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**"Human, Organizational and Social Dimensions of Information Systems Development"**

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<p style="text-align: center;"><b>Information Systems Development Methods and User Participation: a contingency approach</b></p>
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**Abstract**

The influence of participation in information system development, is not always positive. Some researchers have proposed a contingency approach with a rather monolithic view of users. The aim of this paper is to show that this approach may be improved if different types of participation are taken into account. The first part highlights the variety of forms of participation, through six case studies. The second part shows how participation takes place in an organizational context and induces social interactions. The effect of participation on complexity depends on the choice of users, the attribution of roles and the selection of phases during which they participate. The differing modes of user participation may serve differing aims. It is one factor involved in the monitoring of a project's progress; they must be chosen according both to the contextual framework and to the project 's goals.

**Introduction**

The idea of method is based on the possibility of identifying categories of problems which call for analogous responses. Expertise and previous experience are reduced to a set of concepts to be reused when dealing with a variety of problems which belong to the same category. The result is what may be called a theoretical method. Confronted by difficulties encountered in information systems development, several researchers have called the traditional life cycle into question (Ahituv et al. 1984; Boehm 1988). They have attempted to go beyond this rigid framework and have put forward contingency factors and relationships which guide the choice and practical use of a method (Davis et al. 1986; Kraushaar 1985; Iivari 1983; Mahmood 1987).

While theoretical methods hardly deal with the problems raised by user participation, it is a key issue when putting a method into practice. Some researchers have proposed a contingency approach of participation (Tait 1988; Mann 1984). The aim of this paper is to show that this approach may be improved if different types of participation are taken into account. User participation is one factor involved in the monitoring of a project's progress ; different modes of participation must be chosen according to the contextual framework.

## **Rationale**

The idea of a "user" took on its full meaning when the IS Function stopped being part of an Administrative Department and became a separate function in its own right. The lack of participation, at that time frequent in the development of information systems, was experienced as a power struggle between the IS Department and User Departments (Ballé and Peaucelle 1972). Since the 1970s experiments and research into participative design have flourished (Bjorn-Andersen 1980; Land 1980; Berger 1980; ACTIF 1981), but the results did not allow one to draw any definite conclusions as to the positive influence of participation. According to Ives and Olson (1984), this is notably owing to methodological weaknesses. We have chosen an idiographic research strategy with the primary aim of finding out how and why events happen.

This paper is part of an action research, from which I tried to establish how different project situations call for fitted practical methodological approaches (Morley 1991). Six projects were selected, in which I have been acting both as an observer and as a participant, either a member of the project team or a methodological advisor. Assuming that a project is "complex" if one can hardly have a clear view of how to identify the requirements and to build a workable solution, the six cases were complex projects. For all of them, a new ISD method was being implemented.

Focusing here on user participation, I have attempted to answer the following question :

*Does user participation reduce the complexity of a project or is this depending on the features of the project?*

In the first part, we will highlight the variety of forms of participation, which goes beyond the idea of level used by numerous writers: consultative, participative and consensus (Mumford 1979; Ives et al. 1984; Hirschheim 1985). In the second part we will analyze the effect of participation on complexity.

## **Part One : the many-sided reality of users**

### **Case 1 : Insurance**

This firm is a large General Insurance Company which, in order to check a fall in profitability, decided to computerize on a large scale. The Processing Departments were compartmentalized. The management objectives were to standardize "products" between the various Departments and to simplify the processing of contracts by reducing the number of individual cases.

These objectives came up against the resistance of the Heads of Departments. These changes, which they had felt to be inescapable, seemed to be threats: the knowledge acquired over the years and which was the basis of their authority was now going to be shared, open and accessible to all, especially via the Product Information Database and through standardization. In addition each Department feared domination by the others. The size of the firm and the specific nature of its products called for participation. But inter-departmental rivalry and their desire for autonomy slowed down the definition of a new management system. Additionally, no single department had a global view of the firm's activity.

A Steering Committee had been formed with the Head of each Department. Conscious of the importance of the changes, General Management sought a consensus and refused to arbitrate.

Thus there were obstructions in the decision-making process and no organizational or management option was taken as definite.

The development model chosen was that of the waterfall. All the stages of the Merise method (Tardieu 1985) had been planned over five years. The project quickly ran into delays which led to an increase in the size of the team. Split up into eight sub-projects undertaken in parallel with the participation of each department concerned, the project failed to progress owing to the absence of key decisions on certain fundamental choices (eg a contract identifier) and constant backtracking.

