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INFORMATION TECHNOLOGY MANAGEMENT: AN INTEGRATED APPROACH

Summary

by
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Canada

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Sommaire

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FOREWORD

This report presents an integrated process for the management of information technologies. The research on which it is based was conducted while the author was a guest researcher at the Canadian Workplace Automation Research Centre (CWARC), between October 1987 and August 1988. The author was seconded to CWARC under the contributions and exchanges program from his position as a Professor at the École nationale d'administration publique.

We would like to thank CWARC for having us. This report would not have been possible without the resources made available by the Centre and the experience of the researchers around us. Our thanks to Michèle Guay, Director, Organizational Research, who guided us in designing an integrated approach to information technology management. We also wish to thank the researchers of the Organizational Research Directorate, who discussed this report with us and offered their cooperation in various ways.

Jo Katambwe, a CWARC researcher, deserves special thanks. His work and our many discussions made an important contribution. Antonin Tremblay, a guest researcher at CWARC and a Professor at the Université du Québec à Chicoutimi, and Claude Maltais, a CWARC researcher, were particularly helpful in contributing to our thoughts on strategic planning. Finally, Michel Frenette, a guest researcher at CWARC, assisted in many ways, specifically by allowing us to take part in a strategic planning exercise for workplace automation implemented in the public service. That experiment gave us real facts on which to base the approach proposed in this report.

A number of people deserve thanks for their comments on a preliminary version of the study report, resulting in considerable improvements: René Poirier, a CWARC researcher; Jean-Marie Fahmy, a guest researcher at CWARC and President of FGT (consultants in training, management and technology); and Pierre Voyer and Yves-Chantal Gagnon, Professors at the École nationale d'administration publique. We take responsibility for any remaining errors.

Michel Paquin

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INTRODUCTION

There are many works dealing with the management of information technologies, and anyone who undertakes a study of the field may end up feeling as though he or she has become lost in a jungle. The purpose of this study is to survey the various approaches and discover a path through that jungle leading to an integrated approach.

In this summary report, we will give a general description of an integrated approach for managing information technologies, intended for people involved in managing those technologies at the planning, implementation or evaluation level. They may be consultants, managers in an organization, specialists in information technology or human resources management, or users of the technologies who sit on committees or design groups.

The report is divided into seven sections. We first present the steps in the information technology management process, and then discuss an approach for each step. Sections 2 and 3 are devoted to the strategic planning process at the corporate level and for information technologies, respectively. Sections 4 and 5 explain the planning approach for a project, including the needs study (Section 4), options study and design of the selected option (Section 5). Section 6 deals with the implementation of the project, and Section 7, its evaluation.

I. THE MANAGEMENT PROCESS FOR INFORMATION TECHNOLOGIES

"Information technologies" here refers to the means employed to produce, process, store, retrieve and disseminate oral, written and graphic information. The new information technologies are likely to bring about major changes in organizations, and such changes need to be managed efficiently if the introduction of new technologies is to be successful.

The management process is the structured combination of activities related to the introduction of a new technology, and comprises the standard phases of planning, implementation and monitoring/evaluation. Figure 1 illustrates the various activities in the management process.

The first two steps in the management process are related to strategic planning: firstly, corporate planning and, secondly, planning of information technologies. The strategic importance of information technologies means that they must be considered in the company's strategic planning. The strategic (or master) plan for information technologies is based on the strategic plan for the entire organization.

Steps 3 to 7 apply to specific projects described in the strategic plan. Steps 3 to 5 correspond to the project planning phase. For each project, a design group begins with a diagnosis of the situation and a study of needs (step 3), studies and compares various options (step 4), and produces a detailed design for the selected option (step 5). This planning phase is not restricted to technical aspects, but also looks at human needs.

