

ABOUT NON TECHNICAL BARRIERS PREVENTING EFFICIENT TRIZ INTEGRATION INTO ORGANISATIONS

Denis CAVALLUCCI, David OGET, Michel SONTAG, Nathalie GARTISER
Institut National des Sciences Appliquées de Strasbourg (INSA)
Strasbourg, France

When adequately performed, every TRIZ action on a problem-solving situation undoubtedly leads to an inventive solution, often satisfying the initial technological requirements imposed by the company. Nevertheless, when observing the arrival of TRIZ for the past ten years in highly industrialised countries, we have witnessed how incredibly difficult its progress in corporate strategies has been. The paradox lies in the sense that while successful actions are there and properly trained people are ever more numerous, there still remains (ever stronger) obstacles to TRIZ penetration in these organisations. This paper aims to provide the reader with the results of an analysis of blocking factors through the state-of-the-art knowledge found in the human sciences and their link with several realities found in TRIZ and its arrival in an organisation.

KEYWORDS

TRIZ, psychology of actors, educational process, innovation management, multidisciplinary approach.

1. INTRODUCTION

1.1. Context of this study

The hindsight we now have concerning the modes of acceptance of TRIZ by companies is based on a full ten years of experience. The sources for this article are taken from the last seven years (the period which seems to us more significant in terms of efficiency) and concern around fifty companies where our actions have helped us gain the experience relevant to the theme of this article. The source for our proposed contribution lies in the fact that a paradox has arisen in the situations we have experienced, which may be presented as follows: nowadays, TRIZ is formally acknowledged as an efficient way of addressing technological problems and consequently, when it is adequately performed, it meets with the full and total satisfaction of its sponsors (the companies). However, in spite of all these positive points never before attained by a methodological approach relative to industry, the psychological and educational problems encountered as to its acceptance by organisations confronted with the problem of its integration, are very significant, and may even lead to integration options being eradicated very early on in the decision-making process.

We wish to clarify the reasons for this paradox blocking the progress of acceptance, firstly by analysing the findings of three scientific domains belonging to the human sciences relating to "traditional" resistance to the arrival of any novelty in the company, and secondly, by analysing what is specific to TRIZ and how a relationship can be set up between this resistance and the "standard" behaviour patterns that should be adopted in such cases. The aim is to provide the architects in charge of introducing TRIZ into organisations with viewpoints that sometimes have little in common with their integration plans since they stem from disciplines which are alien to their own. This article also aims to propose a set of basic rules which should be incorporated into integration plans so that they may be taken into account in a specific process.

1.2. The classic integration plan

This section is not going to deal with developing a new theory on how to integrate TRIZ into organisations. This theme, while being extremely interesting, must be subjected to in-depth research and integrated into an exhaustive state-of-the-art assessment of strategic practices linked to innovation management in companies and how it can be involved in the development

of the innovation process in organisations. This research should, moreover, be conducted in collaboration with a multidisciplinary team of researchers from management sciences, economics, psychology, sociology and educational sciences so that its impact in companies may become a reality. For the purposes of this article, we have decided to draw up a partial picture at a given time T of what has contributed to the success and failure of TRIZ practices in organisations.

The diversity of practices can be summarised in 9 categories. When we examine these categories, it is easy to conclude that there is an evolution in the passage from refusal to acceptance, passing through an intermediary phase, which is doubt. Our aim in this article is to elucidate the cognitive aspects which enable companies in the situation of the first group to develop towards the last group. A brief description of the 9 situations follows:

- Organisations which do not even want to hear about it (adamantly against what they have heard or read).
- Organisations which have never heard about it (not alerted by their intelligence departments or too engrossed in their own affairs or who have passed over the information without looking at it).
- Organisations disappointed or unconvinced by the basic arguments (including when the culture of the decision-makers is opposed to the basic postulates because of what they have read or heard about TRIZ).
- Organisations which want to find out more but at no extra cost (at least at the beginning, or want to wait until others have done the spade work).
- Organisations which have "tested it just to have some idea" (a budget is allocated to see what it is all about).
- Organisations which have "trained an engineer" (sometimes in the hope of repercussions at a later date).
- Organisations which have set up a strategy of "integrating skills" (or searched for a solution giving them autonomy in their practices).
- Organisations which have taken the decision to "outsource skills" (they understand the relevance of TRIZ, but think that their needs for TRIZ and the efforts required have not reached a threshold level for a return on investment in terms of in-house integration).
- Organisations which have decided to "set up a strategy" (convinced of the relevance of TRIZ, and having decided to build an integration strategy, have committed human and financial resources thereto).

