based organization, which means that a house or a part of a house becomes an area of responsibility

2 A system or function based organization which means that a system, for instance ventilation, becomes an area of responsibility

3 A task based organization, which means that one field of work becomes an area of responsibility, for instance preventive maintenance for all systems and all buildings.

Different principles can be selected for different levels of the hierarchy. BM has selected for level 1 - that is immediately under the Chief - the system-based organization, and for the next level - that is within each team - the task based organization. The organizational principle selected should be independent of whether tasks are performed by the in-house staff or by contractor. BM's present organization does not fully comply with this principle. Another principle which is not applied, but which is important according to the study, is that the responsibility for consuming electricity, water etc should go with the responsibility for the function.

4.3.2 Prerequisites

The suggested changes of the organizational structure given here presuppose the following:

1 The same organizational principles should be selected as those that are now applied within BM

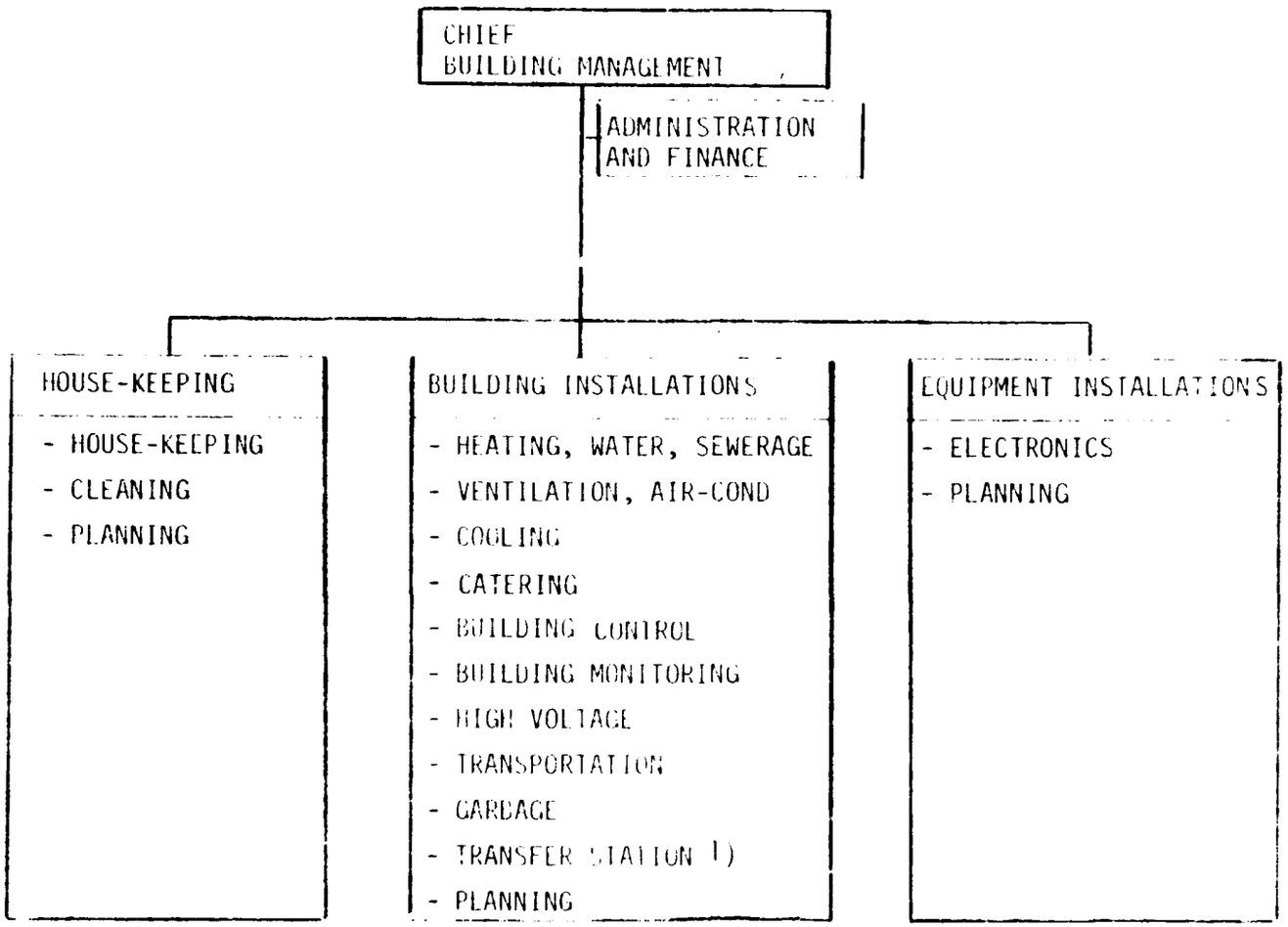
2 The organizational structure shall be independent of whether in-house staff is used or contractors

3 The responsibility for the consumption shall be connected to the operation of the systems

4 The smallest possible changes of the present organization should be made

Based on the above prerequisites we have produced the following two organizational structures.

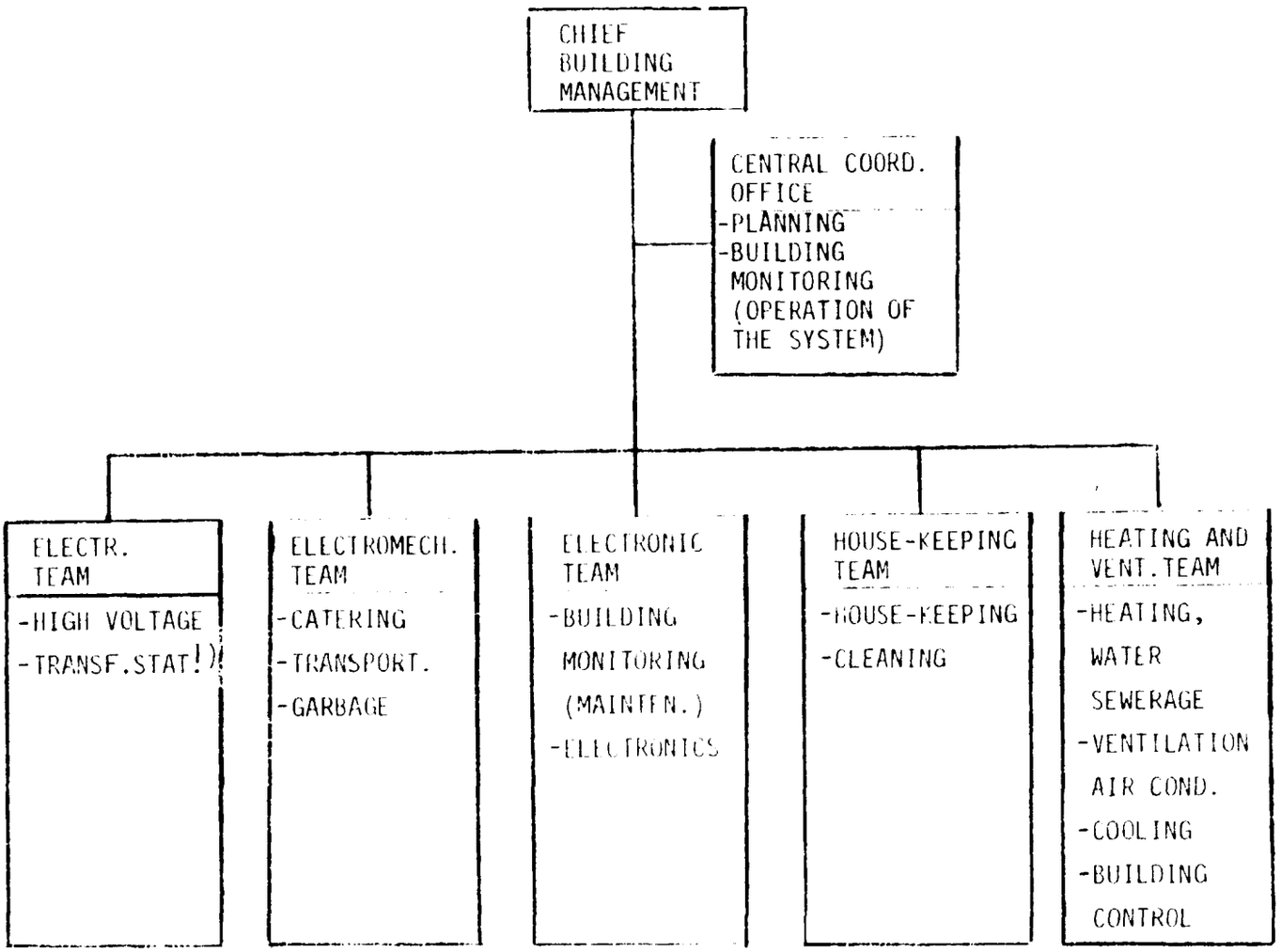
4.3.3 ORGANIZATIONAL STRUCTURE A



In this structure, the functions have been divided into three main groups; a house-keeping unit, a building installations unit and an equipment installations unit. All units have the total responsibility for each function and carry out all tasks (see paragraph 4:2).

