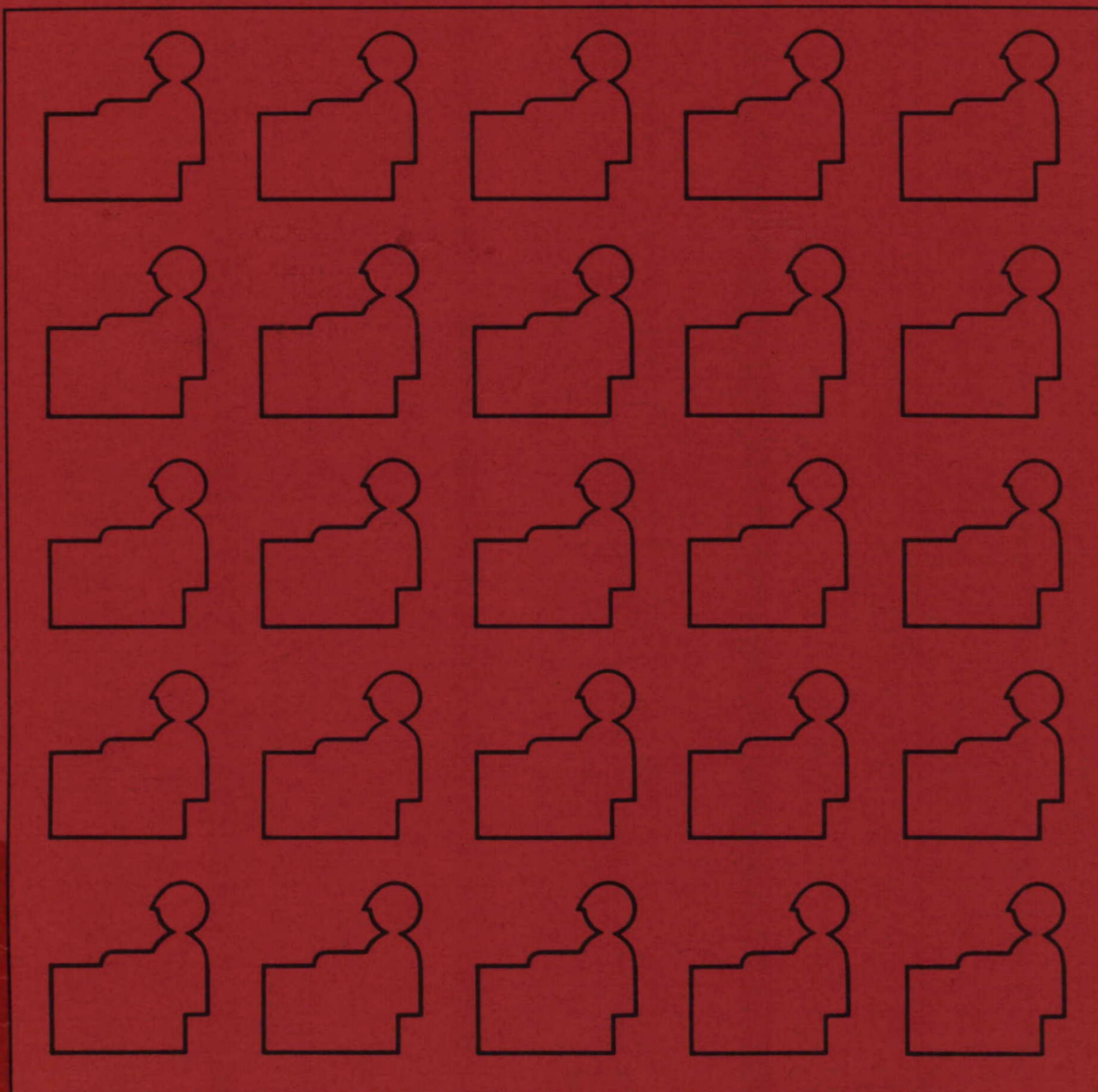


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OFFICE COMMUNICATIONS SYSTEMS PROGRAM