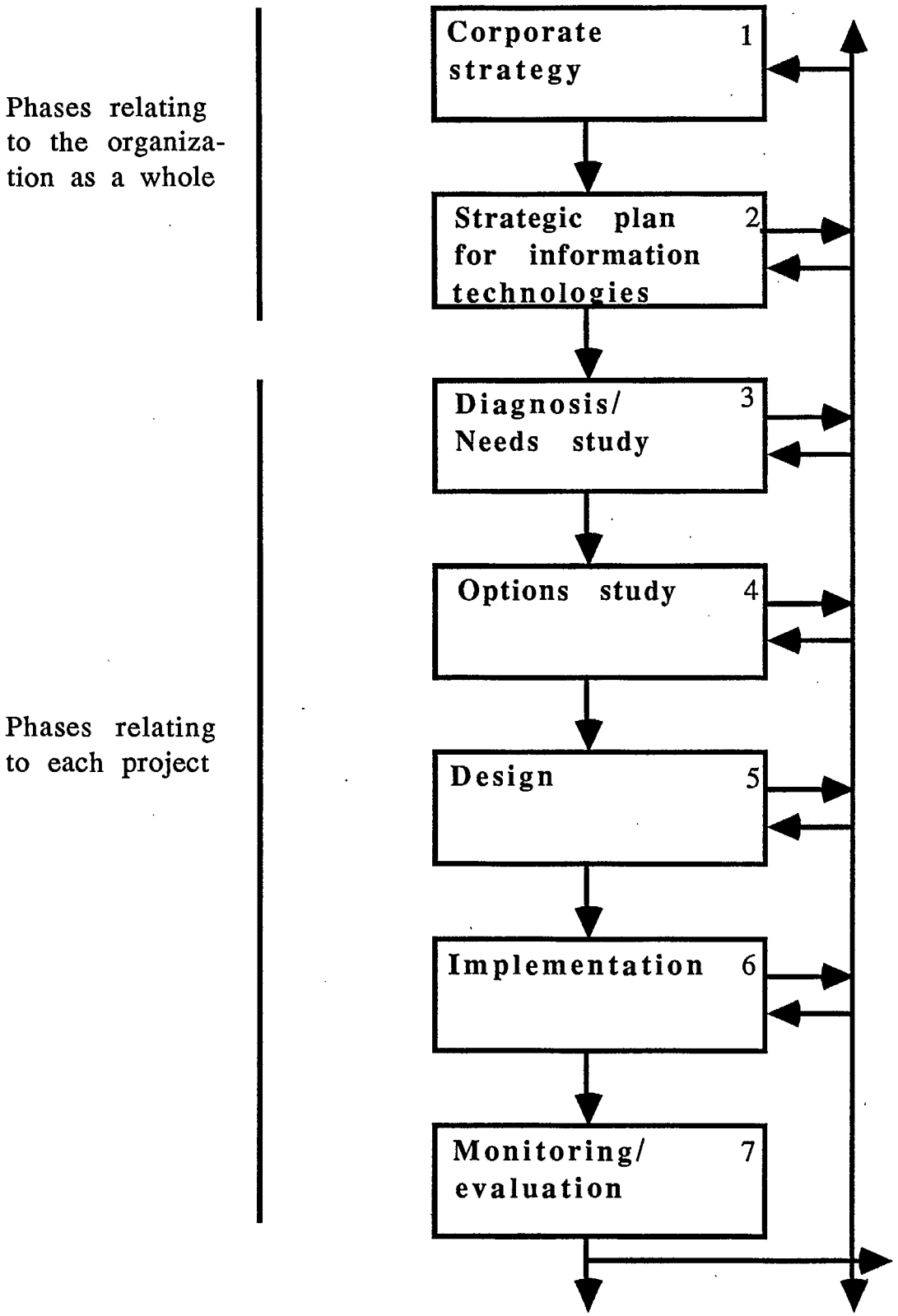

Figure 1 Management process for information technologies

The implementation of the new technology (step 6) assumes that employees have been informed and trained, support mechanisms designed, and an implementation strategy devised. The monitoring/evaluation phase (step 7) is intended to ensure that the project is implemented and operates as planned, and to measure its effects.