1) The responsibility for the contract with IAKW

4.3.4 ORGANIZATIONAL STRUCTURE B



In this structure the functions have been distributed on 5 operating teams each having the responsibility for

- operating
- preventive maintenance
- repair and trouble-shooting

The central coordination office is responsible for

- development
- replacement and reconstruction

The responsibility for the consumption is with the 5 teams.

1) The responsibility for the contract with IAKW

4.3.5 Selection of structure

The organizational structure that is selected will not directly effect the manning although a certain "economy of scale effect" will occur. As said in paragraph 4.3.2 the structure should be independent of whether in-house staff is used or a contractor.

We recommend structure A which has the following advantages

- a logic division in three operating units
- a total function responsibility for each system

4.4 Manning

4.4.1 Estimate of work amount

The 1981 invitation to bid comprise a specification ("Annex B") of the installation concerned and the preventive maintenance in detail to be carried out on these installations.

Based on our experiences from corresponding tasks in Swedish buildings we have estimated the time required for carrying out these preventive maintenance routines in the specification.

For those installations where the preventive maintenance has not been included in the specification, we have made own estimates. The calculations are compiled in Annex 4:1.
The calculations show that the required amount of work for the preventive maintenance would be:

- ventilation, and air-conditioning	18,000 hours/year
- heating, water and sewerage	900 hours/year
- high voltage, emergency power and lightning protection	900 hours/year
- building monitoring	500 hours/year
- facade cleaning	250 hours/year

The mission described by the specification ("Annex B") also includes adjusting maintenance (trouble-shooting and removing failures) of installations put under preventive maintenance, to the extent required.

The time required for this will depend on the preventive maintenance that has been performed. As the VIC has been occupied for less than two years and the installations have been the object of preventive maintenance during these years, the amount of work for the adjusting maintenance should not exceed 50 per cent of the amount of work for the preventive maintenance.

The total amount of work required will then be:

- ventilation, and air-conditioning	27.000 hours/year
- heating, water and sewerage	1.350 hours/year
- high voltage, emergency power and lightning protection	1.350 hours/year
- building monitoring	750 hours/year
- facade cleaning	375 hours/year

To this should be added staff for continuous checks of the monitoring computer; if shift working is applied 2 x 4 persons are needed using the present double manning. However, 4 of these 8 persons can be used to a 100 per cent for performing maintenance work (both preventive and failure adjusting), and then consequently perform work included in the amount given above.

To make comparison we have calcultated the amount of work we would recommend for the corresponding ventilation and air-conditioning plants of public buildings in Sweden. We then find that this amount is about half of the amount given above. It makes a difference of about 8 staff years. In addition, if we were to man the monitoring system as normally is done in Sweden - i. e. using one person during normal working hours - a further 3 staff years could be saved, and the required amount of work would totally be about 11 staff years.

These figures will not be commented further in this report but we recommend a comprehensive review of "Annex B".

As mentioned in paragraph 3.2 the warranties do not include any service-undertakings. The amount for operation and maintenance will therefore not increase when the warranties expire.

4.4.2 Staff requirement, alternative in-house staff

In this alternative in-house staff is used for all functions except the transfer station and the high tension switch plants and transformers.

According to the calculation of amount of work (see 4.4.1) the below amount of work is required to perform the maintenance stipulated:

- ventilation	27.000 hours/year
- heating	1.350 hours/year
- high voltage	1.350 hours/year
- building monitoring	750 hours/year
- facade cleaning equipment	375 hours/year

The staffing required depends on the working time per year. BM calculates with 1.700 hours/year and that figure is also used here.

The staffing required is as follows:

	STAFF YEARS
VENTILATION (AND BUILDING CONTROL)	15,9
HEATING	0,8
HIGH VOLTAGE	0,8
BUILDING MONITORING	0,5
FACADE CLEANING	0,2
TOTAL	18,2
OPERATING THE BUILDING MONITORING SYSTEM	4
ADMINISTRATIVE ASSISTENT	1
GRAND TOTAL	23,2

In the 1.700 working hours per year are included annual leave and sick leave for which normally temporary assistents are employed.

This means that the 23,2 staff years required also includes temporary staff for replacement during sick and annual leave. We are therefore calculating with the following 23 posts.

- 2 experienced ventilation technicians for the ventilation and air-conditioning function working mainly with preventive maintenance and repair. One or both will be appointed to team leader. (G7, G6)

- 2 experienced technicians for the building control system and for process control (G7, G6).

- 12 skilled mechanics working mainly with the ventilation and air-conditioning installations (6 x M6, 6 x M5).

- 1 skilled plumber working with the heating, water- and sewerage installations (M6).

- 1 experienced electrician working with maintenance on the high voltage installations (M6).

- 4 technicians manning the building monitoring system (G6).

- 1 administrative assistent(G5).

The maintenance of the facade cleaning equipment should be done by one of the present electromechanicial workers and an electrician. The distribution per function for this alternative is shown in Annex 4:2.

Two functions remain with IAKW. The transfer station and the high tension switch plants and transformers. The transfer station has been discussed in paragraph 3.2.5. The switch plants and transformers are installations between the transfer station and the low tension installations in the buildings. We have been informed by our principals

that these installations must according to Austrian laws and regulations be operated and maintained by the same organization that is operating the transfer station. The staff required for this task and the transfer station has been calculated to 4 persons.

4.4.3 Organization alternative in-house staff

The organization for BM in alternative IN-HOUSE STAFF and structure A is shown in annex 4.3.

4.4.4 Staff requirement, alternative contractor

In this alternative a contractor is used for the same functions as in previous alternative. The amount of work is also the same. Annual working hours for contractors are estimated to 1.750. The staffing required is as follows:

	STAFF YEARS
VENTILATION (AND BUILDING CONTROL)	15,4
HEATING	0,8
HIGH VOLTAGE	0,8
BUILDING MONITORING	0,4
FACADE CLEANING SYSTEM	0,2
TOTAL	17,6
OPERATING THE BUILDING MONITORING SYSTEM	4
CHIEF OF OPERATION	1
ADMINISTRATIVE ASSISTANT	2
SECRETARY	1
ASSISTANT CHIEF OF OPERATION	1
GRAND TOTAL	26,6

When working with an outside contractor an effective control of the work performed by the contractor must be done. This is not the situation at present. An experienced engineer is therefore required in the UN-organization.

The distribution of staff per function is shown in Annex 4:4.

4.4.5 Organization alternative contractor

The organization of BM in alternative contractor and structure A is shown in Annex 4:5.

4.5 Finances

4.5.1 Alternative in-house staff

In annex 4:6 the cost for staff required is calculated. Overtime and extra cost for shift work has been estimated to 10 %.According to IAKW the cost for the transfer station will be 5,5 million AS and for operation and maintenance of the high tension switch plants and transformers 1,2 million AS if they not are awarded the operations and maintenance contract. A summary of the costs for alternative in-house staff is shown in annex 4:7.

4.5.2 Alternative contractor

In annex 4:8 is shown a "theoretical" calculation for a contractor. The figures used are based on annex 3:1.

In annex 4:9 is shown a summary of the costs in this alternative. Note that the total costs for spare parts is shown in a separate column which also includes spare parts in the present IAKW contract.

4.5.3 Comparison

In annex 4:10 is shown a comparison between current cost and the two alternatives and in annex 4:11 a comparison where functions not affected are excluded.

4.6 The building monitoring system

The building monitoring system is now operated by IAKW. In annex 4:12 is a summary of our survey of the system and our comment.

4.6 Long term implications

4.6.1 General

It has been agreed with the principal that the calculations should be made in fixed prices. The long term implications of the two alternatives will therefore reflect changes in the volume or structure of work or in the staff structure. From our experience a-take-over period of one year is normal for an operation like this with around 25 staff.

The previous calculations for alternative IN-HOUSE STAFF are therefore valid for the second year when the organization is implemented.

In alternative CONTRACTORS the calculations are valid from the first year.

4.6.2 Alternative IN HOUSE-STAFF; the first year

From our experience no savings will be made during the first year. The implementation will depend on the expiry of warranties. We recommend that, in general, the functions are taken over from the present contractor in the time of the expiry of warranties. That will eliminate all discussions with IAKW of whether a problem is a matter of warranty or bad maintenance.