PROGRAMME DE LA BUREAUTIQUE

EVALUATION RESEARCH PLAN FOR THE
OCS PROGRAM FIELD TRIALS OF
INTEGRATED OFFICE TECHNOLOGY



Government of Canada
Department of Communications

Gouvernement du Canada
Ministère des Communications

Canada

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EVALUATION RESEARCH PLAN FOR THE OCS PROGRAM FIELD TRIALS OF INTEGRATED
OFFICE TECHNOLOGY (including a Draft RFP (Request for Proposals) Statement
of Work)

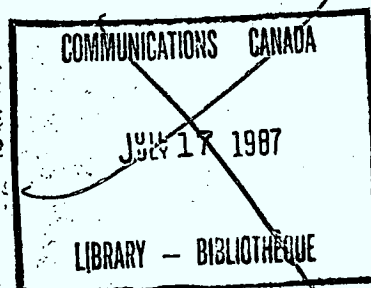
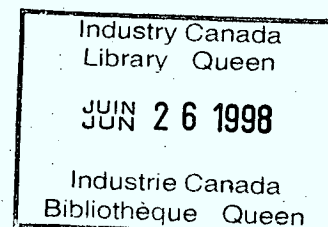
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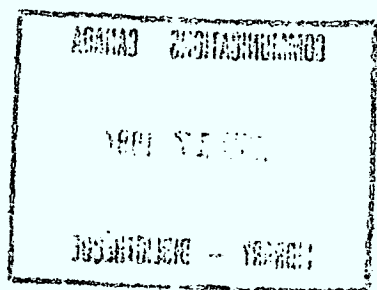
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EVALUATION RESEARCH PLAN FOR THE OCS PROGRAM FIELD TRIALS OF INTEGRATED
OFFICE TECHNOLOGY

Theodore Grusec

Behaviour Research Associates

The Rationale For Evaluation Research

The purpose of this report is to outline the essence of an evaluation plan or strategy for the OCS program field trials of integrated office technology at three sites - Department of Defence, Customs and Excise, and Department of the Environment. These trials are currently at varying points in initiation and are planned for three phases, each phasing lasting about one year. At each site, the first phase involves implementation of a pilot (or pre-pilot) system with a small number of work stations. If the first phase at a given site is deemed successful, there will be increases in the number of work stations at the site by factors of about 10 in each of the succeeding phases. Three vendors are involved in the trials, a different one for each site - Bell-Northern Research at Customs and Excise, Systemhouse at the Department of Defence, and O.C.R.A. at the Department of the Environment.

Various terms are found in the literature for technological thrusts related to the present one - "burotics", "office automation", "communications", "office of the future", "telematics", etc. World interest and concern with integrated office technologies is very high and growing. This is especially true in Western societies where these technologies are seen as having potentially major impacts on productivity in a situation where office costs are very high. In North America, more than 50% of the work force is employed in office work. Of total office costs, it has been estimated that some 75% are for direct and indirect labour, with knowledge workers (managers and professionals) accounting for 70% of those labour costs.

It has been estimated that the office worker, on the average, is supported by about \$2,000 in capital investment. This is to be contrasted with \$35,000 per factory worker and \$70,000 per farm worker. These figures have been questioned as to absolute magnitudes but the relative ratios are plausible. Capital investment is seen by many as the key to productivity increases

although favourable cost/benefit ratios are very difficult to establish and substantiate for office work. Beyond a narrow view of productivity, the new technologies are also seen as having a major potential impact on the quality of working life by eliminating dreary tasks and enhancing intellectual potential. On the negative side, others see these technologies as aggravating unemployment problems by eliminating jobs. Some see especially undesirable impacts on the status of women who predominate in office support functions.

Functions and technologies implicated in integrated office systems include word processing and text editing, conferencing, micrographics, reprographics, electronic mail and messaging, and upgraded telephones. Any given system, of course, will not incorporate all of these. Central to these and other functions and technologies are computers. Power to transform the way work is done is seen as occurring with the union of computers and telecommunications in interaction with office functions and technologies. "Post-industrial society", "information age" and "third wave" are among the terms introduced to describe what some view as the revolutionary nature of the transformations to work and life which office work-related and other high technology innovations may bring.

