IMPLEMENTING INNOVATION PROJECTS: A PARADIGM AND ITS IMPLICATIONS

Josep Riverola

Beatriz Muñoz-Seca

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This paper is the result of the close observation of real business situations, mostly done from actual managerial line positions. One of the authors, after being in the university for 20 years, took a job in a large, Spanish, professional electronics company (we will refer to it as "BEA"), as vice-president of Systems Development. The other author, after several years' experience in the field, was the Human Resource manager of the same company for more than 4 years, and then left to become the CEO of a public Spanish company. During 3 years both authors were deeply involved in setting up an organization that could successfully cope with a high degree of innovation, and, throughout this work, an effort was made to conceptualize the sources of difficulties and the logic behind them.

Furthermore, we cross-checked our experiences with more than 20 other firms involved in the same activity, both in Europe and the United States, that we visited during the span of our work. No formal data collection process was established; instead we kept records of the qualitative properties of each situation.

In this paper we report the results of this experience. Thus, although based in large measure on an in-depth case study of the company "BEA," we think that our observations are not limited to that company but instead are widely applicable.

The organization of the paper is as follows. First we describe the company that provides the main source of empirical observations, followed by a list of the observed problems. We identify what, we believe, is the single main cause of these problems, presenting a conceptual framework that allows us to understand the situation and act accordingly. We then present a scheme to identify the presence of this factor, the alternative courses of action that are open to the manager and their desirability depending on the situation. One of the courses of action is singled out both for its importance and because of its deep organizational implications. It gives rise to an alternative form of delegation that we call "delegation by trust."

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[1] Professor, Production, Technology and Operations Management

Although much has been written about Project Management (e.g. [13]) and High-Technology Research and Development management (see e.g. [6], [7]), little has been written on the management of projects from the point of view we are taking here. [10] and [11] are close in spirit to our approach but fall short of it. Related work on the human side of innovation projects appears in [12] and [21]. We have also been strongly influenced by the thinking of our colleagues in IESE (see [1] and [15]).

What is exactly meant by an "innovation project" is, at best, difficult to define. It will turn out that, to our minds, the best way of defining such a project is in terms of the concepts presented in this paper. However it is important to remark that we are not restricting ourselves to R&D projects; we include any project that involves a substantial amount of change. Therefore we include company-wide projects like organizational changes, introduction of new procedures (e.g., Just-in-Time, new accounting systems, MIS, etc.), and local projects involving the development of a new product, a new process, etc.

1. An Overview of BEA

BEA is a company involved in the design and manufacture of large-scale systems for civil and military applications. This area is a fast-moving one, lying at the intersection of electronics, computers, engineering and mathematics. BEA is the main Spanish supplier of military systems; its leading competitor is roughly half its size. To help develop technology in Spain, the Ministry of Defense insists on the participation of Spanish companies in any major purchase by the armed forces. This puts BEA in a highly innovative environment, and is probably one extreme situation of constant innovation. The company has little experience in many of the projects it undertakes, and very few systems produced by BEA are ever replicated. Most of them need a degree of technology transfer from foreign companies, but leadership is strongly recommended by the customer. Projects range in size from 10 to 100 million dollars, with a time span from two to five years. The company is very much involved in cooperative international programs, a result of the recent integration of Spain into both NATO and the EEC. An example of an international program of this sort is the European Fighter Aircraft (EFA) project, developing and manufacturing a sophisticated European plane.

The company employs 3,000 people, with as many as 1,500 holding degrees in engineering, physics, computer science and related areas. The technology base includes microwave engineering, real-time software development, avionics, signal processing, optronics, etc.

Most of the projects now being developed are related to aerospace applications, including, for instance, fault diagnosis and maintenance for planes (F-18, Airbus, etc.).

The customers usually require fixed and firm prices, and the process of selling is always through competitive bidding. This means that judgmental errors in the price estimation phase have long-lasting effects in the company future. Also, since the pricing is competitive and there is excess capacity in the world for this type of work, winning a bid requires an aggressive pricing policy.

The performance of the final system is critical, and heavy penalties could be incurred for delivering faulty systems.