We recommend the following steps after a decision to select alternative IN-HOUSE STAFF.

- an extension of the present contract with IAKW for 3 months
- a review of "annex B". (This step will result in a reduction of the required amount of work. See also page 20).
- a detailed plan for the take-over
- negotiations with IAKW about the details in the take-over,
- recruiting and training of staff.

The review of ANNEX B should also include operations and maintenance instructions.

Our estimate is that after 6 months about 50 % of the functions have been taken over.

The savings during the last 6 months will correspond to additional cost during the first 6 months and the total will be nil.

4.6.3 Alternative IN-HOUSE STAFF, the fifth year

The UN salary-system gives the staff member an automatic annual increase in salary. The average increase is 3 % per year or 15 % over a five year period. The financial effect on BM:s budget depends on the structure of staff. We estimate that the net-effect will be 10 %.

We have studied the trend for maintenance costs in public building in Sweden and we have found no significant increase over a five years period.

4.6.4 Alternative CONTRACTOR, the second and fifth years.

As have been seen in the new bids, a contractor will reduce the amount if awarded a long term contract.
The difference between a 1 year och 5 years contract is 5 - 10 %.

Like UNIDO a contractor has an increase in real cost for employees. Normally is there an escalation clause in the contract where both inflation and real cost increases are settled.

We have estimated the increase in real cost to an average of 2 % per year.

In annex 4:13 is shown a summary comparing costs for time periods of one, two and five years.

5 SUMMARY

The study has shown that using an outside contractor for the functions here studied will cost around 9 million AS more per year than performing it with in-house staff. Even if the efficiency of in-house staff has been over-estimated the difference is substantial. We have studied the 1981 bids and found that the majority are lower than the "theoretical" in annex 4:8.

The bidders are also in general operating with less staff than we have estimated. The bids are now evaluated by the Buildings Management. There is one important factor that we would like to underline and that is the interpretation of annex B. IAKW has at present a different opinion of annex B than BM and in the new bid they have a clause saying that they do not want to follow it completely.

To sum up this study we recommend UNIDO to take the following decisions

- settle the present operations and maintenance contract with IAKW and replace it with in-house staff,
- review the annex B, including necessary operations and maintenance instructions
- reorganize Buildings management according to structure A

DISTRIBUTION OF THE "IAKW-CONTRACT" PER FUNCTION

1. ESTIMATED DISTRIBUTION OF COST FOR STAFF

FUNCTION	MAN YEARS	AVERAGE COST/h[1] AS	TOTAL COST (1 750 h/year)
HEATING, WATER, SEWERAGE	2	300	1 050 000
VENTILATION, AIR CONDITION	10	280	4 900 000
BUILDING CONTROL SYSTEM	1	300	525 000
BUILDING MONITORING SYSTEM	6	300	3 150 000
HIGH VOLTAGE	2	300	1 050 000
TOTAL	21		10 675 000
OVERTIME 10 %			1 068 000
MANAGEMENT AND PLANNING			
CHIEF OF OPERATION	1	600	1 050 000
ENGINEER	3	400	2 100 000
CLERK	2	320	1 112 000
SECRETARY	2	260	910 000
TOTAL	8		5 180 000
GRAND TOTAL	29		16 923 000
2 ESTIMATED COST FOR SPARE PARTS AND TOOLS			1 500 000
3 DIFFERENCE [2]			1 463 000
4 TOTAL			19 886 000

1) Source: Hourly rates for personnel in IAKW:s proposal 1981

2) Risk? Profit? Miscalculation?

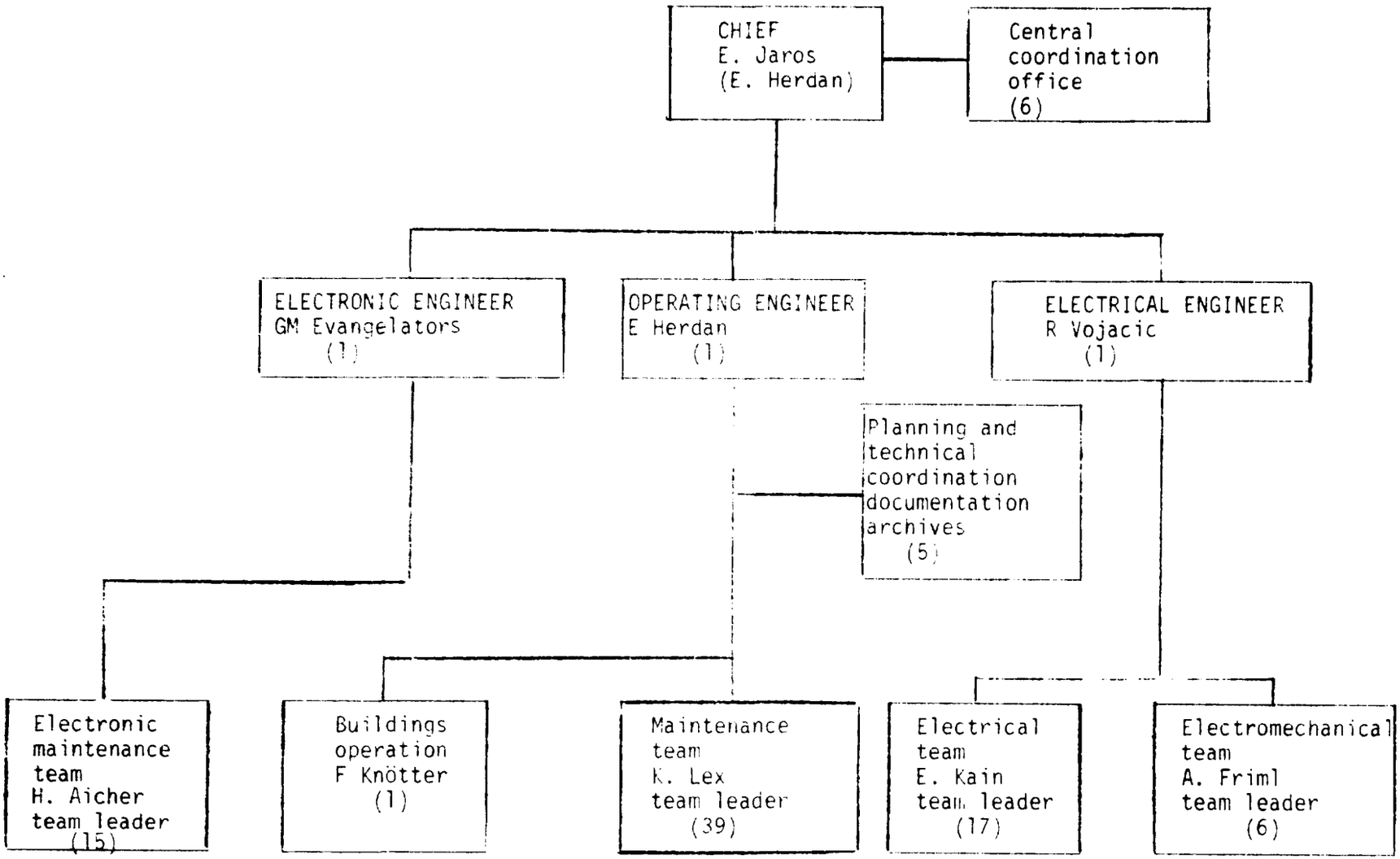
FUNCTIONS USED IN THE REPORT

FUNCTION	CONTENT
HEATING, WATER, SEWERAGE	Heat exchanger, pipeworks, radiators, convectors, pumps, compressed air and water treatment
VENTILATION, AIR CONDITIONING	Ventilation - air conditioning - and induction units, fire dampers
COOLING	Cooling of equipment for catering facilities, bars, commissary and computers
CATERING INSTALLATIONS	Dish conveyors, beverage systems and kitchen equipment
BUILDING CONTROL SYSTEM	Regulators, pneumatic equipment as reducing stations, valves etc
BUILDING MONITORING SYSTEM	The computerized monitoring system for installations, doors etc
HIGH VOLTAGE, EMERGENCY POWER	High voltage installations 220/330 V. Low tension interlockings, floor distributors lighting, emergency lighting, diesel engines and lightning protection.
ELECTRONICS	Telecommunication equipment, door surveillance, loudspeakers, fire-alarm system, intercom systems and conference room listening devices
TRANSPORTATION	Mechanical transportation systems such as elevators, escalators, hoists, document conveyors, facade cleaning equipment, movable shelving and roller shutters
GARBAGE	Garbage equipment
HOUSE-KEEPING	Painting, partitions, furniture, laundry, gardening etc.