These innovations are anticipated to be the dominant growth industry of the 1980's. The objectives of the OCS program include stimulating Canadian industrial capacity on the world scene in these leading edge technologies. Such stimulation may significantly enhance Canada's economy. As well, the OCS program aims at introducing the technologies within the Canadian government, a large consumer of office workers and office products.

Whatever enthusiasm or scepticism one may have about the various views mentioned above, one thing is clear about the new integrated office technologies: namely, implementation comes to the fore in a crucial role as never before. The office technologies of the 1960's and 70's were comparatively simple to implement. Those technologies consisted largely of limited function devices and machines - for example, copiers, data processing equipment, stand-alone word processors. Implementation may have posed various problems but the end point was never in doubt. It was always fairly obvious whether or not the equipment did what it was supposed to do. Training was relatively straightforward since little creativity was possible in the use of the technologies.

There were organizational impacts but these consisted largely of transforming certain circumscribed support functions into an "industrial age" mode - for example data processing departments, word processing pools. Many regard such transformations as lowering the quality of working life for the affected workers. These developments affected mostly support workers. As we saw above, these workers represent about 30% of office work labour costs.

The picture is considerably different for integrated office technologies. These are especially aimed at knowledge workers - managers and professionals - who now absorb some 70% of office labour costs. Such multi-function workers were relatively unaffected in a direct way by the industrial age technologies of the 60's and 70's. For this class of worker, it is no longer sufficient for a vendor to have a "good" product or family of products. Individual office work functions and related technologies are specifiable as in the list above, and, in that sense, they are generic. But there will be much more unique tailoring needed for each specific office and worker situation in the integration of functions than ever before. As with computers in general, the tailoring of software is especially critical. Thus, an in-depth needs analysis of any given specific office situation and of specific workers within that office assumes great importance in the implementation process unlike ever before.

Furthermore, learning assumes new dimensions with these new office systems. The fact of multi-function integration alone dictates that basic training may be relatively prolonged. But, in addition, the integration means that the technology makes possible new creative ways of doing work which cannot be completely foreseen and which may evolve in significant ways over a long period of time. Especially in the present OCS field trials, new possibilities initially unforeseen and unforeseeable by the vendors, host departments and users, even after intensive needs analyses, may dictate continuing changes in detailed capabilities of software and hardware. Hence a long term creative learning process for vendors, client departments and individual users may occur over at least the whole first phase of the trials and probably well into the second and third phases. Proper handling of this creative learning process becomes another major facet of implementation. Rather than there being a defineable end point, finality may be an ever-changing target.

The critical nature of the person/machine interface in hardware and especially

in software should be mentioned too. This also is part of the ongoing implementation effort which the new technologies demand after hardware installation. Our aim here is to stress that hardware and software can no longer stand or fall on its narrowly defined technical capabilities alone. The implementation process is of fully equal importance. The literature suggests that some 40 to 80% of system failures and rejections are now due to improper implementation even where the systems installed meet pre-established functional specifications. It is frequently the case that clients and users become seriously disenchanted with systems some time after the designers and vendors have completed their work and have left in the belief that the system was fully successful. The unexpected further expenses after vendors have left which are entailed in such scenarios may be avoidable by a properly executed implementation process.

Our primary concern here is with evaluation research. We saw above that the implementation process is crucial to successful launching of integrated office systems. The view we take is that evaluation research is an integral part of the implementation process. This is true in general, but it is especially true in the present field trials where the vendors are relatively inexperienced in integrated office systems design and installation. System installation is always a learning experience for clients and users, but, in the present case, it is equally so for vendors. And so the total exercise is a learning experience for all parties involved, including also the OCS program itself as well as the other intra-governmental special interest groups who are concerned.

