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# *What is Information Requirement? A Constructivism versus a Positivism perspective*

By

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## **Abstract:**

Information Requirement elucidation has been intensively studied in MIS field. But yet, it had not gone far away. Why? Because people looked at it in an inappropriate way. Information Requirement had been considered from a positivism point a view, as a “positive data”, that is to say something that has a “real” “existence” in an user mind. We believe that the constructivism perspective explains better the nature of information requirement. Information Requirement is a construction, being constantly constructed and re-constructed by several actors being influenced by all the systems (organizations, society, etc...) in which that lived.

«Nothing is obvious. Nothing is given. Everything is a construction».

Gaston Bachelard,  
*La formation de l'esprit scientifique*, 1938, 1982, p.14.

## INTRODUCTION

«In spite of all the rhetoric to the contrary, requirements definition remains a most important problem» (Telem 1988, p.549).

«REQUIREMENTS ANALYSIS CONTINUES TO BE THE MOST CRITICAL and most difficult activity normally undertaken in information system development » (Zmud et al.1993, p.176, typography respected).

Although the Information Requirement (IR) analysis is an old process, it is considered an important problem (Boar 1986, Telem 1988, Zmud et al. 1993) because it is one of the most difficult steps (Munro 1978), indeed the most difficult step in the life cycle of system development (Zmud et al. 1993). Why is that step acknowledged as the most difficult one? Because, according to many authors (McKeen et al. 1979, Davis et al. 1986, Leifer et al. 1994), a satisfactory IR analysis should record a comprehensive whole of the users' real requirements. However, the authors mention that it is difficult to achieve this exhaustivity and this exactness for many reasons:

- the users may be unwilling to express their requirements (Land 1982, Davis et al. 1986, Reix 1995), because they don't want the changes that the new system will unavoidably provoke;

- the users are not always « aware» of their needs (McKeen et al. 1979, Leifer et al. 1994);

- even if the users know their needs, they will not always be able to express them (McKeen et al. 1979);

- ...

Reading these authors' articles, one understands that the underlying general idea is that users do indeed have a need. Often, they either cannot express or even realize what those needs are. Therefore, the analyst's task is to reveal them. This idea according to which the requirement

is «real» is always found in literature, even in the articles dealing with the prototyping process. Indeed, according to the authors, this technique (like the others) allows requirements that were pre-existing to the application to be revealed.

It is clearly evident that the authors consider the IR as positive and real data which is important to analyze. It is a typical positivism approach. Believing that it is possible *to take a census of all the real requirements* is to consider IR as positive data. Now, IR can also be considered as a construction. So the constructivism approach could also be used. The IR, far from being real, imposed and determined data, is, hence, on the contrary, data which is built by the subject, according to the way he or she interprets his or her background, in other words, according to his or her own interpretations. Consequently, one must study a subject's representations before studying his or her IR. If one considers the IR as a construction, the objective of the requirement analysis phase (the one of taking a census of the comprehensive whole of real requirements) becomes null and void. Indeed, the notions of completion and reality do not correspond to the notion of construction. Thus, the inability to take a census of a «comprehensive» whole of «real» IR is no longer a problem<sup>1</sup>. Furthermore, an exhaustive census of real requirements is not an objective any more as well. However, everything must still be done in order to satisfy the users. The objective of an analysis of the users' IR is to produce a list of requirements to be satisfied which consequently result in the elaboration of an IS satisfying the users' needs.

Since the requirement is considered as a construction, *the analyst* becomes a fundamental actor in the process of requirement determination. His objective can no longer be to take a census of all the user's real requirements, but rather to propose a list of requirements which result in the elaboration of an IS that should satisfy the users. It is favorable to the process that the analyst be aware that, by taking part in the process of requirements determination, he has an effect on the expected results. Actually, if the individual is conscious of the ineluctability of his influence, he is more able to reduce it than if he were not conscious of it. As Watzlawick emphasizes:

«One cannot *not* influence. It is, therefore, absurd to ask how influence and manipulation can be avoided, and we are left with the inescapable responsibility of

deciding for ourselves how this basic law of human communication may be obeyed in the most humane, ethical, and effective manner.» (Watzlawick 1978, p.11).