CLEANING	In-house - and facade cleaning
TRANSFER STATION	Transfer station now operated by IAKW
MANAGEMENT PLANNING	Overhead functions, management, planning documentation and archives
COMMON	Functions (and cost) not distributed on other functions.

ORGANIZATION BUILDING MANAGEMENT SECTION

Annex 3:3



( ) current number of staff

DESCRIPTION OF BUILDINGS MANAGMENT

1. CHIEF

The chief buildings managment has the over-all responsibility

2. CENTRAL COORDINATION OFFICE

Consist of

- secretary to the chief
- finance assistent who makes up the budget does the cost control and orders spare parts and expendable items
- administrative assistent who is in charge of staff administration and all contracts concerning cleaning and house-keeping
- clerical employee who answers the telephone, types, helps registring working times and other administrative duties
- clerical employee who answers the telephone takes down short hand notes and types
- clerical employee who receives failure nonfication operates the copying machine dispathes calls to BM-staff over paper and walkie-talkie system

3. ELECTRONIC ENGINEER

The electronic engineer assigned his duties on May 1, 1981.

As the Chief of the Electronic Maintenance Team, he is responsible for the supervision and management of the Electronic Maintenance Team and for the preparation of technical studies, cost controls and budget projections in his area of responsibility.

He is assisted by a team leader, and 14 engineers, technicians and manual workers. The team leader has up to now had the electronic engineer's responsibility. The other 14 have roughly the following tasks:

- one person performs the function of foreman and inspector of outside contractors'work, mainly in the areas conference operation and low voltage equipments
- three persons are occupied with the conference operation
- seven persons are working with new installations, mowing, inspecting and repairing telephones, connections, switchboards, etc and arranging the necessary telephone and computer line wirings

- three persons work with low voltage equipment mainly

3. OPERATING ENGINEER

The operating engineer is deputy to the chief BM. He is responsible for the supervision and management of the work of the Buildings Management Operations Team and for the preparation of technical studies, cost controls and budget projections in his areas of responsibility.

The following are placed under the operating engineer:
- planning and technical coordination, documentation och archives
- building operation
- maintenance team

Planning and technical coordination, documentation and archives are maintained by the following five persons:
- an architect who is responsible for all structural changes, external and internal
- a supervisor doing the overall planning of the work within the Operations Team
- one engineer and one draughtsman responsible for drawings and documentation; the engineer for producing alternation drawings
- one planning assistant responsible for space allocations change of offices signs and telephones

Buildings Operation employs today one engineer only, as the operation and maintenance of the primary installation systems of the buildings are managed by a contractor.

The buildings operation function is therefore mainly to control the contractors performance and ensure that the requirement given in the contract is fullfilled. The following employees have this kind of tasks also to a certain extent:
- chief of BM
- operating engineer
- all team leaders

The Maintenance Team concists of a team leader and 38 persons distributed on 7 crews

- service crew, 15 persons, mainly occupied with office moving transports

- partition crew, 4 persons, moving partitions, doors, funiture
- key service, 5 persons, administer and renew VIC's supply of keys and clean, grease, and repair door closers, hinges, handles and locks
- locksmiths and mechanics, 3 persons, mainly occupied with iron and plate work as ordered, for instance partition walls, glass walls ans clothes racks
- carpenters,3 persons, mainly occupied with repairing office furniture and manufacturing new office furniture when special kind of furniture is required
- upholsterers,4 persons, for repair of chairs, new upholstery, new coverings, laying new carpets, repair and hang curtains, maps and paintings
- painters, 4 persons mainly occupied with painting walls, ceilings and doors and spray-lacquering ordered work done by locksmiths and mechanics

4. ELECTRICAL ENGINEER

The electrical engineer will take up his employment around end of May 1981. He is responsible for the supervision and management of the work of the Electromechanical and Electrial teams and for the preparation of technical studies, cost controls and budget projections.

Two teams are placed under the electrical engineer.
- the electrical team
- the electromechanical team

The electrical team consists of a team leader and 16 persons employed as follows

- 4 persons working with electrical equipment, one of these working mainly with kitchen equipment and machines
- 3 persons take care of maintenance and alternations of electrical installations according to the power plants of the office floors
- 3 cooling technicians and 3 plumbers: two working full-time with cooling and refigerating installations in the catering facilities, bars commissary and the computer. 1 person working with cooling and refrigerating installations as well as with heating water and sewerage installations in the office storeys.

3 persons working full-time with heating, water and sanitary installations. This includes the kitchenettes, automatic coffee dispensers, towel and soap-dispensers.

- 3 persons in charge of garbage containers, garbage compactors and cleaning of roads and parking deck.

The electro-mechanical team consists of a team leader and 5 persons working with

- elevators
- escalators
- document conveyor system
- dish conveyor
- gate barriers
- roller shutters
- mowable shelving
- automated doors
- facade cleaning equipment

Most of the time - approximately 2,5staffyears - is used on the document conveyor. The dish conveyor and elevators consume almost 1staffyear each The rest of the equipment shares the remaining time, between 0,5 and 1 staff years.

DISTRIBUTION OF BM STAFF COST PER FUNCTION

1. POSTPLAN 1981

GRADE	NO	AVERAGE ANNUAL SALARY 1981 STEP V AS	TOTAL	COMMON STAFF COST (28 %) AS	GRAND TOTAL AS
M 7	9	241 700	2 175 300	609 100	2 784 400
M 6	25	194 300	4 857 500	1 360 100	6 217 600
M 5	10	166 700	1 667 000	466 800	2 133 800
M 4	14	156 500	2 191 000	613 500	2 804 500
M 3	10	143 600	1 436 000	402 100	1 838 100
G 8	2	371 400	742 800	208 000	950 800
G 7	5	299 700	1 498 500	419 600	1 918 100
G 6	6	253 900	1 523 400	426 600	1 950 000
G 5	4	212 600	850 400	238 100	1 088 500
G 4	4	185 600	742 400	207 900	950 300
G 3	1	168 300	168 300	47 100	215 400
P 4	1	618 500	618 500	173 200	791 700
P 3	2	524 700	1 049 400	293 800	1 343 200
P 2	1	440 900	440 900	123 500	564 400
TOTAL	94	—	19 961 400	5 589 400	25 550 800
DIFFERENCE			1 038 600	./.729 400	309 200
TOTAL (EXPENDITURE PLAN 1981)			21 000 000	4 860 000	25 860 000

2. DISTRIBUTION ON FUNCTIONS

FUNCTION	NO OF STAFF	GRADE	ANNUAL COST (AS)
HEATING, WATER, SEWERAGE	1	M7	
	2,5	M6	931.200
VENTILATION, AIR COND	0,5	G8	237.700
COOLING	1	M7	
	0,5	M6	647.200
	1	M5	
CATERING INSTALLATIONS	1	M7	
	0,5	M6	433.800
BUILDING MONITORING SYSTEM	0,5	G8	237.700
HIGH VOLTAGE, EMERGENCY POWER	2	M7	
	4,5	M6	1951.400
	1	M5	
ELECTRONIC	1	G7	
	4	G6	
	2	G5	
	2	G4	3871.800
	4	M4	
	2	M3	
TRANSPORTATION	2	M7	
	2	M6	1329.600
	1	M5	
GARBAGE	1	M6	
	1	M4	632.800
	1	M3	
HOUSE-KEEPING	2	M7	
	14	M6	
	7	M5	8683.700
	9	M4	
	7	M3	
MANAGEMENT, PLANNING	1	P4	
	2	P3	
	1	P2	
	1	G8	6593.900
	4	G7	
	2	G6	
	2	G5	
	2	G4	
	1	G3	
COMMON			309.200
TOTAL	94		25860.000

SOURCE: Interviews with BM staff

CODE	OBJEKT	IAKW CON-TRACTS	SERVICE CON-TRACTS	OTHER CON-TRACTS	SPARE PARTS	UTILI TIES	FURNITURE AND EQUIPMENT	UN-STAFF COST	TOTAL
412	MINOR ALTERATION TO PREMISES			351 900					351 900
413	SUPPLIES FOR MAINTENANCE OF PREMISES				425 000				425 000
414	OPERATION AND MAINTENANCE CONTRACT	1 382 400			293 300				1 675 700
415	MISCELLANEUS MAINTENANCE CONTRACT		437 500	152 500					590 000
417	ELEVATOR OPERATION AND MAINTENANCE		490 865	94 835					585 700
418	CLEANING SERVICES		1 225 000						1 225 000
421	ELECTRICITY					1 529 900			1 529 900
422	TRANSFER STATION	311 000[2]				2 153 200			2 464 200
423	WATER					128 100			128 100
425	OTHER UTILITIES		164 700	13 100					177 800
431	MAINTENANCE AND REPAIR OF FURNITURE						15 000		15 000
435	MAINTENANCE OF BM EQUIPMENT						19 200		19 200
436	PETROL					4 000			4 000
697	UNIFORMS						8 000		8 000
699	MISC-SUPPLIES			17 450					17 450
611	FURNITURE AND FIXTURES						13 000		13 000
632	INTERPRETATION EQUIPMENT						9 200		9 200
653	TAPE RECORDERS						16 300		16 300
691	BM EQUIPMENT						47 100		47 100