As in many other cases, technical people are young, from 25 to 35. Managers are mainly in their 30's. All of them, technicians and managers alike, are highly motivated and strongly believe in their uniqueness and excellence in their own fields.

The above description has probably convinced the reader that BEA is a unique opportunity for a first-hand investigation into the management of innovation. Furthermore, the environment in Spain is evolving so rapidly that the country is going through a process of change in just a few years, which in other countries requires decades. This produces a time compression effect in BEA so that the company goes through product cycles at a much faster rate than other companies in the sample.

2. Types of Problems Encountered in Managing Innovation Projects

The following list of problems was initially drawn from BEA, but the list was subsequently discussed with managers of other companies in the sample, and is therefore assumed to hold true whenever we are facing the management of projects with a high degree of innovation. They are summarized in Table 1 and briefly commented after.

Table 1
Problems observed

1. Instability of projects with frequent changes in duration and cost estimates.
2. Difficulty in isolating critical areas beforehand, or too many changing criticalities.
3. Difficulties in estimating project costs and resources.
4. Delays are not solved by "putting more resources into the project".
5. Management often feels that the project is not advancing fast enough.
6. Frequent review meetings and middle management anxiety.
7. Many management tools difficult to use (PERT...).
8. Difficulties in describing the set of activities to be performed long beforehand.

Comments:

1. **Instability of projects with frequent changes in estimation of duration and/or cost.** The prototypical situation is the project that "becomes one month late in one month," although everybody has been actively working. Review meetings in innovation projects, especially at the early stages, frequently concentrate on redefining the project.

2. **Difficulty in isolating the critical areas that require upper management intervention, or too many changing criticalities.** Upper management is sometimes asked to intervene in seemingly contradictory critical areas. Once a critical area is under the tight grasp of upper management, there is always an unforeseen issue that becomes critical.

3. **Difficulties in estimating project costs and resources.** This is a particularly critical issue in the early stages especially if, as we have seen, fixed and firm prices are required. Even experience in related areas does not always help. The first author was present in a meeting

where a consortium of companies was trying to put together a final offer for the EFA (European Fighter Aircraft) nose radar. Each one of the four companies was asked to quote a price on a given module and all of them had prepared careful quotations. The prices that were submitted from three of the four companies were different by an order of magnitude, even though the companies were among the world's leading experts in the field.

4. **Delays are not solved by putting more resources into the project.** Often the contrary is true: adding more resources, especially people, can create a great deal of confusion and delay the project even more. Very little can be done to recover a delay in the short term. Actions should be planned in the long term, which means the effects are slow to be realized. Pressures in reducing delays sometimes lead the people in the project to give reduced figures because they feel that "this is what top management likes to hear" or they become convinced that they will be able to work faster for no reason whatsoever (the so-called "wishful thinking effect").

5. **Upper management's difficulty in assessing the degree of project completion.** Management often feels that the project is not advancing fast enough, but lacks the skills or technical knowledge to evaluate (or check) the figures provided to them by the people actually involved. This is especially true when management lacks the common handles to performance assessment, such as physical inspection of the item. For instance, in software development it often happens that the system progresses in steps: a piece of software goes frequently from the "not working" to the "working" state in little time. Also, physical inspection does not help too much in evaluating the amount of work already done, and even less, the amount of work remaining to be done.

6. **Frequent review meetings and middle management anxiety.** This problem is related to the previous one. Once upper management decides the information coming from the project is unreliable, it tries to exert an increasing amount of control by holding more review meetings and questioning the project people. Since, most of the time, upper management again lacks the technical skills, the questioning often degrades to the "are you sure?" type of questions. Usually those questions do not add new information to the situation, and could be easily interpreted as upper management's doubts about the information provided. This eventually causes nervousness and anxiety throughout the middle level management directly responsible for the project development.

7. **Many management tools are very difficult to use or just useless.** This is particularly true for PERT-type analysis. It is sometimes difficult if not plainly impossible to make a list of the activities relevant to an innovation project. If pressure is brought to bear, lists are often provided that are later continuously modified. Most of the time the difficulty stems from the fact that nobody knows for sure the complete list of activities, much less how they are related or their expected duration. PERT tools are extremely useful in situations where previous experience allows listing of activities, but in managing innovation projects are next to useless. The same is true of many conventional cost-accounting techniques.