Therefore, the analyst's influence can no longer be considered as a problem that must be removed. It is an inevitable notion. The objective is no longer to remove the problem of influence because there is no sense in it when a constructivism point of view is applied<sup>2</sup>. Then the objective is to reduce the influence to a minimum.

This approach, based on the consideration of the IR as a construction (constructivism approach) is not fully opposed to the approach based on the consideration of the IR as positive data (positivist approach). The aim of the former is neither to «revolutionize» the analysis process of the IR, nor to change in any way the practices, but only to propose a different way to cope with a classical problem. Nobody in the literature surveyed seems to have explicitly considered the IR as a construction. On the contrary, the words the authors use show that the IR is always considered as a positive data (for example, when they use the word «real» and all its derivatives). But sometimes the authors seem not to consider it wholly as positive data, for example when they talk about the problem of the analysts' influence or about the intervention of their mental models. Thus it is time to connect a constructivist epistemology to the IR because it fits with the current beliefs. In order to demonstrate it, we propose the following plan:

- firstly the problematic of the IR should be set out,
- secondly an explanation as to why it is possible to consider the IR as a construct must be given,
- and then the thirdly, a substitution of the word *construction* for the word *analysis* must be made in order to describe the process of determining the IR.

## **1. THE INFORMATION REQUIREMENT ANALYSIS**

Even if the existence of the first step of IR analysis for the elaboration of an IS is uncontested, this fact was not always obvious. The marketing approach was born from the limits of an approach based on the production and then on the stock flow. In the same way, the «by the requirements» approach in IS was born from the limits of the «by the production» approach

(1.1.). The latter, used today as the first step for the elaboration of an IS is considered as «critical» by the authors who recognize that the quality of the IS depends on the first step (1.2.).

### 1.1. THE «BY THE REQUIREMENTS» APPROACH VERSUS THE «BY THE PRODUCTION» APPROACH

During the first decade of the computer era, the construction of information systems was not always based on users' requirements (Peaucelle 1977):

« The underlying idea of this period is that automation is progress, that the computer system is better than a manual system; the machine improves. This perspective remains deeply anchored in the implied postulates of today's computer scientists. Nonetheless it is formulated with less audacity. One mentions it cautiously even if it is modernized with the disguise of the database » (Peaucelle 1977, p.9).

So the first computer period corresponds to the « production approach»:

« [...] before, one used to enter data into the computer then take it out. One would follow their flow. Once the data were available, one would distribute them. Once it was "made", one would try to sell them. Then the data were always used because of the state of computer scarcity in which (theoretically) the target consumers found themselves. » (Peaucelle 1977, p.9).

Then the marketing approach, based on the concept of requirement (Peaucelle 1977), replaced this production approach. Since then, for the IS topic, the result is an admission that the input matter depends on the output matter (Figure 1.) .

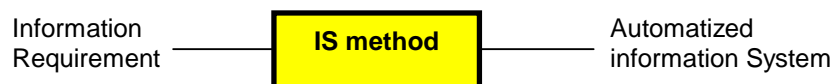


Figure 1: The second decade according to Peaucelle (1977): the automatized information system depends on the customer's IR (copy of Peaucelle's figure 1977, p.11).

During the second computer decade, the idea that it is necessary to understand the users' requirements before building an IS appeared. Then, the conception methods of IR elaborated since this period begin with a step of *IR analysis*.

