Participatory Design in Economic Terms

A Theoretical discussion

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ABSTRACT
According to the fundamental principles of Participatory Design, active collaboration of the users in the design process of a computer system development should contribute to successful design and high quality products. In this paper, we discuss the economic impact of participation. We argue that organizational efficiency requires optimal use of both physical and human capital. A method that minimizes the information asymmetry in the development process is necessary for the maximation of benefits. Furthermore, if the intellectual capital of the participants increases and additionally, the process contributes to the development of a system that does not unexpectedly interfere with work routines, the method will diminish the ex-post transaction costs for the co-ordination and evaluation of the system.

Keywords
Participation, information asymmetry, intellectual capital, economic effects.

INTRODUCTION
System development methods are not only concerned with the identification and formulation of users' needs, but also with the development of effective information systems in organizations [1]. However, several authors have noted that current traditional methods for information systems development, are based on a "computer artefact preoccupation", and are thus not likely to be successful in supporting the needs and goals of the organizations for which they are intended. Another difficulty associated with traditional methods is that they tend to concentrate on the processing role of the information systems, emphazising the use of computers for information processing, storage, transmission and for the presentation of the information. In this way, the needs of individuals (direct users) to be educated in the system and to learn it is excluded [2].

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Only in recent years has it been recognized that the focus on technology has made developers forget the key purpose of information systems, namely to inform people. For this reason, it is argued that it is necessary to focus on how people create, distribute, understand and use information[3]. Therefore, it has been proposed that an increased participation and collaboration between users and technicians would be the appropriate way to link the emerging innovation (e.g., information systems) with the existing environment (i.e., organizations). Developers must be given the opportunity to bring all the participants together in a series of learning experiences that can be used to modify, improve and refine the final products[4]. To meet this exigency, a variety of tools and object oriented methodologies have evolved. Most of these can be considered to be aids to the learning process in the sense that they help individuals to think about, understand and communicate what they are doing. They can also be seen as relationships between social and interpersonal aspects of the development process, which facilitate a division of knowledge or understanding that was not possible before[5].

Participatory Design has been presented as a "philosophy" which encompasses the lifecycle of the whole system. The approach incorporates users, not only as experimental subjects but also as key members of the actual design team[6] emphazising their participation and collaboration in the whole development process of an information system. Furthermore, Participatory Design focuses principally on the relationships between technology and human activity and is concerned with the way in which current technologies support work activities[7][8]. The aim of this paper is to show how participation in system development processes using the Participatory Design approach is a source of competitive advantage for organizations. We explore the implications of participation and its relationship with economic progress. To the best knowledge of the authors, there is no discussion about whether or not the method is economically profitable for an organization.

PARTICIPATORY DESIGN PRINCIPLES
Originally, Participatory Design was introduced to increase

the democratization of working life through the active incorporation and participation of the individuals (workers/users) in the design process[9] and implies discussion, criticism and compromise between users and system developers. Further, users were to redesign and evaluate their work routines by applying the experience obtained during the participation process, and even be provided with an opportunity to improve their understanding of computers[10]. However, another objective for participating in the process of Participatory Design is based on the recognition of the fact that it gives designers new and better ways of gaining an understanding of the user's everyday working practices. Additionally, users are expected to be more willing to accept the final system once it is introduced when they assist developers to arrive at a more accurate and realistic model, and reduces the risk of their being adverse to the new system. The final overall effect of this participation can be considered to be the main incentive to improve work efficiency and productivity. The argument is that participation helps users to increase their skills and thereby increase the quality of the service they provide[11].

Despite these positive potential gains, it has been argued that the fundamental weakness of Participatory Design is the dependency on effective communication between developers and users. Another difficulty is that the relationship between theory and practice seems to be more demanding and complicated in practice than it is thought to be in theory. For instance, the development of a successful information system may need to focus more on quality rather than on quantity of the participation.

ECONOMIC ISSUES OF PARTICIPATORY DESIGN

Economists describe the relationship between manufacturer and distributors as a principal- agent relationship. The same relationship arises when Information Systems are designed. A contract is settled between the principal (the owner of the firm) and an agent (the systems developer experts), in which the principal hires the agent to perform a service, in this case, the development of an information system. Usually the development is performed in such a way that the principal cannot fully control the future outcome of this work due to several important factors.

Knowledge asymmetry

The principal contracts the system development (the agent) based on his current knowledge of the state-of-the-art. If the principal and the agent have different knowledge of different pieces of relevant information at the time of the contract, the contract is incomplete and thus the resulting system can be unsatisfactory at least for one of the parties. Difficulties in communication imply further costs for co-ordination that obviously grow as the number of participants involved increases. This imperfect or asymmetric sharing of information between the principal and the agent during the process of the development of an information system can be considered as one of the main motives for using Participatory Design Approach. In economic terms, the Participatory Design stands for a vertical integration[1] of the system development process, in which the contractual or market exchanges are eliminated by the substitution of internal exchanges (participation), within the boundaries of the firm. As a result of such a vertical relation (regardless of whether the developers are employees or independent contractors), the principal can obtain complete control over the firm's "assets" and even over the entire production process[12].