To summarize: Unstable environment in spite of efforts to stabilize it.

3. A framework for Understanding the Nature of the Problems

In this section we present a conceptual framework that explains the causes of the above problems and points to ways of solving them.

We hypothesize that every project has two levels of managerial definition: the strategic and the operational. [19] Briefly stated, the strategic definition is concerned mainly with the project requirements (i.e., *what* is the purpose of the project), while the operational definition relates to the means to accomplish those requirements (i.e., *how* to achieve the strategic definition). Table 2 lists the major components of each definition. The strategic components relate to several agents, all of them affected by the project: customers, people, suppliers, administration, competitors and the long-range structure of the firm. The operational components have a more limited area of influence, normally the firm and its operational environment. A well-defined project has all the components, both in the strategic and the tactical definition, completely specified. This is not usually the case in innovation projects. Many of those projects do not have a completely specified definition until the later stages of their completion.

Table 2

Any project has two levels of managerial definition

Strategic	Operational
Definition of final product performance	Tasks to be performed
Key technological areas	Time sequence
Insertion in business strategy	Usage of resources
Organizational structure and control	Milestones and control points
Major usage of resources	Quality assurance
Human Resources Strategy	Product characteristics
Financial issues	Maintainability, reliability, testing.
Third panty involvement	Design methodologies
Others	Others

To concisely state the main component of our framework we need a somewhat more precise definition of what is meant by "lack of knowledge" of an issue. First, lack of knowledge is a state of mind, and therefore we subscribe the view that all uncertainties are subjective [16]. Then, in the simplest classical paradigm of decision making, conceptualizing a decision as a choice of an action (from an action set) and receiving a reward depending on the action and on the set of states of the nature, one distinguishes three types of lack of knowledge: Risk, Uncertainty and Structural Uncertainty. Table 3 summarizes each case. We have Risk when the decision maker is willing to specify a probability distribution on the states of nature. This implies knowledge of the set of states (it should be possible to list what can happen) and the sufficient knowledge to carry the probability assignment (a subjective probability). Second, there is Uncertainty when the Decision Maker is willing to list the states of nature but unwilling to assign a probability distribution. Essentially he lacks the knowledge about the ways to relate states between themselves. Finally we say that there is *Structural Uncertainty* (SU) when the decision maker is unable to list the states of nature or even the set of actions. This also means that, being unable to specify the set of available actions, he is also unsure of the outcomes of those actions.

Table 3

Types of lack of knowledge

I. UNCERTAINTY
The set of states of nature is known but no probability could be assigned.
II. RISK
Set of states known and a distribution is known or assigned on them.
III. STRUCTURAL (SU)
Structure of set of states and/or set of actions is unknown.

Now we are in a position to analyze the characteristics of the managerial definition of a project both in the classical case (low level of innovation) and in the case of high level of innovation.

Table 4 lists the properties of the classical situation. Most important is the clear-cut separation of responsibilities. Strategic definitions belong to the top management; operational definitions belong to middle management and technical people. Also notice that SU belongs where it should: the strategic definition. In a sense, this is the orthodox situation for which many organizational structures are prepared: long-range, strategic decision with SU belongs to the top levels of the organization. Low levels are mainly concerned with "how-to" issues and those which are highly technical and, therefore, irrelevant to top management.

Table 4

Key Properties in the classical situation

Strategic	Operational
1. Structural uncertainty	Tasks well known, perhaps some uncertainty or risk
2. Long-range effects on company	Short-range effects on company
3. Top management responsibility	Middle Management and Technical Personnel
4. Non recurrent	Recurrent
5. High economic impact	Low economic impact any single decision
6. Heavy commitment	Easily changed or reversed

Operational decisions with low degree of structural uncertainty

Table 5 lists the properties of the high level of innovation project. The strategic definition remains invariant, but the operational definition changes dramatically. The key changes are the long-range effect of the operational decisions on the company and, second and most important, *the existence of Structural Uncertainty in the Operational Definition (we call it "SUDO") of the project.*