When one or more of these actions towards adopting TRIZ is undertaken, we find records and results of the process. Some companies have developed a practice tending towards another action, whereas others have stopped all expenditure linked with TRIZ due to disappointment, lack of clarity in relation to the added value it represents for them or an obvious lack of enthusiasm among the actors of innovation. It seemed worthwhile investigating into the problem of this obvious lack of enthusiasm in order to attempt to identify the underlying psychological motives which, in the end, often result in the following paradox: TRIZ disappears from a company's practices, although its benefits and potential have turned out to be positive for the company's future development.

1.3. Stating the problem

As they contain an element of the unknown, innovations destabilise the operating modes and comforting inertia inherent in the notion of habit. They also give rise to refusals, reticence and fears from those whose existence and habits are disturbed. Resistance is demonstrated in a variety of forms at all levels in the company. In the following section, we shall attempt to identify and briefly analyse the points of divergence between the operating modes of corporate actors

and the same modes as seen from the TRIZ perspective in order to establish rules which will favour its development within the company, whether they are adopted by external or in-house TRIZ actors.

2. ANALYSIS OF THE BLOCKING FACTORS

2.1. Difficulties associated with inaptitude compared with traditional models

We shall now attempt to describe the models inherent in traditional modes of thought and compare them with the thought models provided by TRIZ. The aim here is to highlight the differences and explain, through different scientific domains, the reasons underlying the difficulties of accepting these modes of thought.

Example of a psychological stumbling block

Divergent process versus convergent process

Traditional model: Man is creative by nature: by increasing the multidisciplinary approach of the group and idea-generating opportunities in a structured way, the statistical spectrum in terms of sheer numbers will surely lead to "good ideas" being collected.

Model proposed by TRIZ: The divergent approach consisting in generating a maximum number of ideas only leads to superfluous cognitive and financial expenditure; a convergent process must be set up leading, through reflection, to a narrowed search area before embarking on the creative approach.

Compromise is inevitable versus to innovate, we must refuse compromise

Traditional model: In a design action, compromises are inevitable and the designer's efforts must be focussed on the most appropriate compromise in view of the initial project specifications.

Model proposed by TRIZ: A compromise is never a solution. The action of designing must focus on formalising the key contradiction which is blocking the evolution of the system and solve it without any compromise, by ensuring that the two contradictory properties progress.

Analysis of the psychological state of the actors

The mind is more easily fed with opinions than reason-oriented thought, because opinions translate people's worries, hopes and fears into ideas, whereas scientific thought presupposes a real breaking down of opinions and a rejuvenation of the mind. Our opinions are as old as our prejudices. TRIZ forces us to think under the influence of reason, and not under the influence of our prejudices. This requirement is not doubt one of the reasons behind the resistance to developing TRIZ in a group or a company.

The second, easily identifiable, reason does not stem from mere inertia of thought processes, but lies elsewhere - with power games. Resistance to new ideas is also due to the fact that they upset the power structure and relationships. Introducing TRIZ in an organisation calls into question the position of those who direct research and development based on other practices. Here, we come up against power strategies as decrypted in the work of Michel Crozier and Erhard Friedberg (1977) through their analysis of the strategic behaviour of the actors.

Examples of managerial stumbling blocks

The customer dictates evolution versus laws govern evolution

Traditional model: The Company designs and manufactures the products required by the customer through the more or less explicit expression of his needs.

Model proposed by TRIZ: Laws formalised by Altshuller govern the evolution of systems built by man - they must dictate design actions.

Associating innovation and cost-cutting at the same time versus dissociating these parameters in the timeframe

Traditional model: We associate innovation with the desire to achieve new concepts, while avoiding the feeling that they will generate high costs.

Model proposed by TRIZ: The laws of evolution teach us (especially the law linked to ideality) that at the beginning of its life, it is inevitable that the synthesis of a system will generate costs - to give it some chance of existing. Cost-cutting will only occur at a later stage.

Analysis of managerial difficulties

The stumbling blocks highlighted here are fundamental to management sciences, since they quite simply constitute a strong barrier to putting real innovations on the market.