Enterprise effects

When a system development project is initiated, the final quality of the goods (i.e., information systems) that will be available for the firm and the effect on the work routines cannot be known with certainty. In addition, the principal can predict the consequences of the new system with decreasing confidence as longer the future extends [13] due to the most salient characteristic of the future; that we do not know it perfectly. As Henry Mintzberg [14] says " If we can anticipate the future, we should not plan it in detail", and previous experience in business is almost never a sure guide to future performance in new circumstances[15]. If the Information System is not sufficiently appropriate, the economic effects to the principal, are more significant in this case than in other situations, because of the degree of irreversibility involved. Once the system has been implemented it can not be refused, and this would occasion a higher sunk cost for the principal.

Intellectual capital

While capital goods are usually discussed in terms of tangible assets such as machines or plant, the notion of a capital asset as something that is used to increase future output suggests another sort of capital goods, namely intellectual or human capital[16][17][18]. Several authors have recognized the importance of intellectual capital for an organization[19]. They affirm that Intellectual Capital is a firm's only appreciable asset due the fact that the productivity of the individuals improves with literacy and that in general, the longer a person has been educated the more adaptable she or he is to new and varying challenges[20][21][22].

Similar to a bank account, or to Volvo's bonds that yield income and other output over a long period of time, an increase in knowledge improves work activities and/or if the knowledge can be used over much of her/his working

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[1] A relation in which a firm participates in more than one successive stage of the production or distribution of goods or services.

lifetime adds to a person's "appreciation". Moreover, even this kind of capital has to be reinvested to avoid depreciation.

ECONOMIC ANALYSES FOR PARTICIPATORY DESIGN

When the scope of innovation is limited, the need for communication and collaboration between developers and users is restricted to a narrow and easily definable group. In those circumstances information exchange is especially easy when there are existing channels of communication. Consequently, market mechanisms (i.e., price) can work well as an indicator of the "quality" and "capacity" of the goods.

There are, however, limits to the ability to use markets effectively when we are dealing with products with asset specificity (dedicated physical or intellectual capital)[23]. Such kinds of goods, in this case information systems, not only require a total rethinking of the nature and importance of actual work routines, they also require users to have a detailed knowledge of the technology of the goods, and of the ways to evaluate them which are available. Under these circumstances, the cost of acquiring information about the qualities of the goods may be beyond the disposable resources of an organization because experience can only be achieved through a "vertical integration" of the development process. Additionally, the intrinsic uncertainty related to goods, such as information systems, vary over the stages of the product life cycle. In the absence of such a communication and collaboration reached in a vertical integration, potential benefits, for instance, the creation of productive structures or the accumulation of experience in new areas, might be lost altogether or ceded to others, thus retarding the normal progress from the introductory stage to maturity (i.e., the implementation).

Moreover, a method that allows joint ownership of the development process through collaboration can also modify previously proposed solutions. Both the developers and the users can benefit from knowledge of the other's experiences[24]. According to the fundamental principles in Participatory Design, each participant receives inducements from the collaboration in return for which he makes contributions to the "coalition", contributing in this manner to a successful design. However, an important and seldom discussed restriction is the fact that each participant will continue his participation only as long as the inducements offered him are as large as the contributions he is asked to make to the coalition (measured in terms of his value and items of the alternatives open to him). Consequently, as soon as the utility or satisfaction an individual experiences begins to decrease, his contributions to the coalition also diminish.

Knowledge asymmetry

An asymmetry of available information between the principal and providers (the agent) is a source of failure in market processes such as resources allocation. The agent knows more about the quality of the goods than does the principal[25][26. For example, a person who offers his car for sale knows far more about its quirks than does a potential buyer. Similarly, when a contract to develop an information system is signed, the supplier knows far more than the customer about the consequences of the agreement. Under some circumstances, these asymmetries in the distribution of the information can be corrected by the mechanism of voluntary exchange, e.g., by the seller's willingness to provide a warranty to guarantee the final quality of the product. But severe asymmetries can disrupt markets so much that a social optimum cannot be achieved. When that happens, government intervention in the market can usually correct the informational asymmetries, and induce a more nearly optimal exchange. The market for the sale of homes provides an example. The asymmetry in this case can be corrected by requiring sellers to disclose knowledge of any latent defect to prospective purchasers. If the sellers do not make this disclosure, then they may be responsible for correcting these defects without additional economic compensation[27]. But unfortunately, this is not the situation in the market for " computer system development". There, every upgrade or service has to be paid at market price with its additional tax-giving rise to opportunistic behaviour if the principal does not know when "enough is enough".

