

TRAINING ORGANIZATION OF A MIDDLE-SIZE COMPANY ENGAGED IN
INFORMATION TECHNOLOGY SERVICES: THEORY AND PRACTICE

F. Sáez Vacas

Training Manager, ENTEL, S.A., Madrid, Spain

Professor of Computer Science and Cybernetics,
Polytechnical University of Madrid, Spain.

Abstract. In order to establish an active internal know-how reserve in an information processing and engineering services company, a training architecture tailored to the company as a whole must be defined. When a company's earnings come from advisory services dynamically structured in the form of projects, as is the case at hand, difficulties arise that must be taken into account in the architectural design.

The first difficulties are of a psychological nature and the design method proposed here begins with the definition of the highest training metasystem, which is aimed at making adjustments for the variety of perceptions of the company's human components, before the architecture can be designed. This approach may be considered as an application of the cybernetic Law of Requisite Variety (Ashby) and of the Principle of Conceptual Integrity (Brooks). Also included is a description of some of the results of the first steps of metasystems at the level of company organization.

Keywords. Requisite variety; conceptual integrity; Cybernetics; Human factors; Training Architecture.

INTRODUCTION: THE PROBLEM

The importance of training in productive processes and, in general, during times of technological change, has become commonplace.

At the practical level, there are manuals and methods on how to plan for training, on which didactic techniques to employ, and on the educational technology and its advantages and disadvantages (e.g., Auerbach DP Training, 1981).

With this entire arsenal of ideas and tools, the training manager of a company can throw himself into the task of organizing a training program... and fail. He will be faced with a number of difficulties, which are perhaps circumstantial and hard to systematize, that tremendously hinder the achievement of his objectives. He will begin to think that if some ideas have become commonplace that this must be due to their being talked about rather than to their being put into practice. This paper describes a real case in which this problem was confronted. We believe that our

experience has methodological value because the metasystem we are about to present, drawn up before the implementation of the organized, integral training program, is a system (in the sense of the system theory) of ideas.

ENTEL is the first completely Spanish information processing company and, as a result, it exercises considerable influence on public and private sectors through its activities. By international standards, ENTEL is a middle-size company (with a staff of between 500 and 1000 employees). Its rapid growth presents something of a hindrance to the structural organization of an essential activity: personnel training.

Since ENTEL's general manager was concerned with finding a solution to this apparently vicious circle, in early 1982, the company hired an individual to set up a training department, based on the idea that his chief human resources were theoretically any of the many company technicians and experts.

A Problem of Perception, Followed by
a Problem of Organization

Nevertheless, some difficulties arose, an unranked sample of which are listed below:

- Many people viewed training from a very pragmatic short- or extremely short term viewpoint, which was generally limited to the functional area of their own organizational unit. Some had formed no opinion.
- The managers of the administrative units (divisions, departments, services...) fought against giving up their human resources for an internal collective activity such as training, regardless of whether the loss was made up for in the earnings budget or not.
- It was not easy to get the mechanisms going to somewhat accurately explain the training requirements.
- The training budgets were highly fragmented and consumed by individual enrollment inside and outside of the country, with little or no yields for the rest of the company.
- The very dynamics of each and every one of the projects in which the company was involved habitually prevented the regular, planned attendance of the training program participants.
- Parallel training activities emerged.

The above points are summarized in the existence of a two-faced problem: a) the conception (or perception) that each person has of training; b) the company organization with respect to the possibilities of channeling training activities.

The first issue is complex, because it means that there are different levels of perception: that of the individual, that of the heads of the administrative units and that of the general training manager. And this gives rise to a very high cardinality, if we bear in mind the multiplicative factor of personal conceptions. Probably, the second issue depends heavily on the first. This is precisely how we have viewed it at ENTEL, by first tackling point a).

Law of Requisite Variety and the
Conceptual Integrity Principle.

There is a sociological reality represented by the legitimate manifestation of different perceptions

of training, which is generally the result of the point of view of each person in the company organization chart and in life. Nevertheless, we should not forget that reality can be shaped, and the Law of Variety (Ashby, 1956), whose application is universal, brings us to a fundamental point: if we want to control a system, the controller must have the same variety as or a greater variety than the system. Our interpretation is that in order to set up a training system, the cardinality of the perceptions must be adjusted to the variety, and the variety adjusted to a coherent scheme that can handle a reasonable number of perceptions.