At the end of a two year period, General Management stopped the project. Out of a group numbering thirty-five, only four were kept on. They followed up the Customer Database Sub-project, which was less threatening for the users and on which agreement could be reached.

## **Case 2 : Banking**

The Securities Department of this bank employed six hundred people. This figure was much greater than average-sized banks with a comparable field of activity. A plan to computerize operations was launched at the end of the 1970s with a view to cutting two hundred jobs.

A Preliminary Analysis worked out a five year plan. but seven years later, only one fifth had been computerized. There had been far-reaching changes in the regulations dating from this period. Each Head of User Division was supposed to take responsibility for the area of the project that concerned him but they were too absorbed in the short term to devote time to a project which seemed to them to be remote.

In 1986, a new Director was appointed to head the Securities Department. He decided to start the project again and seconded one of his assistants to manage the project and represent the users. With the help of an IS project manager and a consultant he undertook an Information Analysis using Merise method (Tardieu 1985). This procedure strongly reduced uncertainty as many users were now replaced by one person who could bring a working knowledge of the subject and its internal and external regulations and also take decisions. The new system came into operation two years later without any major difficulties or rejection.

Two phases can be contrasted ; during the first seven years, there was a wide-ranging theoretical participation and much inertia. During the second phase, the active participation of one single individual made it possible to bring the necessary know-how to the elaboration of the new system.

## **Case 3 : Transport**

This case involves a major urban transport company at the end of the 1980s. The Road Network Department included large Central Services to which were attached some twenty bus depots. Central Services had noticed that the quantity of maintenance equipment used varied from depot to depot. The information system was not sophisticated enough to provide an explanation. So the

Road Network Department asked the IS Department to study which management information system could be useful for a depot head.

The project manager suggested experimenting with a system approach (Mélèse 1972), with a participative design involving representative staff at every level in a pilot depot. The consolidation of the different models brought to light the manner in which Central Services guided activities by remote control via the daily submission of detailed and voluminous reports. The logic of the organization was based on a bureaucratic model (Crozier 1963) with a centralized 'brain' and the depots restricted to merely carrying out orders from the Central Services.

Creating new management tools could only be useful if it went hand in hand with the power to make decisions. It was necessary to be able to identify the types of activity which acted as the lever controlling and managing the activity. The project group designed such a working model. However, as the orientation of the study had provoked negative feedback in Central Services the study group restricted its report to merely stating a weakness in local control. The Road Network department decided to stop with the project.

This case sheds light on different reactions depending of the function of the users:

Operational staff at the depots, associated with modelling were not used to being consulted on the organization of their own work. They were surprised to be involved, some were even worried, but they made it possible to acquire a good knowledge of the depot's operation.

The depot head, associated with modelling, diagnosis and proposals for a new working system, hoped for fundamental change which would bring him more management autonomy. Central Services, cut off from operational services, expected a more accurate source of information which would enable them to detect possible fraud.

The Director of the Road Network Department, caught between a General Management advocating management preoccupations and Central Services with a conservative outlook wanted to avoid any conflict.

#### **Case 4 : Aeronautics**

This case involves a medium-sized firm whose main field of activity is the manufacture of aeronautical equipment. It had a good reputation as far as its products were concerned but found it difficult to meet delivery deadlines. IS Department suggested that a better organization and an adequate information system would reduce production times.

The study used the same system approach as in Case 3 above (Mélèse 1972) but the participation of operational staff was open and constructive. Several coordination disfunctions were brought to light, which called into question one aspect of manufacturing management.

The supervision of a Steering Committee made it possible to bring together various departmental heads to look into problems of organization and coordination.

However, the project group was not able to surmount the firms's hierarchical barriers: when it wanted to bring together both middle managers and operatives to discuss and go deeper into the proposals it came up against opposition from the formers.

The instability created represented a risk for heads of department. The Production Director refused to share responsibility for a process of organizational change and fell back on a "technical" solution, calling for a new information tool. The Director of the Mechanical Division

intended to remain independent in the choice of a package for his plant. Procurement did not wish to depend on Scheduling.

The fears of the supervisory staff, the expectations of the workers and the misgivings expressed by the heads of department worried the General Manager who decided to suspend the operation. Management's refusal to accept a period of "disorder" in which hierarchical demarcations would no longer be strictly respected blocked the passage towards a model with more responsibility (goals and control-boards at different levels) and less autonomy (with necessary coordination between units).