Another problem is if one party in a potential transaction is ex-ante better informed about a relevant variable in the transaction than the other party. In the specific case of a system development process, the problem for the supplier (the agent) is how to determine the actual risk, which the potential clients represent. The agent can of course, uses any means to find out this information without the co-operation of the potential client. However, many sources of private observation, for instance a firm's unofficial information channels, are basically not available to the other party and this constitutes the essence of the information problem. The only solution in this case, is to reflect this risk in the price and thus charge more for the final price of the new information system.

Fortunately, in many cases there are some other solutions to the problems of hidden information, both for suppliers and clients. Since the essential problem is one of "unobservability" or information asymmetry, one manner of decreasing this market imperfection is by co-operation. Therefore, if the two parties are risk averse[2] they prefer to

[2] An economics agent is said to be risk averse if she/he considers the utility of a certain prospect of money income to be higher than the expected utility of an uncertain prospect of equal expected monetary value.

"pool" the risks[28] of the final outcome and be sure that they will not be burdened alone with the whole responsibility for the final product.

The problem of how much of the resources of every organization should be allocated to this particular activity, co-operation, can be represented as

$$Co = \alpha C1 + \beta C2 \qquad \text{(Eq.1)}$$

where each group wants to maximize his own objectives (to acquire/obtain some information), and C1, C2 are the objectives of the two groups. This requires the two groups to do two things

1. - Accept each other's objectives/ necessities, and

2. - Agree on the weights (α), (β) assigned to each objective/ necessity. Only if the members of the two groups are able to meet both conditions can they jointly (by participation in the process) maximize an overall objective function (Co).

Enterprise effects

Economic efficiency presupposes technological efficiency. This implies that efficiency and economic growth much depend upon the acquisition of an appropriate information system that does not alter work routines or that allows new work routines to be formatted efficiently.

Work routines arise in repetitive situations and store organizational experience in a form that allows the organization to transfer that experience to new situations rapidly [29][30][31]. Consequently, even if some habits become obsolete as a consequence of a change, for instance after the introduction of a new information system, participation makes it possible for the new routine to be formed in a rational manner under the external supervision or monitoring of the experts. The economic benefit of participation in the process of a system development is consequently, the formation of appropriate work-routines (habits). The indirect consequences of such a situation is a saving in all costs associated with the decision-making and or trial and error, which would or might occur if the individual in an organization does not dominate the new system or does not understand the new routines. For this reason, the formation of a work routine or habit may be viewed as an investment process, by both the individual and by the external supervisor, if such exists, and the work routine itself viewed as capital goods that can be evaluated as

$$\text{Max TV} = \text{Max (B - C)} \qquad \text{(Eq.2)}$$

TV represents the difference between the value of the total benefit that is expected by the individual (firm) B and the expected value of total cost C of forming habits.

In these circumstances, an approximate measure of the benefits expected from participation is the expected market value of the time saved in forming habits by participation in the process, and an approximate measure of the expected costs of the time spent in forming habits after the implementation of the new information system. This includes the intangible costs that the individual obtains if the habit becomes obsolete as a consequence of a change when the information system become available. Probably, during the first period, the individual will realize sooner or later that the habit is not working well or is simply not working at all. However, this does not imply that the individual will abandon it immediately.

Intellectual capital

There are several mechanisms for acquiring intellectual capital in an organization e.g., by acquiring experience through participation in a process, or by buying competence. It can be argued that as a consequence of the implementation of a new information system, workers with the "correct" abilities could be considered to replace the whole staff in a firm. But this situation, at least in Sweden, could raise incalculable costs due to current work-legislation. Additionally, to buy the "correct staff" involves advertising costs, costs for selection procedures, costs for checking references and costs for introducing the individuals into the idiosyncrasy of the organization. The result can be similar to the systems used in sports teams where millions of dollars are spent on searching for new talent to lead them to victory, with the risk that investment in free individuals often does not win championships in a sport for which teamwork is required[32].

It is therefore important to analyse the acquisition of "on the job knowledge training", as the most important source of investment in intellectual capital[33][34]. Due the fact that innovations downgrade the economic value of competence or knowledge capital, the prime task of the organizations has to be to organize a worker's intellectual capital. Normally, this can be achieved through suitable internal conditions that steadily upgrade the current workforce's competence base, making it stronger and better and also more learning oriented.

Several authors agree that there is a general lack of receiver competence in a system development process. New competence cannot be communicated artificially; it is embodied (tacit) in individuals or teams of people. Disseminating the new competence through out the systems development teams (supplier and customer) is therefore a matter for the organizational technique of allocating knowledge through participation[35]. Additionally, participation in a process gives individuals the chance to acquire comparative specific knowledge advantages (the value derived from such an investment is embodied in an individual) that remain with the organization for many periods and that also induce the firm to achieve a more

rapid growth in the short-run. Employees with specific training also have less incentive to leave, and firms have less incentive to fire them.