The coherence of the scheme is essential and its essentiality is rooted in the way in which it meshes with the activities, functions and needs of the company and its employees. This is what Brooks (1972) would call the Principle of Conceptual Integrity: "I will contend that conceptual integrity is the most important consideration in system design. It is better to have a system omit certain anomalous features and improvements, but to reflect one set of design ideas, than to have one that contains many good but independent and uncoordinated ideas".

In short, the conclusion of our analysis was that the design of a company training system should be preceded by the design and execution of an (qualitative) adjustment process for the variety of ideas and perceptions that the entire company staff must have about training. Moreover, this had to be carried out based on the Principle of Conceptual Integrity. The second stage would take up operative development.

FIRST APPROACH TO TRAINING.
A FLOW OVERVIEW

Figure 1 is a simplified diagram (Rosnay, 1975) of the production factors of a company seen as flows, which the company obtains from some reserves by means of a distributing mechanism of the corresponding market. The arrows marked 1', 2', 3', 4' and 5' denote the payment flows, generally made with money, used by the company to pay for the use or consumption of these factors.

In the figure, we have colored in some circles to highlight those factors which preponderate in our case and which should therefore be given greater attention. If we take a good look at the diagram, it is easy to see that behind its economic appearance other

interesting aspects can be discovered.

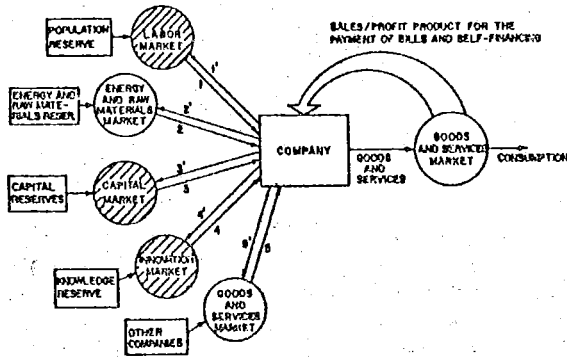


Fig. 1. Production factors of a company.

For example, Flow 1, which represents the work done by the company employees is largely an intellectual contribution. Consequently, given that here knowledge/know-how is an important factor of production, it is of prime importance to coordinate a reinjection that is not only economic but also intellectual in order to strengthen the internal knowledge/know-how reserve. This reinjected flow is not shown in the drawing and must be assumed to be hidden behind the monetarist label of self-financing through economic profits. Our mission, however, is to clearly reveal it, first on paper and later in deed.

Table of Flow Relationships

How does the company capitalist perceive this diagram? Setting aside the less important flows, we can postulate that the capitalist hopes that the business managers successfully

- .maximize 1, 3, 4 (1)
- .maximize the 1:1'ratio (2)
- .maximize the 3:3'ratio (3)
- .maximize the 4:4'ratio (4)

Naturally, a typical company employee displays a different point of view in this regard. He will exert pressure to successfully

- .maximize 1' (5)
- .minimize the 1:1'ratio (6)

If diagrams are always cold, there are all the colder when they hide human beings. Thus, our employee has been "buried" under the dehumanized label of the population reserve (workforce). But, since a cultural being demonstrates a need for information/education, on which he spends a part of his income, as a borrower of

intellectual labor, he probably hopes that part of his payment will be in the form of an information/educational flow (here we will only discuss the training aspect in order to keep to our objectives).

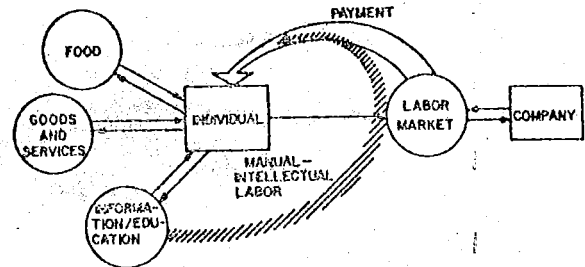
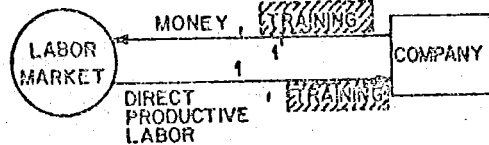


Fig. 2. Some production factors of an individual.

We can already see that it is impossible to satisfy both the equations (2) and (6), which represent opposing objectives. For this reason, we must look for a compromise where the improvement of the remunerative factors that are not directly economic, such as training, play an elastic role.