### **Case 5 : Automobile Manufacture**

This case study takes place in the Spare Parts Division of a major car manufacturer. A marketing need had become apparent. Beyond the follow-up of sales within the network itself, it was also necessary to know the figures of the global market and measure the manufacturer's ability to supply against customer demand. Sales & Marketing Department, whose marketing section was a recent development thus asked the IS Department to create a marketing information system.

The requirements analysis was fraught with uncertainty as it was new, there was no existing information system nor standard solution. The project manager therefore launched a participative study - consensus participation - in order to clearly fix the goals of a future system. This would be done through the technique of value analysis. The project group was made up of seven users (of which two were decisionmakers), two designers and a value analysis specialist.

At the beginning, this procedure was difficult to implement because it needed to break out of the existing framework. But it gradually made it possible to imagine other roles for Marketing, made feasible by bringing together data disseminated over the network. The degree of involvement in these creative sessions encouraged them to consider their own role in an open and innovatory fashion. Neither the designers nor the users working alone would have been able to arrive at the same result, namely defining new functions and identifying the necessary data.

### **Case 6 : Equipment**

**Equipment** is a subsidiary of a major car manufacturer, specialized in the production of gear boxes. At the beginning of the 1980s, the Plant Director wanted to improve the efficiency of the Maintenance Department. Much time was devoted to information-gathering concerning machines that were out-of-order, parts availability and the whereabouts of necessary tools. After discussions with the IS Director, the idea of a computer aided maintenance system was born.

Unlike an IS which is part of an operational activity, a CAM system is not indispensable when carrying out maintenance tasks. Any bypassing of the system by the workers therefore had to be avoided, whereas maintenance personnel were less than enthusiastic as the future system would introduce more transparency in their work which had not been greatly supervised hitherto. The need to motivate users led to an evolutionary approach (Courbon 1979) based on a real-life prototype (Janson 1985).

After an exploratory survey led by a manager from the Maintenance Department with the help of an IS project manager, a Statistics module was developed first in order to build up a picture over time. Three hundred requests for intervention were batch collected each evening. Several months later, the first set of statistics made it possible to carry out a review of each machine and each sector of production, which aroused the interest of several production and maintenance executives.

In the second phase a prototype was developed and set up in one section of the plant. Over the next few weeks, the user project director received and channeled a deluge of requests for modification. Next, after five series of refinements which enabled one to change screen presentation and add data, version 1 was set up in a part of the plant with fewer production constraints than the others. The motivation of production and maintenance workers who were involved, was a model for the rest of the plant. Their suggestions were taken into account for version 2, which was progressively extended to each production line.

Thus, after a representative participation reduced to just one individual, participation was extended to consolidate the design and encourage learning and use.

## **Part 2 : Integrating participation in project control**

### **2.1 Variety of effects and modes of participation**

From the case studies described above, we can observe that participation can lead to different results. The first two cases show how users may generate much of a project's difficulties. Extensive participation does not guarantee the success of the project, and may even affect it. The next two cases show how staff and middle management participation, in a highly hierarchical system, may lead to a questioning of the status quo and trigger off a conservative reaction. These two final case studies show two situations in which users as protagonists in their own process of change made change possible.

The case studies also illustrate various forms of participation: users may play different roles and their grouping may lead to different configurations.

Developing a new IS requires to gather knowledge, to make decisions and to build workable solutions. These requirements lead us to think of the question of participation through different roles depending on the tasks assigned to each of them. Four roles are commonly identified:

In the *client role*, the user expresses the request of a new IS. Then he has to decide upon a complete deliverable, that is part or all of the new IS.

In the *informer role*, he brings knowledge palliating ignorance on the part of IS designers.

In the *designer role*, he builds up solutions, usually with IS staff.

In the *end-user role*, the user has to test a first or a partial version of the new IS, in order to anticipate the reactions of the future end-users.

These four roles are hierarchically ordered: there is a "line" between client - designer - end-user, the informer being a resource person for the designer.

Roles are played by actors having a permanent function, in a hierarchical structure. When being engaged in a project they can be considered as a group which may show different structures. The case studies brought to light three possible configurations, depending on the power interactions between them.