The management process is iterative. The information obtained at each step can be used to review the results obtained at previous steps, as shown by the feedback arrows in Figure 1.

II. INFORMATION TECHNOLOGIES AND CORPORATE STRATEGY

Companies generally have a strategy, whether or not it derives from a formal planning process. Information technologies must be taken into account in preparing that corporate strategy, since they may make a substantial contribution in strategic terms, such as giving the company a competitive advantage.

Information technologies change the nature of competition in three ways. First of all, they change the structure of the industry. Secondly, they may constitute an important asset for companies that wish to apply them to gain a competitive advantage. Finally, they spawn entirely new services and products (Porter and Millar, 1985). Many authors (Bakos and Tracy, 1986; Benjamin, Rockart, Scott Morton and Wyman, 1984; Groupe DMR, 1987; Gerstein, 1987; McFarlan, 1984; Parsons, 1983; Porter and Millar, 1985; Wiseman and Macmillan, 1984; Wiseman, 1985) have pointed out that information technologies can represent an important advantage for many companies. Let us see, then, how the strategic contribution of information technologies can be taken into account in the corporate strategic planning process.

Strategic planning generally presupposes that the company defines its aims or its niche on the basis of its values and culture, that it sets objectives (market share, profits, etc.), in terms of the difference between its current situation and the point it wishes to reach, and that it determines the strategies to be employed, based on its analysis of its environment (study of opportunities and threats) and internal situation (strengths and weaknesses of the company).

Questions related to information technology must be examined as part of that approach. The first question relates to the facts available on those technologies. If the company does not have all the relevant data on the information technologies in use or under development for companies in its sector, an action plan for gathering that information will be needed. In that case, a number of means must be employed: a literature review to

identify new technologies and the experiences of other users who have implemented them, or to gain access to specialists who have practical knowledge of them; consultations with suppliers on available technologies and upcoming developments; visits to companies known for their forward-looking approach to technology; information on competitors' plans, and so on.

Once the present and foreseeable status of information technologies in the company's activity sector is clear, the next step is to examine how those technologies can influence its competitive position. Can the new information technologies help reduce production costs or improve the product in some way to make it more valuable for customers? What changes can be made to the product to make it stand out from competitors' products? Can the structure of competition be altered, for example by making customers more dependent on the product and the company less reliant on suppliers? Do the new information technologies open the door to substitute products that may threaten the company's market share? How do those technologies change the entry conditions for its activity sector? What will be the effect on competition between companies in the sector?

The new information technologies may enable the company to offer new products related to its main activity (automated tellers in the case of banks, telematics in the case of a telephone company, etc.), and such possibilities must be examined closely.

Thus an analysis of the strategic contribution of information technologies is one of the cornerstones of the company's strategy, which in turn is normally used to prepare the strategic plan for information technologies.

III. THE STRATEGIC PLAN FOR INFORMATION TECHNOLOGIES

A number of authors (including Cassar, Garceau and Baribeau, 1988; Gouvernement du Québec, Department of Communications, 1987; Monger, 1988; Tapscott, Henderson and Greenberg, 1985) have suggested strategic planning approaches for information technologies. The approach proposed here, while it may lean on some of those authors' ideas, is founded in particular on the results of a research project carried out by a CWARC team (Frenette and Paquin, 1989).

In the context of corporate strategic objectives, the strategic plan for information technologies sets out specific goals for those technologies, and presents policies related to the technical, organizational and social aspects that will guide their implementation. The strategic plan also includes a list of projects, accompanied by a timetable for their accomplishment. Strategic planning for information technologies comprises the following phases: setting up the planning group, examining the current situation, determining technological, organizational and social aims, evaluating those aims, and drawing up the action plan and strategic plan.