At the same time, we move toward satisfying the equations (1) and (4) by channeling part of flow 1 (labor) to internal training. This, in turn, helps to reach a balance in the equations (2) and (6). (The following figure explains this point.)



Towards an Internal Knowledge and Know-How Reserve

What is true is that a company that operates in a technological innovation sector has the imperative need to establish an internal knowledge/know-how reserve. This requires an organization that dynamically links the isolated elements of this reserve, the bearers of know-how, namely the employees. Solely by creating the appropriate distribution and multiplication mechanism for individual knowledge, a company's experiences can be structured into company know-how and, in short, this know-how is the basic material of the services offered by the company at the marketplace..

SECOND APPROACH TO A TRAINING METASYSTEM

Assuming that everyone has been convinced of the aforementioned ideas, we have yet to see the practical

materialization of this internal know-how reserve, that is to say, the opening and maintenance of the channels that direct the flow of information. This task is not an obvious one; It requires a clear outline of available concepts that are in keeping with the mentalities and concerns of the company, for this materialization means the mapping of flows in the company's organic structure.

Companies like ENTEL build a structure in the form of a scaffold in order to sustain a very dynamic situation, made up of some real, transitory, competitive, unreliable, ... working units (projects) that are largely created by the influence of outside events; these events are situated in time in a fashion that is not very deterministic, and only partial

In all conceptual input a certain explanatory detail is essential, and our theory has materialized into a working document of more than forty full pages. In this paper we are synthesizing drastically. With Figure 3 we converted the synthesis into an ideogram and, in passing, we hope to make it more comprehensible and mnemotechnical.

The Business Sphere

The first things noticed in the diagram is a two-part breakdown: the system and the metasystem, with the metasystem being the set of ideas that will inspire training within the operation (or system). Within the metasystem an attempt has been made to distinguish two sectors, calling one of them the business