We claim that the existence of SUDO makes an innovation project substantially different than its classical counterpart. In particular it has the following implications:

1. **Upper management will feel that critical decisions are being taken beyond their grasp.** The effect of some decisions is not easy to foresee and communicate. Not even the pros and cons will be available. One of the authors felt this effect vividly when, in a

substantial project, a lending technician (a 28-year-old man) made the proposal of using brand XXXX chipset instead of brand YYYY. Even the best justification of XXXX could be logically turned around to apply to YYYY; a most paradoxical situation! However the implications of having the technology XXXX vs. YYYY were different in the long range, although impossible to analyze in the time span available. Again, top management lacked the expertise even to think systematically on the issue.

2. **In some projects you will not know what to do until shortly before doing it.** Obviously SUDO disappears as more information is gathered during the project development. Once the project is completed, SUDO is zero. But some of the actions do not become available until some of the SUDO has been cleared away. Bear in mind that uncertainty is a state of mind, and therefore changes essentially with the information that becomes available. Again, we have encountered this effect in practice many times. In one case the Spanish Air Force requested BEA to develop a fault detection and correction system for their F-18 airplanes that was a radical departure from the ones being employed by the then-users of this equipment. Everybody, including the manufacturer of the plane, agreed on the feasibility of the approach. The bid was presented and the project has been successfully underway for two years [at the time of writing], to the customer's complete satisfaction. However, what BEA is doing today, at the late stages of the project, bears little resemblance to the stated plans two years ago.

3. **It is intrinsically difficult (we would say almost impossible) to draw a complete plan for the project beforehand.** As we have said before, anybody that has tried to draw a PERT chart for a project of this type knows the difficulties of doing so. What we are asserting is that efforts to produce an initial complete plan will produce a plan that will hold just for "a few days." The best that could usually be done is to produce a plan for an initial window, followed by the activity: "do the rest."

4. **Therefore, and this is a particularly important case of 3, costs are difficult to estimate at the beginning of the project.** And since the bid is presented at the beginning, cost estimation is one of the most demanding and risk-taking phases in this type of project. Notice that price estimation has always been considered the province of top management but not usually cost estimation, which belongs to the lower levels of the organization; the rationale being that is very closely related with the technical details of the project.

Table 5
Key Properties in Innovation projects

Strategic	Operational
Same as before	Structural uncertainty task definition
	Long-range effects on company
	Middle Management and technical people
	Recurrent
	High economic impact some single decisions
	Heavy commitment

*Operational decisions with high degree of SU and often highly technical,
managers lacking grasp on them*

To summarize, in situations of high SUDO, you learn as you go. But a clarification is needed here: we are asserting that the above effects are in the nature of the situation. If the paradigm is accepted, they follow logically from the existence of SUDO, and are not defects of the people, procedures or organizational structures involved. Managers should accept this state of the affairs and be aware that "obvious" measures to correct the situation that worked in classical projects may be having very adverse effects in the presence of SUDO.

4. Managing Projects in SUDO Environments

How do you manage projects with SUDO? We have developed a methodology to deal with those situations. The methodology was initially used in BEA, but we feel it is sufficiently general that we are now using it in other cases. It is intended for use in the early stages of the project definition to help in setting up the project team and the organizational relationships, but is based on a philosophy that permeates the whole horizon of the project or even the life of the company.

The stages are as follows:

a) Identify SUDO, where do you have it and how much.

b) Reduce it as much as possible (or convenient); that is, factor out non-intrinsic SUDO by using tools and procedures.

c) Deal with the rest (i.e., intrinsic SUDO) through organizational measures. This frequently calls for new forms of organization, and we are proposing a specific approach: Delegation by Trust.

a) Identification: Identification is important because, as we will be seeing shortly, the actions available depend on the amount of existing SUDO. Table 6 presents the basic approach to SUDO identification. We allow for three levels of SUDO (Low, Medium and High) and base the identification process on the in-depth examination of the four main dimensions of the strategic definition: Purpose of the project, Technology (i.e., knowledge for action) involved, Resources and Organization required. For each dimension we ask in what degree the requirements for the process differ from the ones being used by, or well known to the people of the company. The greater the difference, the larger the amount of SUDO.