The preparation of a strategic plan for information technologies is in itself a complex operation, and a framework for its achievement must be established. The task of preparing the plan generally falls to a task force of technology specialists and persons intimately familiar with operations. Ideally, those persons should be assigned full time to the task, and one person should be appointed to head the group.

The task force reports to a steering committee of senior managers, which decides on its mandate and composition, approves the work plan drawn up by the group, monitors the work carried out, decides on the information policy as concerns the master plan, and approves the plan submitted to it.

The summary of the current situation consists in identifying the organization's objectives and describing its situation in technological, organization and social terms.

A number of sources are necessary to draw up this summary of the current situation. Useful information can be drawn from documents already available on the organization: the company's strategic plan, statements of objectives, investment budgets, previous plans concerning information technologies, studies on existing information systems, equipment inventories, organization charts and so on.

A detailed inventory of the information technologies used in the organization should be prepared, if not already available, including a description of existing technological architecture. That inventory will make it possible to determine which of the facilities already in place can be of use for the new systems planned.

The summary should be rounded out by interviews with key personnel and, in some cases, questionnaires on specific aspects. The interviews should provide a detailed picture of the organization, bearing in particular on its critical success factors[1], work processes, technologies in use and problems encountered. To obtain a sufficiently comprehensive overall view, interviews should be conducted in every administrative unit.

Working from the organization's objectives, critical success factors, type of activities, technologies in use and human factors, the group can define technological, organizational and social aims to assure the company's success.

The persons involved in discussions when the situation summary is drawn up can point out the strengths and weaknesses of the technologies currently used. In many cases, they make suggestions to modify or replace existing systems. Sometimes studies have already been carried out

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[1] Critical sucess factors are those for wich satisfactory results must be obtained to ensure good performance. For exemple, in a compagny's stores, stock turnover and availability of products are critical success factors.

and proposals put forward concerning the introduction of new technologies. Those studies can serve as a starting point for identifying promising technologies, but are generally insufficient. In most cases, it is appropriate to proceed with a review of specialized publications that discuss ongoing developments in information technologies and report on successful experiences.

Furthermore, it is often a good idea to meet with suppliers of equipment or various applications who can conduct demonstrations of specific technologies, to visit organizations recognized as being on the leading edge in the technological field, etc. The information gathered can be used to identify the most promising technologies, in view of the organization's needs.

To carry out an analysis of these promising technologies, it may be appropriate to group them by purpose or field of application. For example, communications, operational information systems, document creation and publishing, management information, decision support and administrative support systems could all be examined in turn.

Once the analysis by field of application have been completed, an examination of the integration options must be the next step. The results of the analysis will allow the task force to suggest an integrated architecture: location of computers, communications networks and interconnections to be set up, location of shared equipment, configuration of workstations, etc.

In addition to technological considerations, organizational and social factors must be taken into account. Accordingly, policy statements should be issued on quality of work life (ergonomics of hardware and software, work environment, job enrichment), employee training, job security and re-assignment, and so on. The processes necessary for the implementation of the plan must also be devised: means of designing specific projects, creation of a support structure (an info-centre, for example) and its role, etc.

A cost-benefit study must be part of the strategic plan. That study should take an overall view, however -- it is only when analysing specific projects that in-depth cost-benefit studies are called for. The purpose of the cost-benefit study carried out when14 the strategic plan is being prepared is to show that the technologies under consideration hold sufficient promise to be included in a strategic plan, with feasibility studies to be conducted later for the projects selected in that plan.

With the knowledge of the applications to be developed and the technological infrastructure in which the development is to take place, the task force can then draw up an action plan with a schedule for the projects, and present budget estimates. This action plan is a general one, spread over several years. A detailed operational plan must also be drawn up every year.

Once those steps have been carried out, the strategic plan for information technology can be prepared. That plan will explain the company's strategic aims and objectives, its current technological, organizational and social status and aims, the cost-benefit analysis conducted, the proposed action plan, its update and the distribution of responsibilities for its achievement.