However, an extended participation requires resources to be withdrawn from the production of goods for current consumption. Consequently, future productivity can only be improved at a cost equivalent to the value placed on the time and effort put in by the trainees, the teaching and the material used, e.g. a prototype[36]. These are costs in the sense that they could have been used in producing current output if they had not been used in raising future output. Further, because the firm's investments in training, production and consumption of Intellectual Capital have a different date, the demand for participation, at a particular time, does not only depends on current price. It also depends on the perceptions of the individual or the firms owners about the price that the product (the acquired capital) will have in the future. Anything that changes production costs affects all prices over time. Furthermore, much of the existing intellectual capital, before a new information system is implemented, will be redundant in a few days. Even the best worker who does not retool intellectually, will be displaced. For this reason, if the expected output of the participation (knowledge capital) increases during the participation process, this could be an incentive to create participation between the principal and the agent. This decision situation can be illustrated in equation (3).

$$Kt = [\, MPk = Nt \,] \qquad \text{(Eq.3)}$$

Kt: is the end-of-the participation process and measures the outlay (intellectual capital) of participation

MPk: is the marginal product or receipts of intellectual capital

Nt: is marginal (capital) expenditure

As we can see, the choice of whether or not to acquire intellectual capital also has the basic elements of a capital investments decision

DISCUSSION

Our theoretical analysis suggests that shared investments during participatory design processes (in both liquid and human capital) are beneficial for the organizations involved by an increase in knowledge capital, a decrease in information asymmetry due the different backgrounds of the participants, and by updating work routines in a "natural " manner. In our opinion, a central question is how to motivate in formal economic terms an "apparently" cost demanding methodology (often expressed in direct costs) to develop information systems. We agree that social motivations play an important part, because these questions are partly matters of culture, of which morality is another part[37]. Crude economic motivations also play an important role because collaboration with the coalition will much depend on the individual's reaction to uncertainty. In general, the greater the degree of uncertainty that exists in a market, the more lengthy and complex will be the contracts negotiated between the buyers and sellers. Creating a dependency through participation, not only induces a better understanding of the organizations needs, it also increases the individual's welfare, stimulates efficiency and permits a better disposition for adapting situations to today's higher flexible market. As a consequence this decreases the ex-post transaction costs for co-ordination and evaluation of a goods[38].

Today there are also strong existential reasons for increasing participation in system designs. One is that a fundamental characteristic of the type of society we live in today, is its preoccupation with issues of welfare and personal development[39]. Another similar reason is the increasing interest in the connection between the effectiveness and the democratization of working-life organizations. The third and most important reason, from an economic point of view, is that efficiency requires the use of physical and human capital. Every new system or methodology that ignores this relevant relationship induces a risk for long-term effects, for instance, a diminishing in the expected profit due to high costs for re-educating or replacing personnel once an Information System has been implemented. It has therefore gradually become clear that in the process of the development of an Information System, we cannot focus only on the organization as such and regard the internal and external environment as a set of explicit circumstances. The unit of analysis has to be the organization, with its environment, and its technical necessities and especially its human resources and how these factors influence the final outcome[40].

The new post-Taylorian organizational paradigm has introduced work situations that seem to benefit from direct participation and personal involvement. Instead of segmented work processes, we see an emphasis on the development of the complete task, self-managing groups, ongoing learning and the ability to exert influence[41]. Especially in the Scandinavian countries, a democratic structure for participation has been introduced as an attempt to stabilize labour relations. However, any collective, which has an economic goal, must find a means to control individual's efficiency in participation[42]. This implies that the resources devoted to a democratic participation must contribute to the economic optimization of these. One strategy for diminishing the risk of obtaining an inappropriate information system would thus be to increase the number of individuals that participate in the process. If many individuals are linked together in an organization,

each can make different observations about the world. But there is no value in having them observe the same signals, provided these are observed without error[43]. Multiplicity of observers creates a new problem, that of co-ordination. Clearly, if every signal received by each observer had to be transmitted to another, the total amount of information handled would be greater than in the absence of the "coalition". Economy arises only if the signals transmitted within the coalition are summaries of the information received. For this reason, to include too many parties in participatory design processes involves a risk of long-term dangers of petrifaction, due the fact that communications routines have costs of initial investment, which are irreversible. It would seem necessary to continue a discussion of by whom and when participation is economically optimal. To generalize participation and have it as a standardized solution for all kinds of problems is a contradiction of democratic principles (e.g. liberty of opinion and liberty to choose what bring more utility to an individual). Unreflected forms of enforced democracy can also cause a loss of profits to any organization.

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