### 1.2. A "CRITICAL" ACTIVITY !

Different methods have been elaborated to develop an application of an IS project. Most of them are based on the notion of project life cycle (Davis et al. 1986, Necco et al. 1987) which involves a cutting out of the development in successive steps. The process is linear. The research literature does not reveal the existence of a standard life cycle (Davis et al. 1986, Necco et al. 1987, Reix 1995). In 1970, Murdick already took a census of 17 different life cycles from IS authors' published work. Reix (1995) proposes a classic example of a life cycle which is composed of 5 steps:

- 1-Prior analysis (research of the requirements);
- 2-Conception (research of the main principles of the solution);
- 3-Development (accomplishment of the solution);
- 4-Implementation (the setting up of the solution);
- 5-Maintenance.

According to Mendes (1980), it is around the mid 70's that the first empirical studies show the importance of the step of requirement analysis for the elaboration of effective IS. The step of IR analysis is recognized as the most important or the most critical element of the project life cycle (Taggart and Tharp 1977, McKeen et al. 1979, Zmud et al. 1993, Leifer et al. 1994, Mouakket et al. 1994). For Telem (1988), this is «the Achilles heel» or the «cornerstone» of the management project life cycle. The latter metaphor implies that the phase of requirements analysis is the foundation on which the IS is based. A house is likely to fall if there are no foundations or if the foundations are unsuitable... in the same way, an IS is less likely to be performatory if the step of requirement analysis has been done perfunctorily. If the phase of requirements analysis is wrong, the whole IS resulting from it will be wrong as well (Leifer et al. 1994), since all errors in the first phase will effect other phases (McKeen et al. 1979, Mendes 1980, Mouakket et al. 1994), which explains how many failures in the IS field are due to a defect in the activity of requirement research (Cooper and Swanson 1979, Davis 1982, Telem 1988, Byrd et al. 1992). According to Telem (1988), the failures of the requirement analysis are even the main cause of failures in the IS field. Mendes seems to agree when he says that the failures observed in the developed IS result more from failures in the first step of analysis than from all the other steps. Moreover, according to him, the failures resulting from the first step have more

effects on the quality of the IS than the ones resulting from the other steps. Gilhooley (1986) sums up the damages that happen in an organization when the phase of IR analysis is neglected:

- the conceived systems do not correspond to the users' requirements;
- the managers do not approve of them;
- they are difficult to maintain;
- the maintenance is very expensive (the costs of corrections of the failures inserted in the phase of requirement analysis are even higher than the ones inherent in the failures inserted in the other phases (Mendes 1980));
- they are not adequate to the plans of IS;
- the development budget and the time allowed to their elaboration have been exceeded.

So, the authors agree to recognize that the quality of the IS depends on the quality of the IR analysis phase. This is the most critical phase in a project life cycle of an IS development. A theoretical reflection about this phase does not seem superfluous because of the importance of this step. This reflection begins with the identification of the constructive factors of the IR.

## **2. THE "CONSTRUCTIVE" FACTORS OF THE IR: A CONSTRUCTIVISM APPROACH**

The schema that allows the users' needs to lead to the adapted IS would *ideally* be such that the IS follows from the IR of the organization or of an entity of the organization. This is the analysis method which allows the passage from the needs to the deliverable (figure 2):

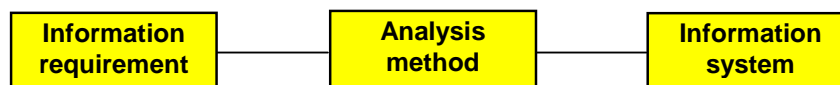


Figure 2: The ideal schema of the passage from the IR up to the adapted IS.

Nevertheless, this schema can be completed. The elements that complete it can be called: «the constructive factors of the IR» because they have an effect on these requirements. The factors include: the kind of IS, the technology, the economic context, the analysis method

and the analyst. The first two factors show that the relationship between a requirement and a deliverable is not as linear as figure 2 might suggest.