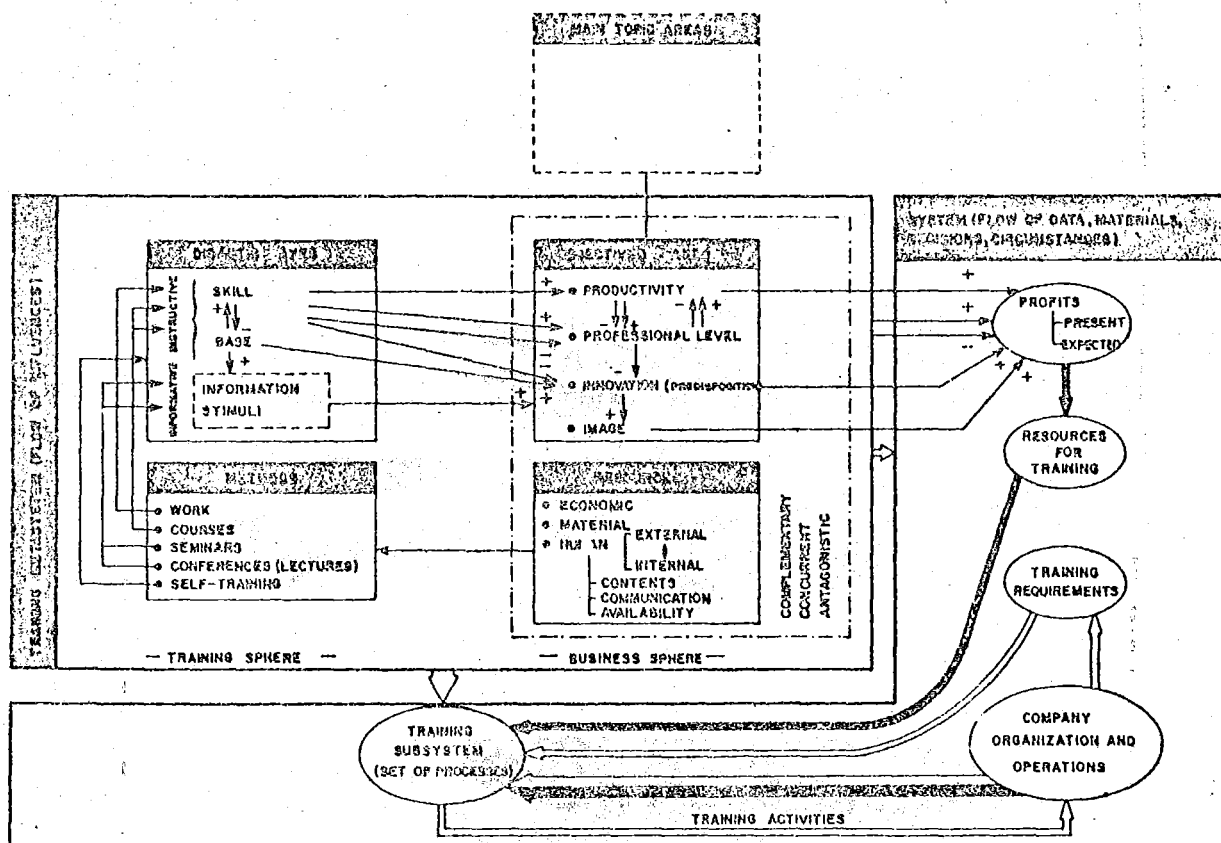


Fig. 3. Metasystem diagram

control is exercised over them. And this all takes place within a highly changeable setting: information technology. Both circumstances are determinants in the characterization of our design.

sphere, which gives expression to those factors whose specific definition falls outside of the decision-making area of the training department. The arrows of the metasystem represent influences

(+sign means positive influence, - sign means negative influence).

As we can see, the concepts of the training sphere are trapped between (conditioned by) two poles of outside responsibility: the objectives to be attained and training resources.

a) Objectives. If training is to contribute to company goals as an internal know-how reserve, these goals must be defined in concrete terms and in the specific area of performance (in the diagram the *main topic areas* box has been left blank). This is a delicate subject to be studied and decided upon: to qualify and quantify the objectives of productivity, of professional level planning and development and of innovation preparation; the image objective is of a commercial nature. Normally, it does not make sense to choose one from among these objectives, but rather to pursue all of them at once, giving each of them the proper attention, because they are dialectically interwoven: they complement each other and, in a setting of limited resources and diversity of decisionmaking centers, they are concurrent and antagonistic.

But watch out! In this point there lurks the danger of falling into a reductionist trap, for the human mind, and perhaps particularly a very technical mind, tends to run away from ambiguous relationships, such as the possible simultaneity of complementary, concurrent and antagonistic conditions, which are common circumstances in our complex reality (Morin, 1977, 1980). Thus, by distorting the perception of this reality, each person holds on to the objective that is most in his interest.

Lastly, the objectives cannot be separated from company profits within a given period. Training within a company is organized, in its entirety, under the assumption that it will contribute to higher profits. What is true is that there is also opposition to these profits for two reasons: one objective and direct reason is that training is fed by profits; another potential reason is that if the training program turns out to be inadequate, poorly managed or improperly used, causes damage. And this reasoning is the link expressing the need to hook up what we call the didactic axes of training with objectives.

b) Resources. Although all economic resources end up having an economic assessment, we understand *economic resources* to be the money used to pay

for the various goods and services: course enrollments, trips, lodging, documentation, computations, energy, wages and the social contribution of the employees who will benefit from the training program, etc.

Material resources are understood to be classrooms, audiovisual mediums, educational hardware, offices, libraries, etc.

The distinction between internal and external human resources is the distinction between Flows 1 and 4 in Figure 1 at any given moment. There are also complementary, concurrent and antagonistic relationships in the employment of these resources. In fact, by going through channel 4 instead of channel 1, different ends can be reached; at the same time, the same ends can be reached by going through either of the two channels. And when the ends are the same, there may be disparate direct or opportunity costs. (Note: This applies to the common case in which Flow 1 is the intellectual contribution of the company staff).

Turning to training activities, the model shows that human resources (as instructors) must fulfill only three conditions that are easy to understand and remember and not so easy to meet: that they master the contents of the planned activity; that they have good communication skills; and that they be available at the precise moment and for the time required. This order is one of increasing difficulty for internal human resources that are not assigned to the training department.

Training Sphere

All training activities are specialized projects and require a specific definition. But, given that this model is in no way designed for training experts, it is pointless to present any technical details. On the contrary, technical details would be counterproductive. We have opted to make a table with headings that are closely tied to very specific situations.

a) Didactic axes. Although training may offer a mixture of things that will be listed later, it predominantly provides:

- .skills
- .a base
- .information
- .stimuli

and the dominant feature will shape the didactic objective, the methodology and the means to be employed. All the features are necessary and should be in keeping with the objectives.