b) Factoring Out the Removable SUDO. The process of factoring out SUDO could be very specific to the situation. Techniques specific to SUDO reduction have not been developed. However, three main techniques are already available and could be borrowed from other areas. Two of them come from the software development arena, which long ago realized that software projects called for new approaches and procedures. Techniques available are:

1. Prototyping. ([3], [4]) Developing prototypes as a way to learn more about what is involved in the development of the project. Normally, a prototype is thought to be a fully working unit, functionally equivalent to the final product, but built to easily incorporate changes and modifications. In our case, the prototype does not need to be

an operational unit with the same features as the one to be produced. Rather it should mainly allow the easy identification of the main activities to be performed.

2. Even in high technology areas, companies frequently follow an evolution path. Few projects are really very innovative. Most are evolutions of existing systems or products. In those cases the existing item takes the role of the prototype in the sense we are using it here. For instance, since no manufacturer in Europe had ever built avionic units of the complexity required in the EFA, a demonstrator plane; the EAP was put together to convince the governments of the feasibility of the project. However the EAP served the much more important role of prototyping the EFA, and thus reducing the amount of factorable SUDO in the project.

3. Top-down approach. ([5]) This technique also has its roots in the software development field. There it means a progressive refinement of the problem description until it is cast in the object language. If we equate the problem description (what is to be done) with the strategic project description and the description in the object language (how it is done) with the operational description we get a one-to-one mapping of the technique in our area of discourse. In a nutshell, what it recommends is: recognize the impossibility of a full initial plan and use variable detail planning tools, adapted to the degree of SUDO existing at each instant of time. We are crossing out the traditional full description techniques (like critical activity planning, or PERT) and fully embracing the conflict resolution approach ([18], [19]). In practice, Gantt diagrams go a long way toward satisfying the need for a planning tool. They are flexible and allow a varying degree of detail that better reflects the needs of the decision makers. This explains the poor performance we have observed in more formal techniques and the almost exclusive use of Gantt diagrams in planning innovation projects.

4. Deal explicitly with Uncertainty. ([8], [16], [17]) This is a collection of techniques rather than a single tool. To give an example of what is meant: we implemented in BEA a procedure for cost estimation that provides interval estimates of cost instead of point estimations as had been done before. This is also very useful in allowing the negotiating people in international ventures to take into account additional information in pricing meetings. The situation is an interesting one and SUDO provides a powerful explanatory mechanism.

Table 6
1. Identification

	Low SUDO	Medium SUDO	High SUDO
Purpose of project	Well defined with clear specifications	Ill defined specifications	Degree of success is difficult to define
Technology	Existing in the company	Existing related technologies	New technologies are required
Resources	Well known and experienced	Could be estimated a priori with confidence	Only estimable as project unfolds
Organization	Same as existing	Has to be changed but could be defined a priori	Will depend on the wat the project evolves

The presence of SUDO, and the fixed price structure of the usual bids, forces the estimators in the high SUDO companies into overestimating costs to cover for the uncertainty. Therefore the point estimates are usually higher in the high SUDO companies than in the low SUDO ones. In a pricing meeting there are often requests for price modifications. Those with lower SUDO levels tend to suggest lowering prices, with the objective of securing the bid. Often this is done by providing information about their own costs (e.g., by disclosing some of their purchasing costs). An estimation of SUDO allows the negotiating people to trade off cost for information, in itself a valuable form of technology acquisition, with a rough estimate of the risks involved. Interval estimates, a form of probabilistic estimation, makes this kind of comparison easy.

In another case we estimated cost by using regression analysis, a technique not frequently used in normal projects.

c) To deal with the rest, in high SUDO environments we need new and bolder approaches, involving new organizational structures and specially a different concept of delegation: the delegation by trust. This will be the subject of the rest of this paper.

5. Delegation by Trust

Delegation by trust provides the manager with an organizational approach to succeed in situations where SUDO leaves him at a loss. The strength of this form of delegation lies in the idea: "Because I trust you, because you and I are committed to this idea, because you know how important this is to the company and you to the company, and because I know you are intrinsically motivated to succeed, you have full authority in this project."