Indeed, in the innovation project, marketers must be and very often are involved, quite simply because they are in direct contact with the customers and are therefore in a better position to express the customers' needs. Dissociating the needs of the customer and the natural evolution of a technical system such as it is given in TRIZ, is tantamount to taking the risk of making the innovation fail. It therefore becomes essential to make sure the two dimensions are coherent and, by taking care that the marketers are properly integrated in the project, to ensure that a very high level of coherence is preserved between the needs of the customer and the evolution of the product, i.e. the innovation about to be introduced.

Another dimension which must be integrated into any TRIZ approach concerns the objectives to be set in terms of defining the product range. Indeed, what are we trying to do? Introduce a totally new product, complete a range of products, introduce incremental modifications to an existing product to step up sales, etc.? Each of these objectives is going to have a high impact on investment, and also on the turnover generated. In view of this, it is important to understand that we will not necessarily have the same standpoint on the laws of evolution when putting the TRIZ approach into practice. Integrating questions as to investment and profitability in an efficient manner becomes possible at this stage.

Example of an educational stumbling block

Functional analysis versus systemic analysis

Traditional model: The teachings of functional analysis tell us that any technical system must be observed through a morphological breakdown of its elements and attributing a hierarchy-associated function to each component part described.

Model proposed by TRIZ: The system is analysed through modelling, placing it in a multi-screen pattern in order to understand its "real systemic barriers" and evolutionary jumps in time.

Analysis of the actors' educational difficulties

One educational difficulty that the TRIZ expert may encounter during his intervention in the company is due to the fact that the cognitive environment in which the learner finds himself is insufficiently identified. Here, for the purposes of the analysis, we consider that any person exposed to an intervention by a TRIZ expert is in a learning environment, and that the TRIZ expert is there to train, inform or solve a technical problem.

A survey of the cognitive environment aims to describe how the learner interacts with the people around him by attempting to give an accurate answer to the following question: why does the learner refuse to learn? How can someone totally reject everything to do with TRIZ? The reasons may be psychological or managerial, but may also depend on what the learner is capable of knowing.

His abilities can be picked up by the TRIZ expert by observing the learner from the angle of his cognitive instincts, i.e. what irresistibly drives him to adopt one cognitive behaviour pattern rather than another. From this point, the cognitive problem involving the TRIZ expert consists in assessing the importance of each type of instinct for each learner.

3. PROPOSAL FOR ANALYTICAL LOGIC PRIOR TO ANY TRIZ ACTION

Since the previous section has led us to observe that the differences in cognitive modes of thought has obviously hindered acceptance of TRIZ, we shall now propose the use of rules specific to knowledge stemming from the human sciences as modes of action which should be adopted to counter these difficulties.

3.1. Synthesis of the aspects to be implemented

Considerations inherent in the cognition sciences

The way in which we address the issue of the difficulties TRIZ encounters in terms of corporate acceptance – in terms of epistemological obstacles or the strategic behaviour of the actors – will also determine which answer should be applied. In the first instance, it is more a matter of making an effort on an educational level and in the second instance; it is a question of searching for a strategic alliance. These two concepts are no doubt complementary.

Yet, here, we would like to suggest another path. On the one hand, resistance to TRIZ is in fact only one example of the difficulty that a group or a community encounters in taking on board new ideas and intellectual approaches. Let us not forget that in his day, many years passed before Louis Pasteur managed to convince the scientific community of the time about his ideas on fermentation, despite the backing of experimental controls available to everyone. From 1898 to 1864, proponents of the theory of spontaneous generation, which included renowned scientists such as Félix Archimede Pouchet, contested his discoveries at first. On the other hand, solving technical problems concerns technical facts which are defined by the laws of Nature, whereas psychological resistance stems from subjective representations which are built up during interactions. Resistance is therefore included in discursive exchanges and can be addressed as a question of legitimacy.