CODE	OBJECT	IAKW CON-TRACTS	SERVICE CON-TRACTS
695	MISC EQUIPMENT		
01[illegible]	ESTABILIZED POSTS		
030	TEMPORARY POSTS		
040	CONSULTANTS		
060	OVERTIME		
101	COMMON STAFF COST		
	TOTAL US $	1 693 400	2 318 065
	TOTAL THOUSAND AS[illegible]	22 522	30 829

1) EXCHANGE RATE 13:30

2) THE DIFFERENCE WITH FIGURE ON PAGE 6 IS DUE TO DIFFERENT EXCHANGE RATE

OTHER CON-TRACTS	SPARE PARTS	UTILI TIES	FURNITURE AND EQUIPMENT	UN-STAFF COST	TOTAL
			17 000		17 000
				1 177 400	1 177 400
				319 300	319 300
70 000					70 000
				85 000	85 000
				365 500	365 500
699 785	718 300	3 815 200	144 800	1 947 200	11 336 750
9 307	9 555	50 742	1 926	25 860	150 741

CURRENT COST THOUSAND AS

FUNCTION	IAKW CONTRACTS	SERVICE CONTRACTS
HEATING, WATER, SEWERAGE	1 155	
VENTILATION, AIR COND.	5 390	
COOLING		
CATERING INSTALLATIONS		108
BUILDING CONTROL SYSTEM	578	
BUILDING MONITORING	3 465	
HIGH VOLTAGE EMERGENCY POWER	1 155	106
ELECTRONICS		3 403
TRANSPORTATION		6 544
GARBAGE		950
HOUSE-KEEPING		2 263
CLEANING		16 452
TRANSFER STATION	4 136	
MANAGEMENT PLANNING	6 180	
COMMON (Not distrib)	1 463	1 003
TOTAL	22 522	30 829

OTHER CON-TRACTS	SPARE PARTS	UTILITIES	FURNITURE AND EQUIPMENT	UN STAFF COST	TOTAL
	436	20 723	69	931	23 314
	2 531	6 4 82		238	14 641
	50			647	697
	50			434	592
	67	174			819
	200			238	3 903
	382	23 310		1 951	26 904
2 327	1 405		805	3 872	11 812
1 700	431		27	1 330	10 032
	20			633	1603
3 711	2 487		616	9 684	17 761
	19		77		16 539
					4 136
931				6 594	12 705
638	1 486	53	332	308	5 283
9 307	9 555	50 742	1 926	25 860	150 741

Building 11c

Item no.	Installation	Number of units	Estimated time for the preventiv maintenance work									
			Weekly routines		Monthly routines		Quaterly routines		Yearly routines		All routines	
			hours per unit	total hours	h p u	t h	h p u	t h	h p u	t h	h p u	t h
	Air cond. / Ventilation											
1	Build up inlet units ≥ 30.000 m³/h	17		153		505		519		254		1431
2	Premanufact. inlet units ≥ 15000 m³/h	41		738		821		405		222		2186
3	Premanufact. inlet units ≥ 8000 m³/h	50		675		1001		495		270		2441
4	Premanufact. inlet units ≤ 8000 m³/h	70		630		819		528		275		2252
5	Exhaust fans ≥ 15.000 m³/h	15				162		108		105		375
6	Exhaust fans ≤ 15000 m³/h	34				122		88		145		355
7	Exhaust fans ≥ 8000 m³/h	114				281		167		320		768
8	Exhaust fans ≤ 8000 m³/h	172				232		135		309		676
9	Pipes and shut-off valves in air cond. plants	1) 4200						506		337		843
10	compensators and vibration dumpers	1) 680				155						155
11	Induction units	1) 15000								4500		4500
12	fire dampers	1) 5000								2000		2000
	Summ.			2196		4098		2951		8737		17982
	Heating, water and Sewerage											
13	Radiators and convectors	1) 400								45		45
14	Pipes and shut-off valves in water prep. plants	1) 225						27		18		45
15	Watersoftening plants	7		79								79
16	Phosphates inject plants	8		90								90
17	Heatwater prep. plants	2		23								23
18	Heatexchanger warmw.	8				44		9				53
19	Waterpreasure increase plants	7		118		29		21		9		177
20	Pipetunnel and shafts, Check points	1) 120						54				54
21	Interior gullies in plants	1) 500								2) 56		56
22	Fire fighting conduits	18								41		41

Building VIC

Item no.	Installation	Number of units	Estimated time for the preventiv maintenance work									
			Weekly routines		Monthly routines		Quaterly routines		Yearly routines		All routines	
			hours per unit	total hours	h p u	t h	h p u	t h	h p u	t h	h p u	t h
23	Lawn watering system	180 1)						121		6		127
24	Plaza pool	1	Daily	56				36				92
25	outside gullies	200 1)							half year	45 2)		45
	Sum			366		73		268		157		927
	High-voltage installation											
26	Batteries and rectifier	7				9,5 2)				4 2)		14
27	Electrical install. for aircond. and ventilation	178				107		36		89		232
28	Electrical install. for heating water and sewerage	30				18		6		15		39
29	Low tension switch plant	6				8 2)				203 2)		211
30	Emergency power	6	2 weeks	175						236 2)		411
	Sum			175		143		42		547		907
	Remaining install.											
31	Building monitoring	1				459		59				518
32	Lightning protection	7 1)								13 2)		13
33	Facade clean. equipm	7						252				252
	Sum											783

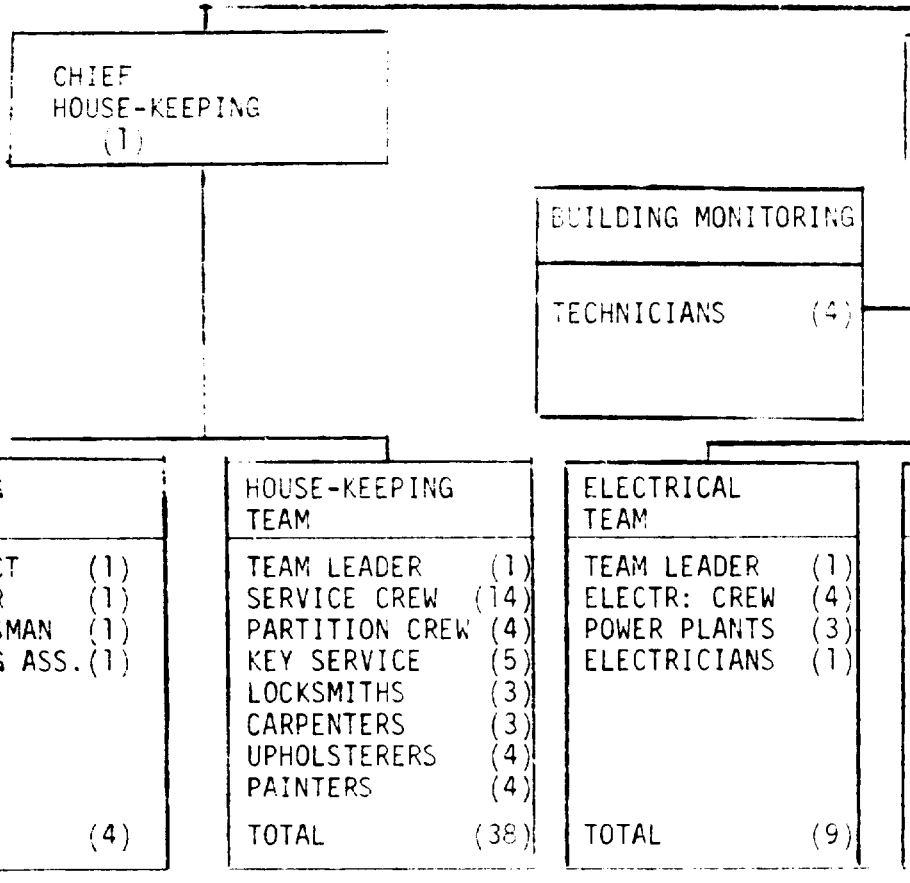
1) ESTIMATION 2) INTERPOLATED FROM STATED VALUES