This concept seems to have been underlying some of the work in Human Resources Management (e.g. [12], [20]), but has not been, to our knowledge, fully developed and applied. To do so, there are some conditions that have to be satisfied.

First the individuals have to be ready to accept the responsibility of dealing with a new set of rules. This is normally better accepted when other control tools are not available and one finds oneself forced into the situation as the only organizational answer to the dilemma.

Second, the organizational culture has to be able to assume this new concept of organizational behavior and there should be an atmosphere of open communication. The technician needs, in order to get the motivation to be innovative, an organization which is sensitive to his needs and which fully understands him. We will go deeper into these points when we explain the nine points of delegation by trust.

Third, both parties, the one who delegates and the delegated, should share the commitment in the development of objectives and both should be motivated by the knowledge of their own responsibility in assuming this new concept. Figure 1 shows the above mentioned situation (i.e., a high residual SUDO one).

Before going deeper into the delegation by trust and in order to get a better understanding of the framework, we would like to clarify some of our ideas about the differential characteristics of innovation environments, both their organization and the individuals involved.

In our experience there is a particular atmosphere that surrounds the innovation work and differentiates it from the rest of the company's. In this environment, time is often not a relevant factor; the target is to achieve perfection of what is being developed and this technical perfection is a must. Researchers are often self-centered, self-motivated, very persistent, introverted, independent, voluble, and very sensitive to alterations in their surroundings. They sometimes live in their own worlds, very much apart from daily pressure and stress. They are different people, in a different world with a different set of values and productivity can only be achieved if managers understand this. If not, frustration will arise and insignificant details in a company's life will become essential for their productivity and wellbeing.

Figure 1

Conceptual Diagram
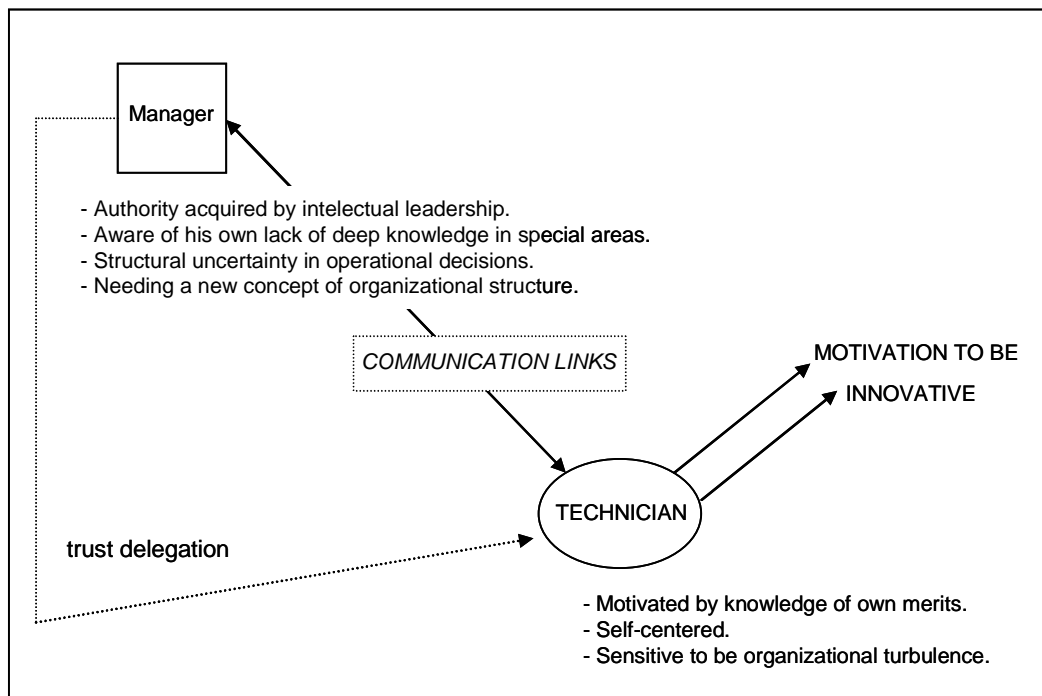
The awareness of these differential factors, plus the high level of residual SUDO in the projects, leads us to postulate a set of values in which trust and communication are the main issues. Thus, we come up with an alternative approach: delegation by trust.