IV. THE NEEDS STUDY

When the strategic plan for information technologies has been approved, an in-depth study of each of the projects in the plan must be undertaken before they are implemented. This analysis or planning phase involves three steps: the diagnosis or needs study, the study of options and, finally, the detailed design of the option selected. This section is devoted to the needs study step, and deals in turn with the design group, the general examination of the situation, the technical analysis and, finally, the social analysis.

The preparation of a strategic plan for information technologies normally involves setting up, for each project, a group responsible for the analysis and detailed design of that project. A steering committee is responsible for establishing those design groups, defining their mandates, issuing them with instructions and monitoring the work performed.

We recommend that design groups consist mostly of users, with the expert(s) appointed to the group playing the role of adviser rather than designer.

One of the first tasks of the design group is to define the approach it intends to employ. We recommend an approach that takes account of both technical and social factors, whether it is a proven one such as the user-driven method (Tapscott, 1982), the ETHICS method (Mumford, 1983) or the socio-technical analysis (Pava, 1983) or an ad hoc approach.

The analysis work of the design group begins with a general examination of the unit (or system) concerned. The purpose of this step is to reach a consensus among the members of the group regarding the mandate of the unit, its objectives and critical success factors, principal external influences affecting the unit, organization of production, the work process, physical layouts main obstacles to production, strengths and weaknesses of the technologies used, the philosophy of the organization in

terms of human resources management, the major problems experienced by employees, etc.

The technical analysis consists of studying the unit's production processes, the tools and procedures employed and the problems encountered (with regard to input, processing and output). The study of those problems leads to the quest for technology-based solutions. There are numerous methods designed for examining technical systems, and the design group will have to look carefully at the possibilities before choosing one or more methods. Depending on the type of tasks carried out, some methods are more appropriate.

According to Pava (1983, p. 49), the type of analysis to be conducted depends on the relative proportions of routine and non-routine tasks. That observation leads him to distinguish among three types of situations: routine work, non-routine work and, finally, mixed situations where there is a combination of routine and non-routine tasks. We will now examine the analysis methods appropriate to each of those situations.

In the case of **routine or structured tasks** giving rise to a sequential production process, the analysis of variances by means of a matrix showing the repercussions of a variance during a specific operation on subsequent operations is particularly pertinent. There are examples in Pava (1983, pp. 79-84) and some in applications where the ETHICS method was used (Mumford, 1983; Mumford and Weir, 1979; Mumford and Henshall, 1979 and 1983).

In the case of **non-routine or non-structured tasks**, there are a number of possibilities:

- study of the deliberations in which employees are involved (Pava, 1983);
- study of the decision-making roles of managers (McLoed and Jones, 1987);
- critical task method (Harris and Brightman, 1985);

- mobile-bureautique methodology (Conrath et al., 1982; Conrath et al., 1983).17

In the case of **semi-structured tasks or mixed situations**, any of the following methods may be used:

- OAM (Office Analysis Methodology) method (Sirbu et al., 1983);

- variance analysis applied to mixtures of activities too complex to be suited to a variance matrix (Pava, 1983, Ch. 6; Mumford, 1983: pp. 69-76);

- the key product analysis method, proposed by the National Bureau of Standards (NBS) of the American government (1980).

Finally, the user needs workshops method of Johansen and Baker (1984) is applicable to all situations, as is Tapscott's user-driven method (1982). With this latter method, however, needs are determined not through a study of tasks, but by studying opportunities related to each technical function. There are six types of tools (requirements) that should be covered by an opportunity or needs study: communication tools, information tools, decision-support tools, document-production tools, administrative support tools and data-processing tools.

While the technical analysis identifies the organization's needs in terms of its performance, the parallel social analysis is aimed at examining employees' needs. Since there is a relationship between the amount of use of a new technology and employees' satisfaction with the change, the need for changes in the organization of work must be studied when a new technology is introduced, to optimize both the technical and social systems.