ALTERNATIVE IN-HOUSE STAFF

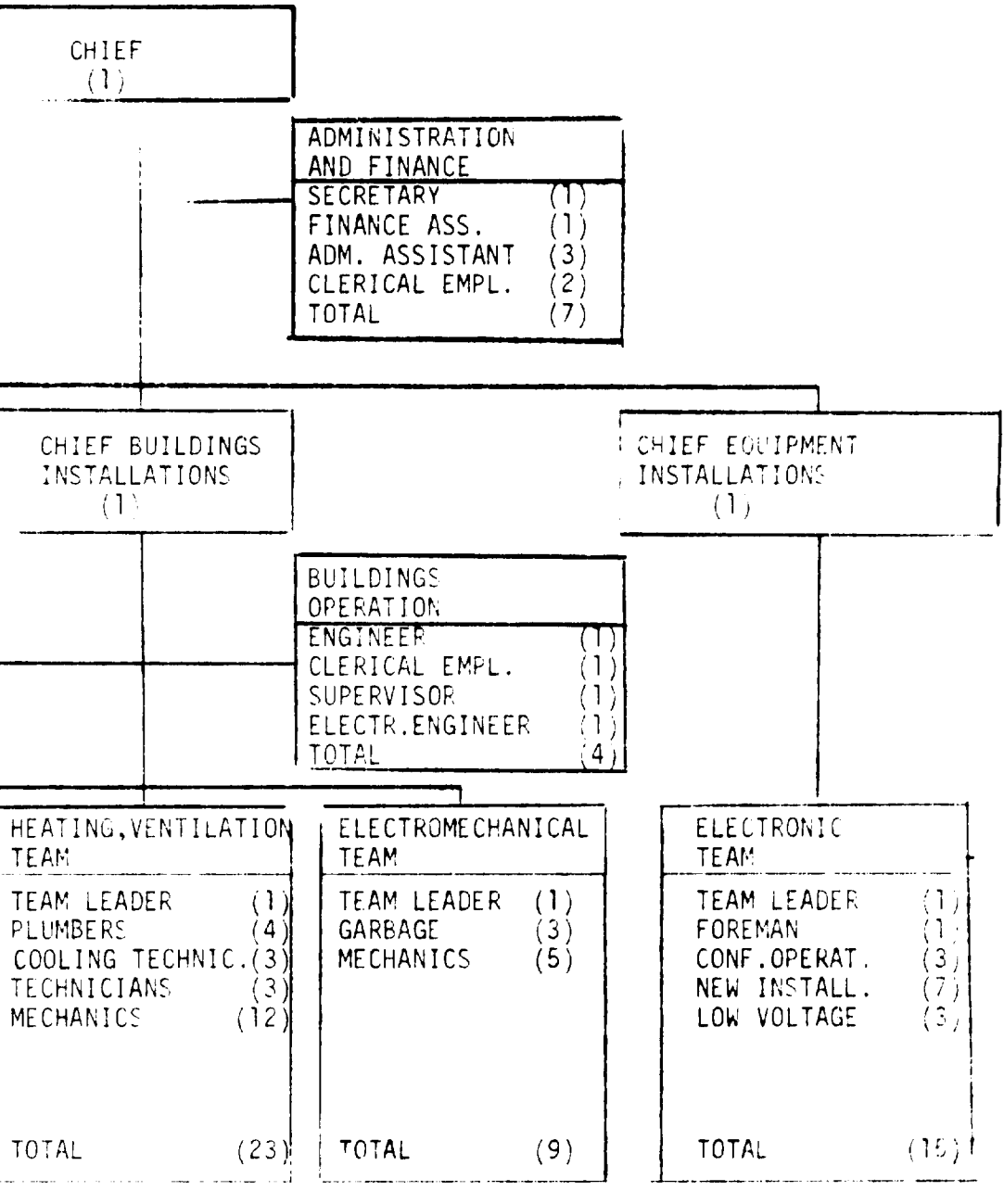
STAFF REQUIRMENTS

FUNCTION \ NO OF STAFF	CURRENT			ALTERNATIVE IN HOUSE-STAFF				DIFF
	IAKW	UN	TOTAL	IAKW	UN CURRENT	UN ADDITIONAL	TOTAL	
HEATING, WATER, SEWERAGE	2	3,5	5,5		3,5	1	4,5	./. 1
VENTILATION, AIR CONDITION.	10	0,5	10,5		0,5	15	15,5	+ 5
COOLING		2,5	2,5		2,5		2,5	± 0
CATERING INSTALLATION		1,5	1,5		1,5		1,5	± 0
BUILDING CONTROL SYSTEM	1	—	1			1	1	± 0
BUILDING MONITORING	6	0,5	6,5		0,5	4	4,5	./. 2
HIGH VOLTAGE, EMERG. POWER	2	7,5	9,5		7,5	1	8,5	./. 1
ELETRONICS		15	15		15		15	± 0
TRANSPORTATION		5	5		5		5	± 0
GARBAGE		3	3		3		3	± 0
HOUSE-KEEPING		39	39		39		39	± 0
CLEANING								± 0
TRANSFER STATION	2		2	4			4	+ 2
MANAGEMENT, PLANNING	8	16	24		16	1	17	./. 7
COMMON								
TOTAL	31	94	125	4	94	23	121	./. 4

BM:s ORGANIZATION
ALTERNATIVE IN-HOUSE STAFF



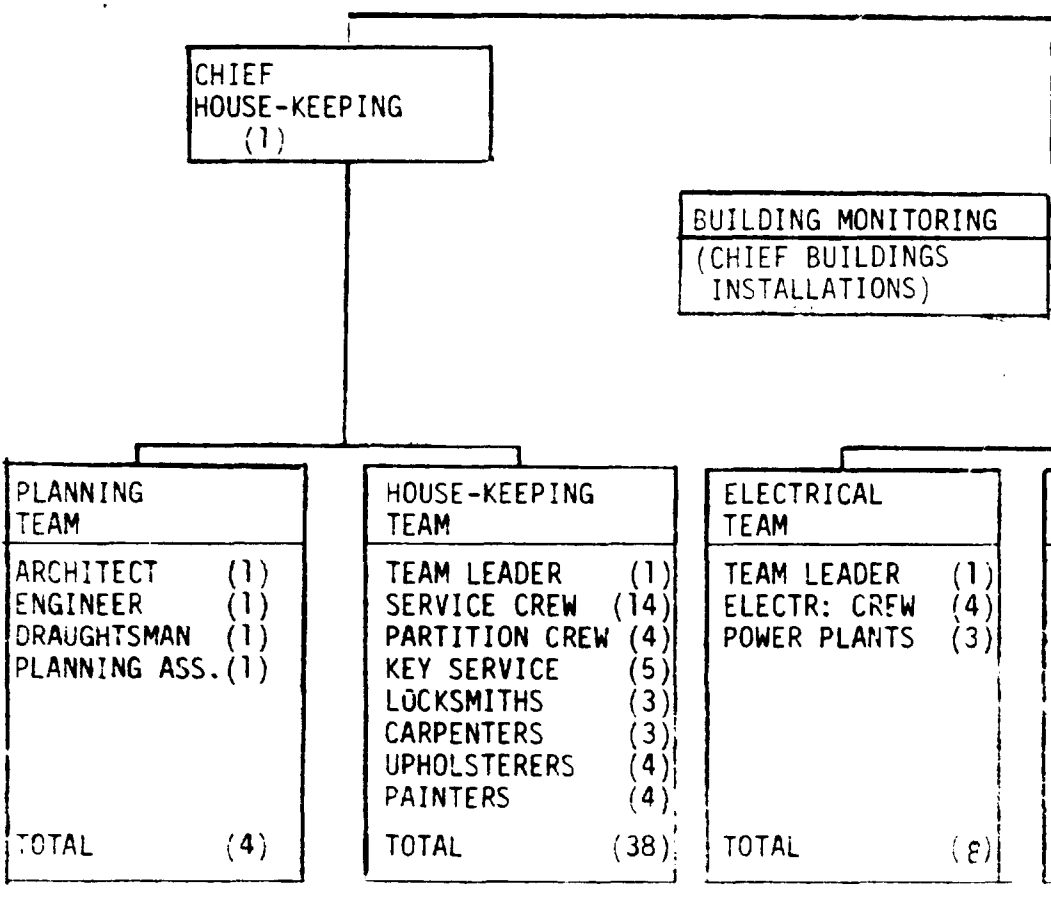
( ) NUMBER OF STAFF


CHIEF
(1)
ADMINISTRATION AND FINANCE
SECRETARY (1)
FINANCE ASS. (1)
ADM. ASSISTANT (3)
CLERICAL EMPL. (2)
TOTAL (7)
CHIEF BUILDINGS INSTALLATIONS
(1)
CHIEF EQUIPMENT INSTALLATIONS
(1)
BUILDINGS OPERATION
ENGINEER (1)
CLERICAL EMPL. (1)
SUPERVISOR (1)
ELECTR.ENGINEER (1)
TOTAL (4)
HEATING, VENTILATION TEAM
TEAM LEADER (1)
PLUMBERS (4)
COOLING TECHNIC. (3)
TECHNICIANS (3)
MECHANICS (12)
TOTAL (23)
ELECTROMECHANICAL TEAM
TEAM LEADER (1)
GARBAGE (3)
MECHANICS (5)
TOTAL (9)
ELECTRONIC TEAM
TEAM LEADER (1)
FOREMAN (1)
CONF.OPERAT. (3)
NEW INSTALL. (7)
LOW VOLTAGE (3)
TOTAL (15)