*Type 1 : the individual.* There is only one user involved in the project and he shares responsibility for its completion. He plays a threefold role: informer, designer and end-user. He participates in the implementation of the new IS. He may be the decision-maker and end-user in the case of decision-making tools (Decision Support Systems) which are customized for and with an individual. He may be a manager who acts as a screen between IS personnel and the various people involved. Thus, he arbitrates the differences between the other users, whether in the position of final decision-maker or after close discussions with the person making the final decision.

*Type 2 : the hierarchy.* All participating users, with different roles, belong to the same organizational entity (Department, Division...). Decisions are taken by the only authority empowered to do so. The allocation of roles usually respect the hierarchical position of each user.

*Type 3 : the system.* Users belong to different entities in the Organization and, in practice, often to different Departments which have the same level of authority in the firm. Thus the role of the client is played by several managers who may be in conflict.

Thus, when tackling questions of participation one should have a perspective other than a confrontation between IS specialists and monolithic users. It is better to think of the designers intervening in an "organizational system".

## **2.2 Participation in the organizational context**

The development of an IS system does not take place in an organizational vacuum. The behaviors of participants are in part determined by the organizational structure within which they operate ie. the division of power, resources and activities, the modes of coordination, operating procedures or status. In addition, relationships between actors are governed by a set of norms (Tabatoni and Jarniou 1975) which restrict, legitimize or limit the field of action. These norms, in part internalized, are founded on the firm's dominant value system (hierarchy, initiative, profit, stability...). Within this framework and system of reference actors do not make up a close group striving towards a common purpose. Within areas of uncertainty are developed the strategies of groups or individuals (Crozier 1977).

The development of an IS is also an organizational change process (Ginzberg 1981; Zmud and Cox 1979; Keen 1981). It can open up change in structure (the Aeronautics case study) or even in norms (the Transport case study). The balance of power or internal power games may be modified or heightened (Markus 1983; Robey and Markus 1984). The greater the potential for change and the more chance there is for norms to be called into question, the higher the likelihood that political infighting will appear and hinder the rational development of a project. Thus, project situations often bring instability.

What does participation mean in the Organization ?



Participation can first be viewed as users bringing special skills which fall outside the scope of IS personnel. That is obvious when a user plays an informer or end-user role. They both bring their know-how, experience or knowledge, which cannot be easily and rapidly transferred to IS staff.

Participation also means inducing social interactions between people involved in the project, which find expression in responsibility, creativity, conflict and motivation.

Sharing responsibility generally leads to a dilution phenomenon: each one individually feels less responsible for the failure of the project, as in the Banking or the Insurance case.

On the contrary, a group can be more creative than the average member: a necessary condition is for the group to be united for a common goal, as in the Automobile Manufacture case. If not, status quo will prevail over change.

Participation can amplify conflicts which were in the latent state: either conflicts between clients around structure and power stakes, like in the Insurance or the Aeronautics case, or opposition between clients and designers around norms like in the Transport or Aeronautics case.

Motivation can be created through the pressure of the group: when the majority agree on a set of decisions, they are likely to be accepted more easily by the minority. Future users, playing a designer or end-user role in a group where a majority support was found, will further the implementation. This was the case in Equipment, where the final system was successfully implemented although only part of the requests for modification from the end-users were accepted.

### **2.3 Complexity and participation**

A project is complex if certain aspects of the IS to be developed are poorly defined and prevent a clear view of the action to be undertaken.

Three causes can be identified: use of new technologies; a field which is vast or hardly accessible; a management system in need of re-definition when an IS is designed.

In the first case, the problem is to be dealt with by the IS department - establishing the options available and the constraints. In the other two cases the question is : what form of participation can reduce the project's complexity ?

#### *Complexity of the field*

Requirements analysis implies a command of the field to be analyzed. The problem therefore is to organize the acquisition of this knowledge as efficiently as possible. The key role is the informer role. The role of the designer is that of a facilitator (Hirschheim,1989).

The Banking case and, in part, the Aeronautics and Equipment case studies show that a limited form of participation is better if the information is reliable: an individual configuration is more effective. Thus a coherent overview of the scope of activities can be obtained; if it is not the case (as in the Insurance case) then the sheer number of people involved may lead to a fragmented and incomplete model of the management system.

#### *Complexity of the new system*

If complexity arises from the need to define the management system concurrently with the future IS, the problem is then to design a system which will not only meet management goals but which can also be implemented without being rejected. Participation must be channelled in the search for a consensus.