Thus, there are two compelling attributes of these field trials. First, they are a large scale learning experience for all. Secondly, the whole exercise is a highly creative one in that, except in abstract terms, the details of the final products - hardware and software - cannot be fully specified in advance. Rather, these final products will emerge only after a long series of sub-goals, each of which will be continually modified during the course of execution. In such a dynamic situation then, evaluation research, as part of the implementation process, must be an ongoing function, ideally started at the very beginning of planning for the trials and proceeding throughout all three phases of execution.

The Objectives of Evaluation Research

(1) Documentation

Throughout the trials, from beginning to end, problems will be encountered and resolved, errors will be made and rectified, decisions will be taken and modified, failures and successes will occur. All of these events, which are very important components of the total learning process, will be lost unless adequately captured by an evaluation process. Appropriately captured, and critically analyzed and interpreted, such a record will be invaluable to the OCS program, to vendors (as additions to their own evaluations), to special interest groups, and, especially, to future planning and implementation of integrated office systems both within government and in the private sector.

The speculative literature on implementation is quite large while well researched, methodologically sound empirical evidence is scarce. With properly executed and documented evaluation research, the present field trials could provide a major contribution to world knowledge and literature as well as a sound set of guidelines for future implementation endeavours.

(2) Monitoring

Evaluation research, as an ongoing function throughout the field trials, can provide continual feedback to all that are involved in and concerned with the implementation process. While various other levels of evaluation will be ongoing simultaneously - by the vendors, client departments and by the Department of Communications - and independent outside evaluator can provide a unique point of view and would be able to flag sub-optimal aspects of implementation which should be addressed at the time of occurrence but which may be missed by the other levels of evaluation. These other levels will each necessarily reflect a particular point of view while an outsider will better be able to see the enterprise in a larger perspective with a view on complex interactions among the more particular points of view.

Additionally, the outside evaluator will be able to observe the evaluations being made by all the other players. Then, later on, it will be possible to critically assess the conclusions drawn from the field trials by these other players. A sound basis will be available to determine whether such conclusions, in detail, are warranted or not.

(3) Gathering new data

Part of the research function of evaluation will be to gather data which may be of little immediate interest to the other players and hence may not be obtained by them in their own evaluations. This includes information for non-participating vendors (and non-participating evaluation experts) whose interests must also be served in accordance with the OCS intentions to aid Canadian industry generally. Also, information should be gathered for the public at large relevant to the larger social and work implications of the new technologies. Similarly, information pertinent to general economic implications and to public policy matters should be obtained from the trials.

All three objectives and roles for evaluation research - documentation, monitoring, and gathering new data - are important. Unless they are fulfilled, the full value attainable from the field trials will not be achieved.

The Number of Outside Evaluation Organizations

The principal advantage of a single organization for all three field trials would be that a coherent evaluation framework would be followed so that comparisons among the three sites would be facilitated. However, this coherence can be obtained in another way which will be dealt with later below. The view presented here is that the evaluation research can best be served by three separate outside organizations, one assigned to each site.

One reason for this view stems from the considerations dealt with previously - namely, that evaluation is an integral part of the implementation process and that the new multi-function integrated office technology does not stand on its own inherent merits but absolutely requires full attention to implementation for viability and success. This implies that evaluation research as part of implementation expertise must be fostered as a symbiotic enterprise associated with the hardware and software industry. Therefore, since one of the aims of the OCS program is to stimulate Canadian capacity in the integrated office systems area, stimulation of implementation expertise must be part of that aim. Accordingly, just as three, rather than one vendor were contracted for the field trials, so three rather than one independent outside evaluation organizations should be employed. Just as the field trials are a learning experience for the vendors, so will they be for evaluators. Evaluation skills are just as much new avenues of learning as are the design of hardware and software in integrated office systems. Even if, eventually, some vendors in the office area will incorporate evaluation and implementation expertise within their own in-house capabilities, the sources of this primarily behavioural expertise are presently without and not within most vendors' organizations and these sources require the same learning opportunities and active encouragement to enter the area as do equipment vendors.