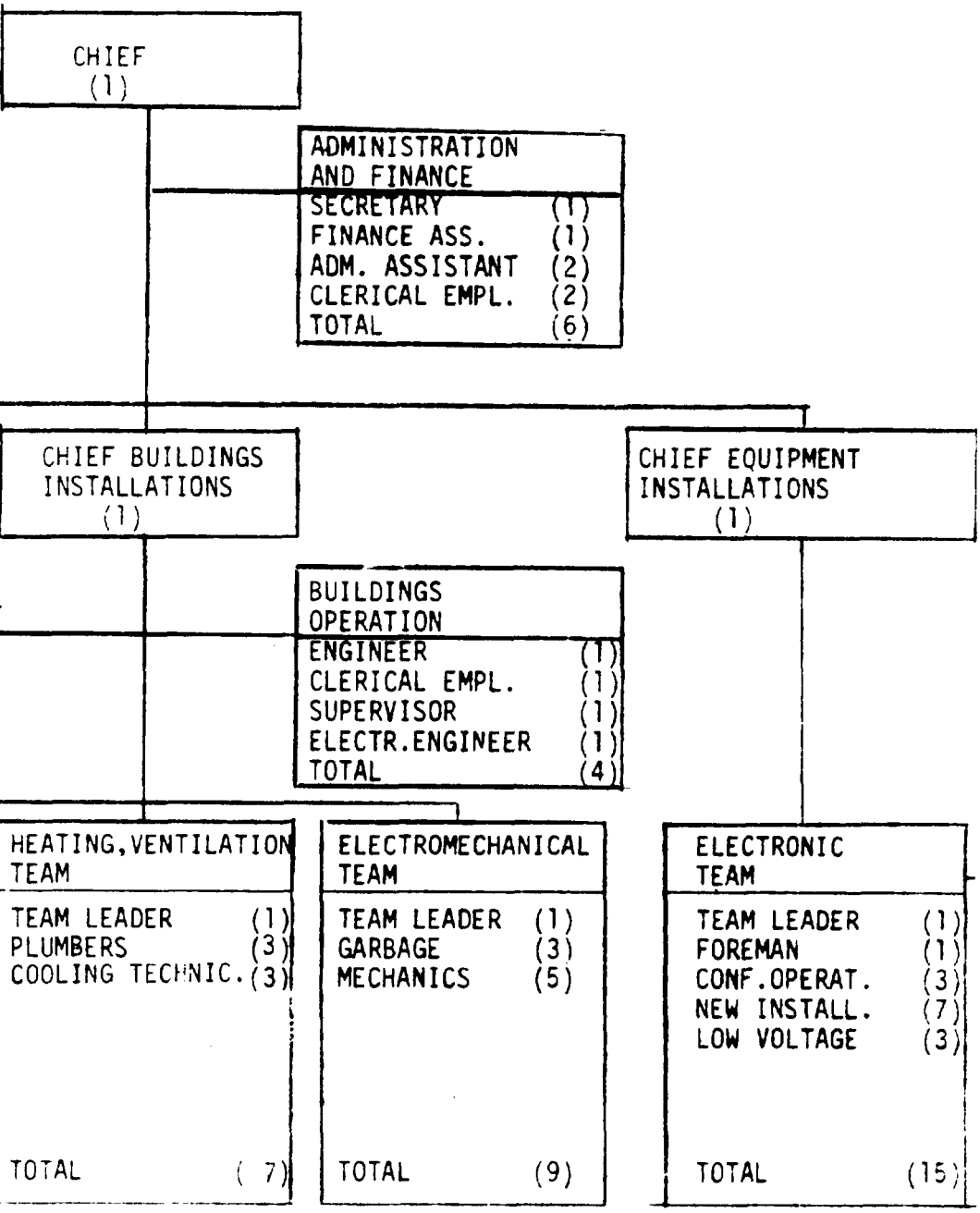
ALTERNATIVE CONTRACTOR
STAFF REQUIREMENT

NO OF STAFF / FUNCTION	CURRENT IAKW	CURRENT UN	CURRENT TOTAL	ALTERNATIVE CONTRACTOR IAKW	ALTERNATIVE CONTRACTOR CONTRACTOR	ALTERNATIVE CONTRACTOR UN	ALTERNATIVE CONTRACTOR TOTAL	DIFF
HEATING, WATER, SEWERAGE	2	3,5	5,5		2	3,5	5,5	+0
VENTILATION, AIR CONDIT.	10	0,5	10,5		14	1	15	+4,5
COOLING		2,5	2,5			2,5	2,5	+0
CATERING INSTALLATIONS		1,5	1,5			1,5	1,5	+0
BUILDING CONTROL SYSTEM	1		1		1		1	+0
BUILDING MONITORING	6	0,5	6,5		4	0,5	4,5	./.2
HIGH VOLTAGE,EMERG.POWER	2	7,5	9,5		2	8	10	+0,5
ELECTRONICS		15	15			15	15	+0,5
TRANSPORTATION		5	5			5	5	+0
GARBAGE		3	3			3	3	+0
HOUSE-KEEPING CLEANING		39	39			39	39	+0
TRANSFER STATION	2		2	4			4	+2
MANAGEMENT,PLANNING COMMON	8	16	24		4	16	20	./.4
TOTAL	31	94	125	4	27	95	126	+1

UMS ORGANIZATION
ALTERNATIVE CONTRACTOR .



( ) NUMBER OF STAFF


CHIEF
(1)
ADMINISTRATION AND FINANCE
SECRETARY (1)
FINANCE ASS. (1)
ADM. ASSISTANT (2)
CLERICAL EMPL. (2)
TOTAL (6)
CHIEF BUILDINGS INSTALLATIONS
(1)
CHIEF EQUIPMENT INSTALLATIONS
(1)
BUILDINGS OPERATION
ENGINEER (1)
CLERICAL EMPL. (1)
SUPERVISOR (1)
ELECTR.ENGINEER (1)
TOTAL (4)
HEATING, VENTILATION TEAM
TEAM LEADER (1)
PLUMBERS (3)
COOLING TECHNIC. (3)
TOTAL (7)
ELECTROMECHANICAL TEAM
TEAM LEADER (1)
GARBAGE (3)
MECHANICS (5)
TOTAL (9)
ELECTRONIC TEAM
TEAM LEADER (1)
FOREMAN (1)
CONF.OPERAT. (3)
NEW INSTALL. (7)
LOW VOLTAGE (3)
TOTAL (15)

ALTERNATIVE IN-HOUSE STAFF; 1 COST FOR ADDITIONAL UN-STAFF (AS)

FUNCTION	NO	GRADE	ANNUAL COST	TOTAL COST	OVERTIME 10 %	GRAND TOTAL
HEATING	1	M 6	248 700	248 700	24 900	273 600
VENTILATION	1	G 7	383 600	383 600	38 400	422 000
	2	G 6	325 000	650 000	65 000	715 000
	6	M 6	248 700	1 492 200	149 200	1 641 400
	6	M 5	213 400	1 280 400	128 000	1 408 400
BUILDING CONTROL	1	G 7	383 600	383 600	38 400	422 000
BUILDING MONITORING	4	G 6	325 000	1 300 000	130 000	1 430 000
HIGH VOLTAGE	1	M 6	248 700	248 700	24 900	273 600
MANAGEMENT, PLANNING	1	G 5	272 100	272 100	27 200	299 300
TOTAL	23			6 259 300	626 000	6 885 300