Training activities that teach skills pursue the acquisition of very pragmatic techniques, methods and knowledge, passing over all that which is out of step with specific targets (in the broad sense), purposes and situations (including time). Many people believe that this is the only kind of training necessary in a company.

Training that provides a base and foundation does not mean, as some people think, a theoretical approach or the application of a coat of culture; rather it is a general, systematic, cementing process that emphasizes basic concepts and techniques that will later be applied in a specialized and diverse fashion.

Some of the programs that provide information or stimuli serve to catalyze, to set a mood and to broaden perspectives. In neither of the assumptions are the results measured by an improvement in the technical, methodological, practical or conceptual levels, but rather by an increase in the rate of information or stimulation of the employee.

Many comments can be made about the interrelationships, with which the reader may or may not be in agreement. The opinion that the acquisition of skills in a real and practical area has a tangible, positive effect on improvements in productivity and in the professional levels of the staff is relatively universal. Less visible is the fact that, if its intensity goes beyond a certain threshold, its influence can also have a negative effect on professional levels and innovation capacity.

Lastly, what is less clear to most experienced people in the business world is the absolutely fundamental and positive role of basic training.

b) Methods. In the specialized sense of the teaching-learning process, rather than methods we are referring to classic procedures or training sources. In the aforementioned document, some practical considerations for organizational and planning purposes are added.

Special attention should be given to the *self-teaching* method. It is recognized as a separate area not only

because it accompanies all the other methods, but also because it is the only way in which the many disperse learning requirements can be met, for not even the most perfect training system can cover them all.

Naturally, if the model shows this method, it is because it has been thought that this method requires human and material means and that it should be sustained and powered by special organizational measures.

STRATEGY FOR INTRODUCING THE MODEL

The following stages were designed and, at the time of writing this paper, the first four had been completed:

a) To genuinely experience the difficulties pointed out in the introduction in order to compile a set of specific arguments to describe the problem.

b) To design and justify the model and present it to the company's chief executives (the two top levels of management).

c) To propose to the chief executives budgetary and organizational changes in accordance with the model, at the same time that well-chosen and fundamental basic training courses are carried out and funded, for the most part, with external resources, in order to make a positive impact on the staff. It involves the demonstration of selection capacity, clear ideas and good organization by a very small training department (3 people).

d) To present the model to the entire managerial staff of the company (the first large variety adjustment).

e) To develop the operations of the entire model.

CONCLUSION. THE FIRST RESULTS IN THE SYSTEM

The metasystem is only an *ideological base*; it carries out the role of intermediary and guide. Its usefulness is conditioned by the way it is interpreted in the system. To begin with, it would be an error to use it as a lever for the drastic reconstruction of the system --if such a thing is possible--; rather, it must be adapted to the very dynamics of the system, /making/ small changes at the appropriate points, because one thing is to adjust the variety of training perceptions and another it to adjust the organizational variety.

That labeled *Company Organization and Operations* in Figure 3 operates as a process multiplicity. Correlatively, the training subsystem, independently of its administrative form, will have to be a set of processes coordinated partly by a department organized like the kernel of the operating system of a computer (Lister, 1981) and partly in a decentralized fashion. Below we have summarized some of the issues that have already been resolved and introduced into the system. It is a situation that spurs us on to continue with the design of the rest of the architecture.

.To introduce a Technological Group at two levels without any budgetary obligations to generate earnings. Level 1 will define innovation areas and standards, synthesize training requirements in relation to the same objective, and offer human resources in order to ensure this training. At level 2 come the very same responsibilities, but in the area of productivity. Subgroup 1 will be responsible for the medium- and long-term and report to first level management; subgroup 2 will concern itself with the short- and medium-term and report to second level management.

.To introduce a Marketing Unit that reports to first level management. This unit, like the other groups, will have duties that are unrelated to training. But, with respect to training, it will take charge of the image activities under the same circumstances mentioned for the other cases.

.To put the company documentation services under the Training Department; they will be technologically fueled to create an environment that encourages self-training.

.To introduce changes into recruitment criteria, both in the area of knowledge prerequisites and in the area of personality factors, by looking for solid bases of knowledge in some of the defined main topic areas, self-starting abilities for self-training, personalities predisposed to innovation and change and personal communication skills.

.To define and introduce seven different training categories that are clearly specified in all the dimensions of the budget, organization, and execution and that are

of course in keeping with the new organizational terms.

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