From the standpoint of the psychology of the actors, the problem of resisting the development of TRIZ can therefore also be put as follows: while TRIZ is scientifically acknowledged, it is not easily accepted in companies. This leads us to say that it is not because someone is right scientifically that he is not wrong socially. For us, there is a clear distinction between the scientific statement which can be proved and social adherence which is gained through experience. The scientific statement depends on the laws of Nature and can be demonstrated, whereas social adherence depends on acknowledged legitimacy which is built up collectively. In other words, there is a great difference between the approach to a technical problem and the approach to a problem of social legitimacy. Proof is not enough to convince - the legitimacy of an idea depends on its acceptance. This process involves a discursive exchange and not just an authoritative assertion. Social, but not scientific, legitimacy depends on a vision of the world, or more simply on a shared representation based on a "social structure". In groups, ways of thinking, asking questions and finding solution-seeking approaches which are believed to be legitimate are built up through discursive statements.

If we start with this way of putting the question, we can understand the problem a bit differently. Commitment to problem-solving thought processes inspired by TRIZ can be roughly compared to training the scientific mind. But instead of only addressing this difficulty from the angle of the epistemological barriers, we also propose to address it from the angle of social legitimacy.

Considerations inherent in educational sciences

With respect to the educational rules which the TRIZ action leader must follow, it seems to us that the assessment of a person's cognitive capacity must, among others, consist in observing:

- the questions the learner puts to himself and the questions he asks other people,
- what the learner learns from his mistakes, his ignorance and his lack of reflection,
- whether the learner accepts that what he has always known and what he strongly believes in will be contradicted,

- if the learner prefers that others ask him questions rather than giving answers
- if the learner is capable of not having opinions about problems which he does not know how to express clearly to the team

Going on from these observations, we can distinguish between two behaviour patterns:

- The first arises from a conservative instinct. It is illustrated by the learner's refusal to question the knowledge he has acquired in the past; a mode of reflection, expression and action upheld by opinions and prejudices; and an old-fashioned thought process based on repetitive patterns. For these learners who reject novelty, we are tempted to suggest that for the TRIZ expert, the battle is virtually lost from the start.
- The second arises from the formative instinct and is opposed to the conservative instinct. It purports that the learner acts through destroying (opinions and prejudices) and rebuilding knowledge. It is with these learners that the TRIZ expert should work.

This list of observations and conclusions is not exhaustive and should be further investigated. It can nonetheless help us to understand the cognitive environment of a group of learners and therefore clarify, both for the expert and the company, the cognitive barriers TRIZ may encounter on the path to development.

Considerations inherent in management sciences

Corporate strategy is one aspect that must absolutely be taken into account from the managerial point of view in all TRIZ approaches. Indeed, an innovation project which develops independently of any reference to the strategic dimension is bound to fail: no coherence on the market, no coherence in the product range, no account taken of the accepted and expected investment and profitability level etc. In view of this, it becomes essential, right from the start of the project, to integrate the dimensions linked to the company's medium-term objectives, and even its long-term objectives. One essential stage therefore consists in making the TRIZ approach coherent with the real, global corporate strategy. Initially, it is therefore helpful to set aside the aspect of tools in order to focus more on innovation management and its appropriateness compared with the corporate strategy and the current organisation of the company. Once this has been done, it will then be possible to integrate the problem-solving aspects which will satisfy the company overall, into the TRIZ approach.

3.2. Basic rules to be followed

In view of these analyses and the discussion put forward in the preceding sections, we propose the following rules as points that are indissociable from the use of TRIZ in an organisation.

Setting up preliminary actions:

- Identifying the actors needed to put it into practice according to the following typology:

The actors / players are divided into four categories:

- The decision-makers: those who have the decision-making power in terms of the company's commitments (managers, R&D or marketing managers, others);
- Special partners: those who have all the skills acknowledged as being favourable to accepting TRIZ ;
- Contradictors: those who feel that TRIZ is a threat to the integrity of their personal project within the company;
- Resource persons: those who have the knowledge required for TRIZ to progress.

We should note in passing that some specific actors may have several characteristics at one and the same time and that the hierarchical level does not systematically correlate to a type of actor.

- Conducting educational observations

The ability each member encountered during an action has to grow out of their traditional cognitive reflexes;

The capacity each member of the study has to be malleable to an evolution in their opinions;

The capacity each resource member in the action has to accept the unacceptable and to contribute clear answers during the project;

The extent of social feelings in the face of the challenges raised by the project;

The real expectations of the decision-makers and the aptness of their desires as they are expressed compared to the objective status of their situation.