In the first stages of the project, designer role and client role are essential. The allocation of roles must respect necessary conditions. In order to be creative, a group should not be divided by latent conflicts. To prevent the risk of participation fading, clients should feel solidarity with each other in making the project to work. Lastly, separation between designer and client must not lead to create a gap between them like in the Transport case. Those conditions imply that design and decision roles must be played either by the same persons or by very close persons.

The Insurance case shows that if the risks of conflict are important, they can be reduced considerably by restricting the scope of the project and the extent of the change, and by involving only a limited number of participants. The designers can then act as mediators (Hirschheim,1989).

If the changes are important and call norms into question, then a representative form of participation involving all levels is necessary, notably those who have responsibility for implementation. In an organization which is complex in terms of people, networks, production circuits and communication systems, it is risky to replace a structure that works (even with some flaws) by an entirely new structure which no top management would wish to accept unless directly concerned in its design. This is shown by the reaction of the Directors of the Transport and Aeronautics firms. Consultative participation of managers is not enough - there must be real commitment (Barki,1989). However, future end-users should not intervene too early, ie. before a consensus on the kernel of the future system is found : they should only play informer roles but not designer nor end-user roles.

Thus, if organizational changes are important, the absence of participation could put the project in jeopardy. But participation must be organized and controlled.

## **2.4 Participation goals**

We see therefore that participation cannot be spoken of in the absolute and that differing modes may serve differing aims. When a project is being steered participation may have an effect on the requirements definition, on the decision-making process or on organizational change. They can be stated as follows:

1. Requirement analysis goals: these are production goals as traditionally expressed in IS development methods.

*Participation attempts to obtain knowledge of a field, a management system or an existing organization.*

In principle, an informer is only asked to transfer knowledge. On the whole, this is easy, as the cases demonstrate. However, they also show that the users solicited are henceforth in a state of expectation. They often go beyond their role of an informer, they not only describe the existing system, they also make observations, criticisms, proposals or indicate their desires.

If we wish to limit these effects, it is preferable to reduce the number of users or even to find an external informer. If, on the other hand, the aim is to destabilize, ie provoke a need, the scope of the consultation must be widened, bearing in mind the need to manage this destabilization.

*It may be a matter of building up a new management system.*

The management system must be thought out or reconsidered. It is a question of making important design choices which will have an impact on the future IS. User participation is necessary, but the role distribution of designer and client role are key factor for success or failure.

2. Decision goals. Any project is punctuated by decisions during the more or less formal moments of ratification. But decisions are often difficult to obtain.

*Participation can make it easier to obtain decisions on design and organizational options.*

It is a question of making sure that the choices are made by those who will implement the future IS. A small number of "pilot" users can play designer roles and a larger group is requested to play end-user or client roles, giving advice or formal approval.

*Participation may help deciding the orientation and continuation of the project*

The users targeted are the decision-makers. They will not make the detailed design choices but the furtherance of the project may depend on their opinions and commitment. The key factor is to ensure that users playing client roles are united around a common target.

3. Change goals. Although it is increasingly less possible to talk of the impact of IS on an organization (Ballé 1979) it is true that organizational choices are made during the development of an IS.

*Participation may ease the use of a future system.*

Giving end-user roles to operational staff may avoid a difficult period of adaptation. Participation can be seen as a means by which changes are adopted and made enjoyable by those who have to live with them.

*Participation may seek to obtain acceptance of the future system.*

In this case, the future system may be bypassed. Thus the commitment of the user must be obtained who contributes and uses all the possible outcomes. This can be achieved through end-user roles, which are given to operational staff or even middle management. For practical reasons (cost of participation and difficulty in focalising numerous requests) a pilot group, whose behavior will have an exemplary knock-on effect, provides a model for others to follow.

*Finally, participation may provoke a change in user behavior*

Involvement in production tasks and decisions has one major objective, that of obtaining changes in behavior either between user groups (by discussions around the future system) or making another form of organization possible. Designer roles and end-user roles can be used.

## **2.5 Development plan**

The diversity of project situations should lead to the creation of a sole development plan. This represents the move from a theoretical method to a practical one. Even if similarities can be found from one firm to another, it is within a specific organization containing people, power, bottlenecks and so on that one has to work. Each Organization is unique and it is necessary to identify the individuals or groups who are crucial because of their knowledge or power.