Another consideration favouring three evaluation organizations rather than one stems from the nature of "objectivity". One meaning of objectivity is that observations and measurements are made in a way that someone else, using the same means, could verify - confirm or disconfirm - the observations and measures. At a deeper level, however, what is chosen and what is ignored

for observation and measurement is critical. It is impossible not to choose and ignore and, in that sense, all observations and measures are necessarily biased. Thus, for example, it could be argued that a "scientific" view is not unbiased, rather, "science" is defined as a particular bias. A realistic view of "objectivity" is that all relevant points of view - as defined by all interested parties - are included in what is chosen and ignored for observation and measurement. The members of any one outside evaluation organization will likely be biased in some ways from some perspective. By having three, rather than one, outside organization, no one consistent set of biases will permeate the whole of the evaluation. This point is somewhat parallel on the evaluation research side to the fact that each of the three vendors is approaching integrated office systems from somewhat different technology perspectives - for example, telephone lines versus local area networks versus cable.

A third reason favouring three evaluation organizations is the advisability of minimizing risks. Even in the unlikely event that everyone could agree that there was one best organization for the job, there is no assurance that serious things could not go wrong and jeopardize the evaluation. There are enormously valuable gains to be obtained from the evaluation research and so it is warranted to try to maximize their achievement.

Also, vendors are legitimately concerned that unfair comparisons among the vendors are not occasioned by the evaluation research. Each site has unique elements and each vendor, as mentioned above, has a different technology perspective. Thus, simplistic comparisons should be avoided and one way of ensuring this is to have three separate evaluation organizations.

Returning now to the question of a coherent evaluation framework across the three trials, the uniqueness of the three should be mentioned again. This is true not only of the specific technologies, but also of the detailed aims of the client departments - for example, an information input and delivery system focus versus a management system and communications stress. A coherent framework can only apply to the common elements and is less important, if even possible, for the unique ones. Thus coherence may not be as much of a problem as it might first appear. But, to the extent that coherence

is desirable and attainable, it might be achieved by contractual stipulation that the three evaluation organizations coordinate their approaches to the common elements. The three could discuss and share their approaches and methods and this might even further contribute to minimizing the risks of poor execution of evaluation research. Approached properly, such sharing need not be very time consuming - a matter of a few early meetings among the organizations.

There are, of course, disadvantages to this method of obtaining a coherent framework. For example, a separate summary report might be needed at the end of each phase to integrate the three trial evaluations. However, we believe that the advantages outlined above for three rather than one organization are the overriding considerations.

The Specific Content Concerns of Evaluation Research

- (1) Quality of working life - job satisfaction, attitudes, equipment acceptance, enhancement of individual capabilities, social effects, organizational adjustments, work privacy and monitoring
- (2) Employment and training - job transformation, job classification, job displacements, training efficacy and optimization, effects on support staff, effects on the status of women, effects on unions
- (3) Health and safety - comfort, radiation, ergonomics (hardware and software), optimal human functioning, working environment
- (4) Organizational effects - productivity, effectiveness, efficiency, service delivery, organizational structural changes to optimize system usefulness, quality of decisions
- (5) Hardware and software - functionality, optimization for tasks, creative possibilities calling for ongoing evolutionary changes

Details of how these various content concerns are to be measured will be addressed in the contract report forthcoming from Trigon-CECIT. Measures will undoubtedly include absenteeism and turnover records, attitudinal assessments, rating check lists, performance measures, processing time, work time activities distributions, equipment use statistics related to given functions, error rates, communication mode changes. Interviews - individual and group - will be a primary source of data.

Since these are field trials and not laboratory experiments, many uncontrolled events will affect the measures. To isolate those effects from those attributable to the technological systems, some form of experimental design will be necessary within obvious practical constraints and limitations. This would indicate quasi-experimental designs with control groups. Also, logs will need to be kept of suspected significant uncontrolled events as plausible explanations of learning curve perturbations and so on.

Special Considerations

(1) Minimizing client department disruptions

The installation of systems will be highly disrupting for client departments. There is concern that further disruptions from evaluation research be minimized. This is to be assured by the outside evaluator working with and through an evaluation team which will include evaluators representing the client department, the Department of Communications, and the vendor at each site. Redundancy of specific research methods and questions can be avoided by full cooperation among these four representatives. In fact, the outside evaluator will serve as an advisor to the other three. However, the outside evaluator must clearly serve the OCS program and not lose his independent point of view by compromising with the interests represented by the other evaluators at the site.