A number of proven instruments are available for the diagnosis of the social system, including:

- the job satisfaction questionnaire associated with the ETHICS method (Mumford, 1983);

- the Job Diagnostic Survey (Hackman and Oldham, 1980);

- the Michigan Organizational Assessment Questionnaire (Cammann et al., 1983);

- questionnaires applying to different work aspects in the collection published by Cook et al. (1981).

Once the needs study of the technical and social systems has been completed, the options study is the next step.

V. THE OPTIONS STUDY AND THE DESIGN OF SELECTED OPTIONS

Before proceeding with the options study, it is important to define the system's objectives. This study must be approached from a socio-technical point of view, and must identify the organizational and technical options. Finally, a detailed design (work organization, selection of hardware and software) will be produced for the best option (depending on to what extent it reaches the objectives).

Working from the needs study (the organization's performance needs, employee needs), the objectives that the new system is to be designed to meet can be identified. It is up to the design group to define and prioritize the objectives. This can be a fairly complex process. Mumford (1983, pp. 85-90) proposes that the minutes of the design group's meetings be used to draw up lists of problems, from which lists of objectives can be prepared.

Once the objectives have been identified, the importance assigned to each must be determined so that they can be ranked. Finally, the objectives are translated into specific and measurable targets. For instance, the objective of increasing productivity is translated into work volumes for specific employee groups.

The organizational options relate to the ways of organizing the administrative unit where the new system is to be implemented, in particular the various work organization possibilities (Hackman and Oldham, 1980; Paquin, 1986); they are designed by distributing, in various ways, the different tasks and activities among work groups, and then among employees.

Once those various options have been determined, the next step is an analysis of benefits and drawbacks as regards job satisfaction and performance.

In that way it is possible to evaluate each of the options with respect to the achievement of objectives, and to select the best organizational options.

The technical options must be designed at the same time as the organizational options. Each of the technical options comprises a coherent set of means (hardware, software and person-machine interfaces) that can contribute to the achievement of the objectives set.

Once they have been identified, the technical options must be evaluated. An analysis of benefits and drawbacks is conducted for each option, with reference to every objective. When that analysis has been completed, the list of the best technical options can be drawn up.

After they have been identified, the organizational and technical options that appear to be the best should be combined. Only perfectly compatible organizational and technical options should be grouped together. The resulting socio-technical options should in turn be evaluated, analysing benefits and drawbacks in terms of the objectives. The option chosen is the one that best meets the objectives.

A new project often must be justified by a profitability analysis. In that case, a cost-benefit analysis should be used (Dumoulin, 1986; IBM; Meyer, Dean and Boone, 1987; Strassmann, 1985). In theory, this type of analysis makes it possible to rank the various options by a specific criterion (the rate of return on investment required by the project, or the cost-benefit ratio) and the best project is the one that offers the highest rate of return or net (less costs) benefits.

In practice, it is often impossible to assign a monetary value to all or part of the benefits flowing from a project, and hence to conduct a true cost-benefit study. In that case it is best to describe the expected benefits in quantitative terms as much as possible (e.g., the improvement in customer service expressed as a percentage of the reduction of waiting time). It is up to senior management to decide whether the investment is worthwhile, by assessing the value of the expected benefits.

When the steering committee has approved the design group's recommendation on the best option, it is time to move on to the detailed design of the selected option, comprising work organization, choice of hardware, selection or design of software, and the design of the work environment.

The design of work organization begins with a detailed analysis of the activities to be carried out, depending on the system to be installed. After those activities have been identified and the processes described (the study of processes deals with the successive work phases), the tasks are distributed among work groups and employees. It is at that point that the size (and number) of work groups is determined, as well as their independence, the type of supervision and the distribution of tasks among the members of the group (polyvalency vs specialization). Finally, a job description must be prepared for each position, and job evaluation must be made.

When several products seemingly correspond to the technical specifications for the option selected, those that best meet the organization's needs must be chosen from among the hardware and software available. The evaluation criteria used may be related to the product's features, the supplier, the maintenance and repair service and the support required for the system (Derome, 1985; Lévesque and Nguyen, 1988).