Delegation by trust is a form of delegation based on nine factors:

I. **Delegation by trust assumes that the human factor is the differential factor in business.** The importance of human resource management is widely accepted. [2] For the authors, the human factor becomes of primary importance in the analysis of competitive strategy and, in companies with SUDO, the role answer for strategy implementation. Control tools are no longer available and trust is the only factor left.

II. **It sets a new trend in business life and, for full implementation, needs the acceptance of the CEO.** Any change in an organization has to come with the backup of its leaders. Since delegation by trust sets a new trend in business life, it needs the CEO's willingness

to support and lead organizational changes. Sometimes it does not have to go up as far as the CEO, but it is an advantage to have his/her support. Organizational changes can cause disturbances in an organization and have to be thoroughly understood by the upper layers of the same. In high innovation surroundings the CEO has to maintain an open minded attitude in which change is welcomed. He has to be aware of the difficulties and changes that his company is dealing with. Any sound concept that can bring a new vision to the organizational structure has to be tried. He has to be aware that some things that might look unimportant to him are, in such settings, of great importance.

III. **It needs, for its implementation, an organization with adequate cultural standards.** This includes the knowledge and sharing of the company's strategy and objectives by all individuals in the organization. In order to implement an idea that is based on communication and trust, there has to be an atmosphere of sharing and commitment in the company. Everybody has to feel responsible for the success or failure of the company. The existing climate should allow people to discuss, freely and with enough knowledge, the strategy and the objectives of the company and their implementation and achievement. This can be done, in any company, through a program to enhance communication that should be designed specifically to suit the company and its strategy [20].

IV. **Communication links become essential and an open communication flow is required.** Communication leads to trust and trust leads to an open communication flow. Nowadays it is impossible to conceive of a company that is not concerned with communication upwards, downwards and sideways. However to implement delegation by trust, communication becomes the link that unites two people. They have to trust each other and should not be bothered by interferences in their communication process. Communication is crucial and has to be understood as such by the whole organization.

V. **There is a need for parties' total commitment in the implementation procedure.** This is just a consequence of IV above. Trust and open communication bring commitment to an idea and an objective. When someone is committed, there is a high motivation to accomplish and the level of creativity is enhanced. Commitment is key to success in any company. It brings out all the buried virtues of the individual in his quest for achievement.

VI. **Individuals should share failure and success on equal standards and in mutual understanding.** As we have suggested, in areas with high SUDO the figure of the leader and manager endures some changes. Although under delegation by trust there is no real need for a day-to-day follow-up, there is a need to know that there is someone who can provide helpful hints and guidance or at least who can listen to one's problems: someone who shares failures and approves success; who understands troubles on an equal basis and has confidence in the work you are doing; who trusts you and whom you trust; with whom you can develop a communication process that will make it easy to trust him in his choices.

VII. **The individual has all the responsibility but feels free to get his superior's advice and support.** Under Delegation by Trust the individual has all the responsibility for achieving his task but feels free to get his superior's advice and support. The manager has to be

sensitive enough to create an atmosphere of acceptance to facilitate the need for help. The technician should feel that asking for help is not viewed as a demerit but as a normal occurrence of everyday life. Innovation is linked with taking risks and therefore is in itself linked with errors.

A manager in a high SUDO environment should be aware of his own lack of deep knowledge in technical areas, and should not feel insecure because of this. People who feel sure of themselves and have a deep knowledge of their specialty areas feel no shame whatsoever in recognizing their lack of knowledge in some other fields, and even feel free to express their desire to learn and understand. This singles them out and makes them widely respected. The manager's target should be to create an open minded environment where a free sharing of ideas should be able to take place, and where one should not be afraid of making errors. This climate would be easier to create if the manager has earned a high degree of authority among the technicians by his/her intellectual leadership.

VIII. **Needs an acceptance of the loss of power by the manager.** There is a natural loss of power when the organizational structure is not ruled in an authoritarian way. Under any form of delegation the person who delegates has to accept the associated loss of power.