- Conducting a synthesis of individual and collective characteristics

The company's hierarchical organisation must be informed of the analysis and its results, and give its backing not only to the assessment approaches, but also to any necessary choices that result therefrom. With respect to the synthesis, the actors should be ranked in order of their ability to adhere to the cognitive criteria put forward. However, it is imperative that at no moment during the process should an actor feel he is being assessed, for if he is discarded by the decision-makers, then there is a high risk that he will become a systematic opponent

- Setting up strategic alliances

The decision-makers, in conjunction with the TRIZ experts and the top-rankers who have the appropriate cognitive profile, must then agree on a strategic alliance which will lead to the efficient and robust development of the TRIZ action and also agree on the specific adoption modes for the actors involved in the project.

- Drawing up a TRIZ strategy to be adopted by all the actors

Putting into practice an adoption strategy for the actors hasn't existed until now in terms of the problem of introducing TRIZ. However, it will eradicate the reticence which generates subsequent social barriers. In the logical approach which we advocate, the method must be constant and dynamic (adapted to each player) throughout the action, as any actor who has been misinformed or discarded becomes a strong enemy of the progress of TRIZ within the company. If the social adherence of some people has not been attained, they must not disappear completely from the introduction phase. The main aim of the adoption strategies advocated is therefore to make sure that the introduction and practice of TRIZ in a collective situation involves everyone, and that each person should find a comfortable role in keeping with his own objectives.

All these analyses can be summarised in four major phases prior to any development linked to TRIZ. They are suggested by the authors of this article as rules to be taken into account to facilitate the acceptance of latent cognitive aspects which often block the progress of TRIZ in an organisation. We shall summarise these phases as illustrated in figure 1, pointing out that their chronology and duration as well as the means used to put them into practice have been drawn up using a particular company model - that of a medium-sized or large industrial group in which the structuring of the innovation process is already advanced or well-established.