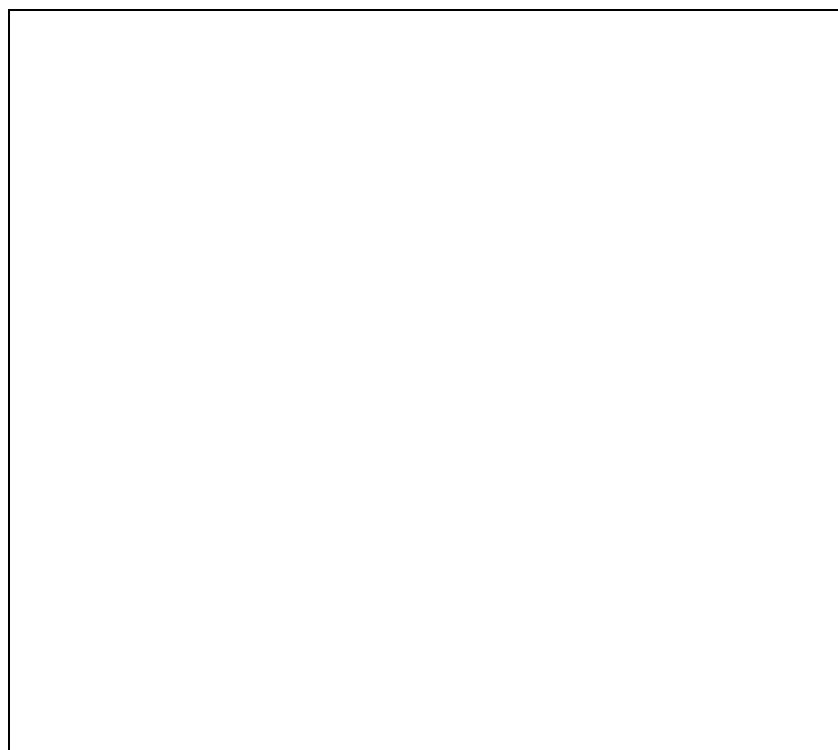
The IS development methods which put forward a series of steps or phases have ignored the factors which are most productive of variety in favor of a development process seen as a problem-solving or intellectual activity.

Social processes (decisions, motivations) introduce an important variable into a problem. It calls for a strategy which takes people into account. Awareness of the uniqueness of a situation finds expression in an appropriate development strategy which should link three processes:

- decision process
- production process
- change process

Preparation for change and firm decision-taking cannot be divorced from production activities. This means that a "personal coordination" is necessary (Mintzberg,1984), in order to make sure the three processes are linked - this is what is involved in project control. Transferring responsibility of managing the project to a user will be unsuccessful if he does not manage all aspects of IS development (Franz and Robey 1984)

The project director should conduct production activities in conjunction with activities leading to decisions and change by setting up participation (user choice and roles) as is illustrated in the chart below (figure 1).



### *Figure 1 : Establishing fitted participation modes*

Each stage of the development plan contains precise goals which focus on the three processes which will be translated into actions. Production goals may be defined with reference to various outcomes obtained in a traditional IS development life cycle. Change goals can make reference to the stages in the traditional change model (eg K.Lewin's model) and the groups targeted. Decision goals are described by their subject matter (Management rules; Organization; IS options (degree and mode); Man/Machine interaction; Outputs) and by the actors involved.

The stages of the development plan, the techniques to be used and the people involved are then identified. Thus, some production tasks (modeling, prototyping) may have a political or social goal.

The various forms of participation are part of the means by which the objectives of the three processes can be achieved. Thus, the methods (who? how?) must be defined at each stage of the project after identifying the goals to be attained.

### **Conclusion**

An analysis of what happens in practice shows that the development of an IS involves three processes - the first one is rational and aims at the production of an application; the second is political and seeks to ensure that the necessary decisions are taken; the third is psychological and manages the individual and social change arising from the new IS. The forms of participation are the means by which one or more of these aspects are managed.

The choice of users, the attribution of roles and the selection of phases during which they participate, can only be made after a diagnosis of the system and identification of the goals. Participation must be used with caution - a poor choice of users may have negative consequences.

These choices come under the notion of project control which contrasts with the idea of following a methodological plan to the letter. The latter only concerns the production component, outside of all political or psychological considerations. Steering a project means integrating them both into the goals and the tasks to be undertaken.

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