Under delegation by trust, this loss is even greater. The manager entrusts the person to whom he delegates with complete power over his actions and with total freedom over his choices. To a certain degree it is a blind commitment. Were it not for the existence of mutual trust and communication, delegation by trust would be a utopia impossible to implement.

There is an enormous amount of motivation in this intercourse and the person feels completely entangled in the process. It is tough for the manager to accept it but, for us, it is the only way we could conceive of having the work achieved in high residual SUDO situations.

IX. **Creates deeper links and involvement of the individuals with their business lives.** When someone shares a common project, when the involvement is so great that one feels the authorship of the development of the program, a bond is created difficult to break. One of the keys for success in any company is the involvement, commitment and motivation of its human resources in the company's strategy. Through delegation by trust this involvement is even greater because people know the responsibility they have been given, and the consequences of their success and failure. They feel part of the organization, they feel important, they feel listened to, and they know their results will enhance the company's 'life.' A company's success is proportional to the degree of integration and involvement of its human resources in the common project. In addition, human beings need authorship in order to feel important and integrated in an organization.

Up to now we have seen what delegation by trust is and when can it be used. Now, we should go into the third aspect: how to implement it. In order to achieve this implementation, two phases must first be completed:

1. **Awareness phase.** The reasons for the failure of the classical control tools should be explained to managers. We feel that the SUDO concept provides an easily understood conceptual model for the phenomenon. An evaluation of residual SUDO should be made and the reasons for its existence must be clearly established. This should convince the

manager of the need for a different organizational approach. It is impossible to implement delegation by trust if the manager is not 100% convinced or at least has an open minded attitude towards trying it.

2. **Creation of an integrated environment.** In order to accomplish this phase a continuous process of communication has to be implemented, integrating the individual with his business life and with its strategy. Management has to clarify the business values, make them common knowledge, and behave accordingly. Management should adopt behaviors coherent with the organizational values, and mixed messages should not be tolerated.

   Phase 2 sometimes requires a cultural modification of the organization. This can be achieved through different methods. For instance, we achieved it in DEA by applying an Intervention Program for Cultural Change [14]. This methodology is now being applied in another company to achieve a complete transformation of its competitive position.

3. **Implementation.** This should be done once phase 1 and 2 are well rooted. To convince the rest of the organization, the first step should be the creation of a pilot program. The participating individuals must not be afraid of taking risks and should have enough knowledge to make sound decisions. The conceptual framework of delegation by trust has to be explained, making them aware of their importance in the success of the program. They must be motivated to make this pilot program a success. They have to understand the trust that the organization has given them, the importance that this pilot program has for the organization and the complete power that they have in making decisions. Power makes people afraid, so it should be carefully explained that having the power to making decisions does not mean that they will be left alone; their managers will back them up in all the decisions they will make. Managers have to show and demonstrate time availability for advice and support and they must be available when needed. The pilot program should be carefully monitored by upper management in order to achieve a smooth organizational adaptation.

7. Summary

In this paper we have presented SUDO, a concept which we feel is important in order to understand the dynamics of innovation projects, and we have explained a methodology for its use. Table 7 presents a strategic overview of the full situation. Actions are recommended to deal with innovation projects in terms of the strategic definition of the project and the existing level of SUDO. The situation presented at the bottom-right of Table 7 requires different organizational approaches, and we have presented one that we have been using successfully, namely Delegation by Trust. We think that the scope of this form of organization goes beyond the management of innovation projects, although it was created to suit them. We plan to discuss those issues in future papers. Much remains to be done in order to have a foolproof implementation strategy. Now the implementation of delegation by trust hinges upon the capability of the implementer to recognize new situations and adapt to them. Thus it is very much dependent on the degree of confidence that management has in the concept and in the person introducing it. As we gather new experience in it, we learn more about the implementation process, but we feel that it is still a tool that should be implemented with care and under the close supervision of experts.

Table 7

Strategic Overview

Strategic Definition	Low SUDO	High SUDO
Project Objetives well-defined	Traditional techniques could be easily adapted (PERT, Cost Control)	Top-Down approach required in project management. Some newtools
Project Objetives illdefined	Prototyping provides answers to both uncertainties	New Organizational approach: Delegation by trust

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