(2) Special interest groups

Intra-governmental groups, such as unions and the status of women, have strong concerns about employment effects of the integrated office systems and about policy implications. Input from these and other groups will be through a consultative committee. The outside evaluator must address these concerns. However, it is extremely important that the concerns are addressed in a manner which will be entirely credible to the interest groups. The outside evaluator must choose measures and approaches that the interest groups can agree are sufficient and appropriate within reason. Direct interface with these special interest groups may be necessary quite early to ensure this.

(3) Sharing of data

Naturally, proprietary data, relevant to hardware and software, is the private domain of the vendor. But, apart from that, it is in the interests of all if evaluation data are freely shared among the four person evaluation committee at each site. Some may feel that this is giving away the benefits of their labours. However, all should realize that they will gain more than lose by having access to data gathered from a perspective different than their own. Any good researcher fully knows that any given set of data is open to a variety of interpretations. The sharing, in this case, is of data, not of interpretations.

Choosing an Evaluation Research Organization

(1) Expertise

- (a) methodology and research. A very broad base of expertise is necessary, encompassing everything from rigorous experimentation to survey methods and correlational approaches to informal observation. This implies quantitative strengths, statistical analysis, skills in research design and research tool development, as well as group and individual interview skills. Good judgement in choosing appropriate means is essential.
- (b) productivity assessment. The concern is mostly with knowledge workers and there are no accepted and agreed upon productivity measures. Hence there is no "expertise". But the organization must be able to address the very complex issue of productivity assessment for this class of work.
- (c) integrated office systems. A good familiarity with new technology hardware and software systems - computers, communications, office machinery - is highly desirable. Ideally, this expertise would be from both a technical standpoint as well as from a behavioural one.
- (d) organizations, social systems. Practical knowledge of and experience with the actual ways in which organizations operate is highly desirable.
- (e) knowledge of government. Besides knowing governmental concerns, this would facilitate expeditious access to necessary data.
- (f) ability to fairly address conflicting concerns. This would allow looking at the various issues from the many different perspectives in a convincing way.
- (g) commitment to leading edge technology and behavioural research. Ideally, a main thrust of the organization's business would be in the specific area of the trials.

(2) Most likely discipline backgrounds

- (a) behavioural psychology. learning, social psychology, ergonomics, environmental psychology, human factors, research design, statistics.

(b) engineering. communications and control, microelectronics, software design.

(c) organizational development. social psychology, sociology

(d) accounting, economics. cost/benefit analyses.

Activities and Estimated Person Days for One Year, One Site

<u>ACTIVITIES</u>	<u>DESIREABLE PERSON DAYS</u>	<u>MINIMAL PERSON DAYS</u>
Individual and group interviews with users:		
20 stations X 2 persons X 2 groups = 80 persons		
80 persons X 4 interviews at 4 per day	80	
80 persons X 2 interviews at 4 per day		40
Meetings with site evaluation team and with other groups		
2 meetings per month X 12 months	24	
1 meeting per month X 12 months		12
Intra-government data access (re: organizational structure, absenteeism, turnover, etc.)	20	10
Report writing	20	10
Research design	10	
On-site monitoring, observation and data collection		
6 days per month X 12 months	72	
Data analysis	20	
Systems analysis/software	15	
Ergonomics/environmental analysis	15	
TOTAL PERSON DAYS, ONE YEAR, ONE SITE	276	72
Costs, at estimated \$500 per diem	\$ 138 K	\$ 36 K

Notes: No provision for travel costs is included above.

At sites where the number of work stations is greater than 20, samples of size 20 could be chosen so that the amount of effort per site is constant.

If total funds permit only the "minimal person days" for each of 3 years (3 sites), then, alternatively, the total funds could be put into the first year "desireable person days" (3 sites) with no evaluation research in the succeeding two years. The greatest information value is anticipated to be in the first year.