SUMMERARY OF COST (THOUSAND AS)

ALTERNATIVE IN-HOUSE STAFF

FUNCTION	IAKW	CURRENT COST FOR UN-STAFF	ADDITIONAL COST FOR UN-STAFF
HEATING, WATER, SEWERAGE		931	274
VENTILATION		238	4 187
COOLING		647	
CATERING		434	
BUILDING CONTROL			422
BUILDING MONITORING		238	1 430
HIGH VOLTAGE		1 951	274
ELECTRONIC		3 872	
TRANSPORTATION		1 330	
GARBAGE		633	
HOUSE-KEEPING		8 684	
CLEANING			
TRANSFER STATION	6 200		

ANNEX 4:7

CONTRACTS; SERVICE AND OTHERS	UTILI-TIES	SPARE PARTS EQUIPMENT FURNITURE	TOTAL
	20 723	505	22 433
	6 482	2 531	13 438
		50	697
108		50	592
	174	67	663
		200	1 868
106	23 310	382	26 023
5 730		2 210	11 812
8 244		458	10 032
950		20	1 603
5 974		3 103	17 761
16 452		87	16 539
			6 200

FUNCTION	IAKW	CURRENT COST FOR UN-STAFF	ADDITIONAL COST FOR UN-STAFF	
MANAGEMENT, PLANNING		6 594	299	
COMMON		308		
TOTAL	6 200	25 860	6 886	

CONTRACTS, SERVICE AND OTHERS	UTILI-TIES	SPARE PARTS EQUIPMENT FURNITURE	TOTAL
931			7 824
1 641	53	1 818	3 820
40 136	50 742	11 481	141 305

ALTERNATIVE CONTRACTOR

1 STAFFCOST FOR A CONTRACTOR (AS)

FUNCTION	NO STAFF	AVERAGE COST/H	H/YEAR	TOTAL ANNUAL COST
HEATING	2	300	1 750	1 050 000
VENTILATION	14	280	1 750	6 860 000
BUILDING CONTROL	1	300	1 750	525 000
BUILDING MONI-TORING	4	300	1 750	2 100 000
HIGH VOLTAGE	2	300	1 750	1 050 000
CHIEF	1	600	1 750	1 050 000
ASSISTANTS	2	320	1 750	1 120 000
CLERK	1	260	1 750	455 000
OVERTIME				1 160 000
TOTAL	27			15 370 000
PROFIT, RISK, CENTRAL ADMINISTRATION ETC 10 %				1 500 000
GRAND TOTAL				16 870 000

2 COST FOR ADDITIONAL UN-STAFF

FUNCTION	NO	GRADE	ANNUAL COST	TOTAL COST
VENTILATION	0,5	G 7	383 600	191 800
HIGH VOLTAGE	0,5	G 7	383 600	191 800
TOTAL	1			383 600

SUMMERY OF COSTS (THOUSAND AS)

ALTERNATIVE CONTRACTOR

FUNCTION	1AKW	CONTRACTOR	COST FOR UN-STAFF
HEATING, WATER, SEWERAGE		1 155	931
VENTILATION		7 547	430
COOLING			647
CATERING			434
BUILDING CONTROL		578	
BUILDING MONITORING		2 310	238
HIGH VOLTAGE		1 155	2 143
ELECTRONIC			3 872
TRANSPORT			1 330
GARBAGE			633
HOUSE-KEEPING			8 684
CLEANING			
TRANSFER STATION	6 200		

ANNEX 4:9

CONTRACTS SERVICE AND OTHERS	UTILI-TIES	SPARE PARTS EQUIPMENT FURNITURE	TOTAL
	20 723	505	23 314
	6 482	2 531	16 990
		50	697
108		50	592
	174	67	819
		200	2 748
106	23 310	382	27 096
5 730		2 210	11 812
8 244		458	10 032
950		20	1 603
5 974		3 103	17 761
16 452		87	16 539
			6 200

ANNEX 4:9
cont

FUNCTION	IAKW	CONTRACTOR	COST FOR UN-STAFF	CONTRACTS SERVICE AND OTHERS	UTILI-TIES	SPARE PARTS EQUIPMENT FURNITURE	TOTAL
MANAGEMENT, PLANNING		2 625	6 594	931			10 150
COMMON		1 500	308	1 641	53	1 818	5 320
TOTAL	6 200	16 870	26 244	40 136	50 742	11 481	151 673

COST COMPARISON I (THOUSAND AS)

FUNCTION	CURRENT	ALTERNATIVE IN-HOUSE STAFF	ALTERNATIVE CONTRACTOR
HEATING, WATER, SEWERAGE	23 314	22 433	23 314
VENTILATION	14 641	13 438	16 990
COOLING	697	697	697
CATERING	592	592	592
BUILDING CONTROL	819	663	819
BUILDING MONITORING	3 903	1 868	2 748
HIGH VOLTAGE	26 904	26 023	27 096
ELECTRONICS	11 812	11 812	11 812
TRANSPORTATION	10 032	10 032	10 032
GARBAGE	1 603	1 603	1 603
HOUSE-KEEPING	17 761	17 761	17 761
CLEANING	16 539	16 539	16 539
TRANSFER STATION	4 136	6 200	6 200
MANAGEMENT, PLANNING	12 705	7 824	10 150
COMMON	5 283	3 820	5 320
TOTAL	150 741	141 305	151 673

NOTE: CURRENT COST FOR THE FUNCTIONS CARRIED OUT BY IAKW AS BASED ON A DIFFERENT INTERPRETATION OF "ANNEX B" THAN THE TWO ALTERNATIVES.

COST COMPARISON II (THOUSAND AS)

	ALTERNATIVE IN-HOUSE STAFF	ALTERNATIVE CONTRACTOR	DIFFE-RENCE
NO OF UN-STAFF	23	1	
NO OF CONTRACTORS STAFF		27	
TOTAL	23	28	-5
COST FOR UN-STAFF	6 886	384	
COST FOR CONTRACTORS STAFF	---	15 370	
PROFIT ETC		1 500	
TOTAL	6 886	17 254	10 368
COST FOR SPARE PARTS	1 500	1 500	
ADDITIONAL COST IAKW	2 800	2 800	
GRAND TOTAL	11 186	21 554	10 368

NOTE: IF IAKW IS THE CONTRACTOR. ADDITIONAL COST IAKW IN ALTERNATIVE CONTRACTOR WOULD BE,0 AND THE DIFFERENCE REDUCED WITH 2,8 MILLION

THE BUILDING MONITORING SYSTEM

The building monitoring system is a central auxiliary aid for the operation of the buildings. This study also comprised an examination of the monitoring system. Ekono has studied the system from the energy savings point of view in its energy savings report of 1980.

There is no documentation of the system. The report of Ekono contains a comprehensive and detailed description of the system. It is not very concrete and it is not possible to say from having read the report to what extent the described facilities are already in the system or can be built in later.

The system still functions unsatisfactorily. There are many false alarms and the reliability of reported data is low. Much time is still spent checking the connections between the very large amount of contact points in the building, correcting failures, trimming and adjustments. This could be one of the reasons why the system has not yet been used the way it is possible to use it. A contributing factor is also that the coding selected - a way of communicating with data - is rather complicated and difficult to learn. This for instance means that only the really initiated can utilize printed out alarms. A reasonable requirement is that serious alarms are typed on a printer and accessible on display terminals in plain text also for persons without special training on this computer system. This would also create a condition for cutting down the staffing outside normal working hours.

An example of unsuccessful programming is also all the operating statuses for the pilot rooms in the building. which are continuously issued and recorded. Hardly anyone has the energy to go through these enourmous amounts of paper produced. The computer should for instance only process information when there are deviations from the desired operating status.

OF COSTS OVER 5 YEARS THOUSAND AS

	YEAR 1			YEAR 2			YEAR 5		
	IN-HOUSE STAFF	CONTRACTOR	DIFFE-RENCE	IN-HOUSE STAFF	CONTRACTOR	DIFFE-RENCE	IN-HOUSE STAFF	CONTRACTOR	DIFFE-RENCE
(ANNEX ...)	150.700	151.700	- 1.000	141.300	151.700	- 10.400	141.300	151.700	- 10.400
IN REAL ...UN-STAFF							800		+ 800
IN REAL ...TORS STAFF					300	- 300		1.200	- 1.200
...COUNT" ...R A ... YEAR		1.800	+ 1.800		1.800	+ 1.800		1.800	+ 1.800
	150.700	149.900	+ 800	141.300	150.200	- 8.900	142.100	151.100	- 9.000