The evaluation criteria for the product relate to the functionality of the system (its ability to perform the expected functions), its reliability, capacity, speed, user-friendliness, ease of use, possibility of adaptation to changing needs, compatibility with other equipment (current and foreseeable) and ergonomic characteristics to ensure the user's comfort. Cognitive ergonomics, often neglected, are particularly important. (On this subject, see Giroux and Larochelle, 1987; and Sperandio, 1987.)

Comparing products on the basis of several criteria may be a fairly complex operation. For each application considered, it is necessary to prepare a list of evaluation criteria (e.g., functionality of the system,

reliability, compatibility, ease of use, ergonomics, service quality, availability of training, etc.), weight and rank those criteria and, finally, evaluate every product with reference to each criterion (by assigning a rating on a scale of 1 to 10, for instance). The result of that operation is a rating for each of the products under consideration; but the final choice can be made only once costs have been taken into consideration, hence on the basis of the cost-effectiveness ratio.

The decision may be to design a system, rather than choose one of the options available on the market. For example, it is not always possible to find an information system (database management system, decision support system, etc.) suited to the organization's needs. In such cases, the information system must be designed. Note that there are generally two approaches or philosophies of system development (as opposed to design): the traditional approach, and iterative approaches (prototyping, evolutionary approach, etc.). The iterative approaches proceed progressively through the development of the system, and involve users to a greater degree. They are particularly recommended when activities are less structured and decisions less suited to programmed solutions (Michon and Gingras, 1986).

Finally, another aspect of the detailed design of the option selected is the layout of the work area and the workstation. The selection of furniture, its layout, space management, lighting, air conditioning, noise protection and air quality must all be considered (Commission de la santé et la sécurité du travail [Workers Compensation Board], 1982; Dainoff and Dainoff, 1986; Goumain, 1989; Oborne, 1985; Poirier, 1988). Satisfaction in those areas is important if the new technology is to be successfully implemented.

Once the design of the option selected has been completed, the next step is its implementation.

VI. IMPLEMENTATION

The implementation phase is particulary critical to the success of a project. Failures are frequent, and are generally attributed to human and organizational difficulties. Introducing a new technology involves the problem of managing change, calling for the adoption of an implementation strategy, an employee information policy, training, re-organization of work in keeping with employees' expectations, support mechanisms and management methods aimed at easing the transition.

When a system is implemented, a number of strategies may be considered with regard to the initial extent of the project and the rate of introduction. Let us take, as an example, the installation of one hundred multi-function computerized workstations (word processing, decision support and administrative support systems, etc.) in a network. All one hundred workstations may be installed at once, or a pilot project may be carried out involving only twenty workstations. Whatever approach is chosen, a decision must also be made between total implementation, introducing all the applications at once, and gradual implementation, introducing the applications one by one.

These implementation approaches each have their benefits and drawbacks. The choice depends on the situation. The greater the uncertainty, the better it is to implement the new technology gradually and through a pilot project (Eason, 1982; El Sawy, 1985; Hotte, 1983; Tapscott, 1982).

Even if it delays the benefits, such an approach may be preferable in that it increases the chances of success if the information gathered during the pilot project makes it possible to improve the project design and management of change.

The fact that representatives of the future users are involved in the design of the project will simplify the dissemination of information to some extent. However, that measure is not sufficient. The design group must

draw up an employee information policy, specifying what information will be provided on the reasons for the project, its organizational and technical aspects and how it will be implemented: speed of introduction, employee training, work re-organization, support mechanisms and specific measures during the transition period. The policy should also set out how that information is to be communicated.

Employee training is one of the most important variables in the implementation of new technology. A training plan must be drawn up to meet the learning objectives, with its contents related to users' real needs. The pedagogical approach and training tools must be specified (Frenette, 1988).