Draft RFP (Request for Proposals) Statement of Work

Field trials of integrated office technology systems aimed at knowledge workers (managers and professionals) are being undertaken by the OCS program. The trials are in three government departments with systems being supplied by a different vendor at each site. The technologies include work stations which incorporate functions such as word processing and editing, filing, electronic mail and messaging, electronic document distribution, time and task management, graphics creation, information retrieval and others. Three different outside contractors are to be chosen to conduct evaluation research, one contractor for each site. While there are technology and function differences among the sites, the outside evaluation research contractors will be chosen first and paired with sites later.

The first year of the trials will be a pilot phase involving at each site about 20 work stations. The situation will be a dynamic one with training and system changes ongoing throughout the year. If the pilot phase is successful, the field trial at any site may be extended to a second and third year with the number of work stations increasing by factors of 10 in each succeeding year. Outside evaluation research contracts will be issued for the first year only with the possibility of renewals for subsequent years.

At each site, the outside evaluation research contractor will work closely with three internal evaluators. These three will represent the client department, the Department of Communications, and the vendor. The outside evaluator will be a key person representing the OCS program, and he must maintain a point of view independent of the three internal evaluators. But data will be shared freely among all four evaluators. The collecting of new data will be coordinated by the four evaluators in order to minimize disruptions in the client department. This coordination will also obviate redundancies and will aid the efficiency of data gathering.

The outside evaluator at each site will have three general objectives:

1. Documentation

This will mean capturing, critically analyzing and interpreting significant events so that future planning and implementation of integrated office systems can benefit from guidelines emerging from the documented experience of the field trial. Methodologically sound empirical evidence will be gathered by the evaluator with the aim of

yielding major contributions to the understanding of integrated office systems implementation.

2. Monitoring

The outside evaluator, with a unique, independent perspective, will be able to flag sub-optimal aspects of technology implementation at the time of occurrence so that corrective actions may be initiated. Also, part of the monitoring function will be to critically assess the methodologies and data gathering activities of the three internal evaluators at the site. The validity of subsequent conclusions by those evaluators can then be assessed.

3. Gathering new data

This will include information of interest to (a) non-participating office technology equipment designers and vendors, (b) the general public on matters of the social and work implications of integrated office technologies, and (c) those who are interested in the implications of these technologies for public policy and the general economy.

The outside evaluator will gather empirical and other evidence for direct and indirect effects of integrated office technology on the following topics:

- (1) The quality of working life - job satisfaction, attitudes, equipment acceptance, enhancement of individual capabilities, social effects, organizational adjustments, work privacy and monitoring
- (2) Employment and training - job transformations, job classification, job displacements, training efficacy and optimization, effects on support staff, effects on the status of women, effects on unions
- (3) Health and safety - comfort, radiation, hardware and software ergonomics, optimal human functioning, working environment
- (4) Organizational effects - productivity, effectiveness, efficiency, service delivery, organizational structural effects, quality of decisions
- (5) Hardware and software - functionality, optimization for tasks, creative possibilities, evolutionary changes

In approaching the general objectives and specific topics above, the outside evaluator must use sound research designs and methodologies which are fully appropriate to the questions. He must use the best extant measures and may also need to develop new dependent measures and methodologies to shed light on the various research questions. Where appropriate, full quantitative treatment and statistical analysis of data will be required. In all cases, the research methods must be reasonably credible to all interested parties, no matter what their pre-existing biases. The aim is to gather sound evidence which will stand up under critical scrutiny so that conclusions and interpretations that are drawn can be readily defended as to their validity.

The following list suggests some of the expertise and knowledge which is pertinent to fulfilling the required work.

1. behavioural psychology - learning, social psychology, ergonomics, environmental psychology, human factors, research design, statistics
2. social research - correlational methods, surveys, group and individual interview skills
3. productivity assessment of knowledge workers, government employees - economics, accounting
4. integrated office systems - hardware and software from technical, engineering, behavioural and cognitive points of view
5. organizations, social systems - social psychology, sociology
6. understanding of government



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