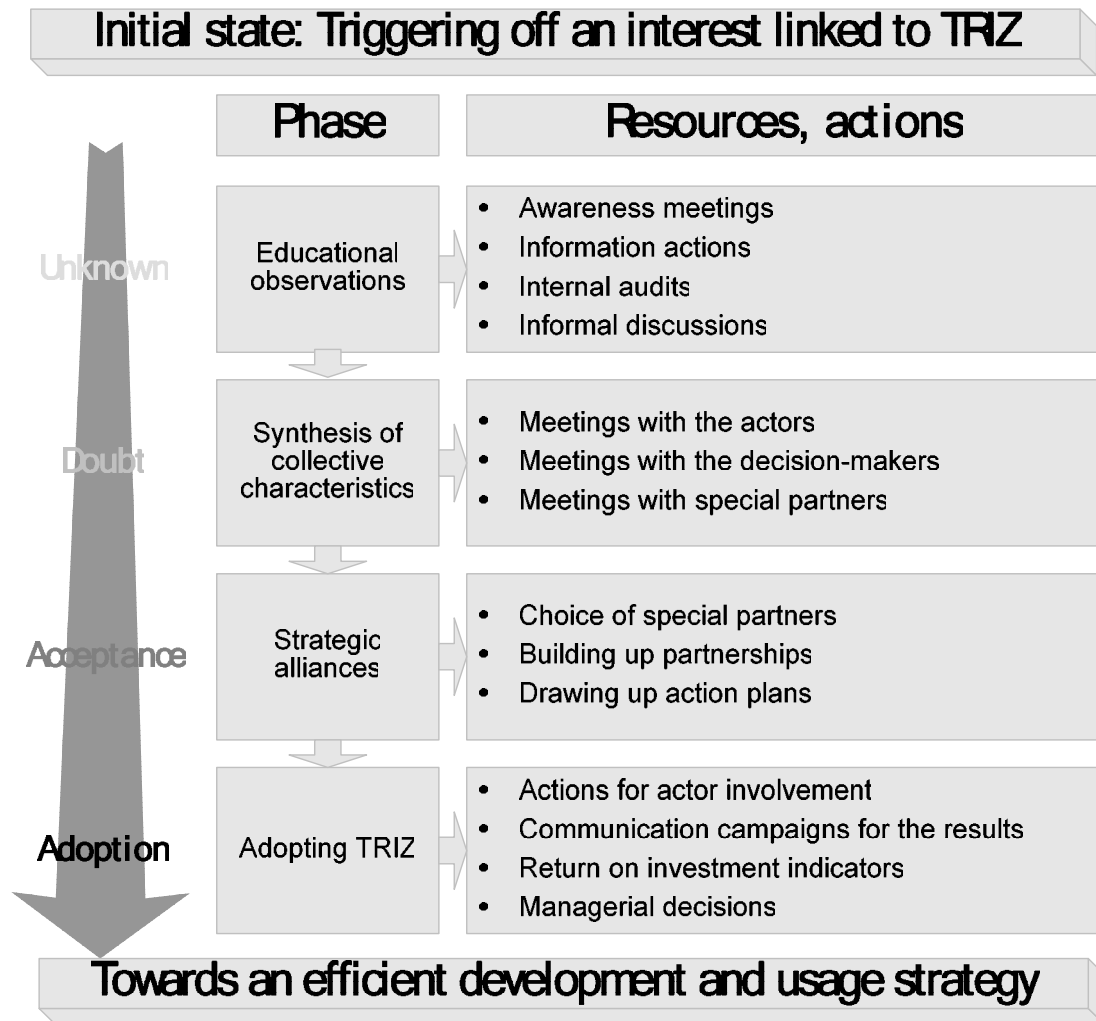


Figure 1: Generic diagram of the chain of non-technical considerations prior to the development of a TRIZ action

4. CONCLUSIONS

In this paper we do not wish to confine ourselves to identifying the types of barrier encountered in terms of the TRIZ way of thinking, but to push ahead with an analysis of resistance to a thought process whose pertinence has been scientifically acknowledged. At present, it is as if people say that it is not because TRIZ is right scientifically that it is not likely to be sociologically wrong. This observation results from our experience of the difficulties encountered in implementing TRIZ in companies, despite its power of invention. Bearing this perspective in mind, we are not dealing so much with a struggle against some prejudice, as ensuring the social legitimacy of inventive thought.

The notion of legitimacy mentioned here in a larger framework (a country, community of countries, all highly industrialised countries) is built up through the existence of benchmark groups which openly manifest their interest and trust in TRIZ's power of invention - the objective here being to help each individual or each potential actor to speak out in positive terms on the subject of TRIZ of his own accord, reflecting on the control he has of it.

In our multi-disciplinary synthesis and proposal to make the problem linked to the introduction of TRIZ in western organisations evolve, we wanted to highlight some of the less visible barriers encountered during so-called "classic" TRIZ actions. They were sometimes latent in the actors we met in the companies, but nonetheless explain why many a determination to implement TRIZ in a collective environment disappears. This contribution towards adoption modes purports to be perfectly coherent with the practices stemming from classic TRIZ methods and does not need a remodelling of the initial scientific models to be accepted more easily. Of course, such situations would generate a drop in the relevance of the development because the basis would be a compromise in terms of the originality of the method. And yet, the basic rules presented in this article together with the recommended adoption approach hold their share of chance. This is a well-known factor in the human sciences as there is no guarantee at any time that an action directed towards the human mind will end in success, since it is highly unlikely that one can control the complexity of reactions to manipulation. And it is a question of manipulation here, although in a more positive meaning of the term, imposing a latent breakdown of the initial cognitive patterns and then rebuilding them so that they are properly in line with the acceptance of the fundamental principles of TRIZ. In all cases, we are involved here in approaches which depend on the idea that social legitimacy is based on discussion and debate which enable us to break down and rebuild collective representations. Consequently, one of the aims we are working towards is to see TRIZ practices develop in organisations with fewer difficulties than currently witnessed, and to see development strategies being built up and receiving an appropriate welcome because of their efficiency and convincing results which at last disclose the truth of Altshuller's clairvoyance when he started out on his crusade. But let us not forget that social legitimacy is first and foremost an issue of community thought and not just scientific thought.

Literature

Michael E. Porter: "The competitive advantage of nations", Macmillan 1990.

Henry Mintzberg: "The Structuring of Organizations: A Synthesis of the Research", Prentice-Hall 1981.

Michel Lebrun: « Méthodes actives pour une utilisation effective des technologies », Louvain-la-Neuve, Belgium 1999

Gaston Bachelard : « La formation de l'esprit scientifique », Editions Vrin, Paris 1969.

Michel Crozier, Erhard Friedberg : « L'acteur et le système », Editions du Seuil, Paris 1977.

Bernard Charlot : « Du rapport au savoir », Anthropos, Paris 1997