It is important that the training effort be well managed, in particular by allocating the necessary resources and evaluating the results obtained. This evaluation must be conducted during the training process so that the necessary adjustments can be made, and on completion, to summarize by measuring the results obtained.

The introduction of a new technology may lead to many changes in work organization (the changes to be made were defined during the detailed design of the option selected). To introduce those changes, the required activities and the schedule must be specified, in accordance with the planned date for the introduction of the new technology.

The changes made to work organization may call for substantial efforts on the part of the organization, as well as a specific strategy. For example, if the approach chosen is to establish semi-autonomous working groups, whereas employees now work on their own and are subject to direct and close supervision, a strategy aimed at easing their transition to automy will be necessary.

The implementation of a new technology cannot succeed without the necessary support from the organization. That support may take various forms, including senior management involvement, which must allocate the necessary resources. An important factor in the successful introduction of a

new technology appears to be the presence of someone who will sponsor the change and guide its introduction into the organization (Mankin, Bikson and Gutek, 1985). The organization must provide the support of technology experts, but also of specialists in work organization, ergonomics and human resources management. Another important factor in its success is to ensure that there is quick response to users' problems.

There may be a rather lengthy transition period when new technology is introduced. Some specific measures must be taken to ease that transition. For example, employees must be given sufficient time to master the system, and the necessary time and resources must be invested. In particular, the organization must be prepared to accept the inevitable drop in productivity that accompanies the learning period.

Once the project has been fully implemented, the next step is to evaluate it.

VII. EVALUATION

The purpose of evaluating a project is to ensure that everything is proceeding according to plan before making the necessary adjustments, if any. There are two types of evaluation: monitoring, which deals with day-to-day operation, and impact evaluation, which looks at the project's repercussions on productivity, job satisfaction, etc. Monitoring should begin as early as possible, so that minor errors can be corrected quickly, while an impact evaluation can be carried out only in the medium and long terms. It may be several months before significant results can be obtained (because of training time, the breaking-in period, etc.).

One of the evaluation team's first jobs will be to define the objectives of the evaluation. In addition to ensuring that the system is operating as planned and meets the goals for which it was designed, the evaluators must also examine aspects such as how and how much it is used, users' satisfaction with the technology, productivity and performance, quality of work life, work organization and its effects on satisfaction with job content and motivation, communications in the organization, etc. See Kling and Iacono (1988), Long (1987) and Zuboff (1988) in particular on the effects of new information technologies on employees and the organization.

A number of approaches may be used for the impact evaluation. The choice of an appropriate approach depends, in particular, on whether preparations were made for it during the project planning phase. If such an evaluation was included in the plan, then steps could be taken prior to project implementation, and the approach consisting of comparing users before (which must already have been done) and after the implementation may be used.

Another approach is to compare the user group with a different group that continues using the same work methods as before. This is a more costly method, since it involves collecting data from another group in addition to the group that is the focus of the evaluation. However, the resulting comparisons are a valuable tool.

Finally, when no preliminary measurements or control group is available, the evaluation can be done on the basis of natural variations in the implementation (Kishchuk and Légaré, 1988). In this case, a comparison is drawn between people or groups who were to have received the same system at the same time but who, for various reasons, had different experiences. Such differences may be related to the training sessions attended by each person, the applications actually available, applications actually used, and so on.

Once the evaluation report has been completed, its conclusions should be submitted to the groups involved, for discussion. The evaluation team will then be ready to make recommendations for submission to the steering committee.

CONCLUSION

Our intention in this report was to present a general description of an integrated approach for managing information technologies. The field we have tried to cover is extremely varied and complex. The approach suggested reflects the author's preferences to some extent. Accordingly, we chose a socio-technical approach that assumes that not only technological considerations, but also the social dimension, will be taken into account during the strategic planning (master plan for information technologies), project planning (needs study, options study and design of the option selected) implementation and evaluation phases.

We hope that the reader will find this report useful and that it will serve as a guide through the jungle of information technology management.

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