## **2.1. THE RELATIONSHIP BETWEEN REQUIREMENT AND SATISFACTION: A COMPLEX RELATIONSHIP**

According to some authors, the fulfillment of a requirement should lead to research toward the fulfillment of other requirements («each fulfillment creates new need for other fulfillment» Rojot and Bergmann (1989, p.258) emphasize). Since then, one can catch a glimpse of a circular relationship between the requirement and fulfillment, because fulfillment can lead to the research of fulfillment of other requirements. In this circular relationship, is it always the requirement that engages the research of fulfillment? On the contrary, might one envisage that a fulfillment could cause the research of a requirement it could answer? Is the requirement always first? Couldn't the awareness of the possible fulfillment of a requirement lead to the state of the corresponding requirement? If it is generally admitted that the state of requirement is first and that the fulfillment follows, the inverse sequence is not to divert; actually, the possible fulfillment of a requirement may result in the state of requirement, because both these sequences are tightly linked.

The relationship between the requirement and its fulfillment or between the state of need and the regulation allowing to find again the equilibrium, is not linear. One cannot say that the need is always first and that, because of a single causal principle, the need leads to the research of strategies in order to fulfill it. In the same way, a unique simple causal relationship does exist between need and fulfillment in the process of determining the IR. Actually, the need is not always first and the satisfaction second, as one can understand from looking at figure 2, which proposes only one simple linear causal relationship between a need and a deliverable (the IS). The complexity of the relationship between the need and the fulfillment can be illustrated in two different ways: considering the effects that the proposed fulfillment has on the requirements it should satisfy (2.1.1.), and taking into consideration the potential of the IT (2.1.2.).

### *2.1.1. The influence of the IS or when fulfillment can result in the need (figure 3)*

According to Mahmood (1987), there are two kinds of approaches to determine the IR for the development of an IS:

- the approach by the project life cycle (the «traditional approach»),
- the approach by the prototyping technique.

The first approach identifies a succession of steps for the working out of the IS. The first step is the determination of the needs. It is a linear progression. The second approach consists in proposing very quickly to the users (Janson and Smith 1985, Davis et al. 1986, Seen 1984), an imperfect and incomplete solution (Reix 1995) which should answer the «elementary» (Seen 1984) needs the users have stated. Once done, the prototype is presented to the users who can implement it and then propose some modifications. Then the analysts improve the prototype until it reaches the users' satisfaction (Seen 1984). This approach by the prototyping technique is particularly adapted to situations in which analysts do not understand the users' needs. In this case, the users are unable to articulate their needs (Alavi 1984, Janson and Smith 1985, Davis et al. 1986, Mahmood 1987, Seen 1984, Reix 1995). The method based on the project life cycle relies upon a linear approach of the development process. On the contrary, the prototype method is heuristic. The latter shows that the relationship between need and fulfillment is not linear and unidirectional but complex. From the statement of confused needs, the analysts build a prototype. This is the deliverable, thus the fulfillment. What happens when it is used? According to the authors, the users are likely to «discover» their needs when they use the prototype. Did these needs exist before the proposed solution? Davis et al. are likely to think so. Actually they declare: «The prototyping process is an heuristic process of a progressive discovery of the requirements » (Davis et al. 1986, p.220) and «this way one grasps [with the prototyping process the requirements] by successive approximations » (Davis et al. 1986, p.218). Seen seems to agree with them and says that the recourse to prototyping allows a «clarification of the needs» (Seen 1984). Declaring that prototyping allows «the discovery» of the needs implies that the needs are preexistent to the presentation and utilization of the prototype. One has «to grasp» these needs. In the same way, to state that prototyping allows «the clarification» of the needs, presupposes that the needs do exist and are confused. So the prototyping process is used in order to find these

hidden needs. Since the users are not able to clearly state their needs, they remain unexposed. So, the aim is to bring the existing needs to light.

But how is it possible to think that the proposed solution does not have any effect on the users' needs? One can easily suppose that when the users discover the solution invented by someone else, they can consider it as a need that they have never thought of before. In addition, one can easily suppose that after discovering the solution, the users imagine other needs that could be satisfied by this solution. These needs were not pre-existent to the presentation of the prototype. Not to believe in the pre-existence of all the needs satisfied by the final IS conceived by the prototyping method is consequently to believe that the relationship between need and fulfillment is complex.

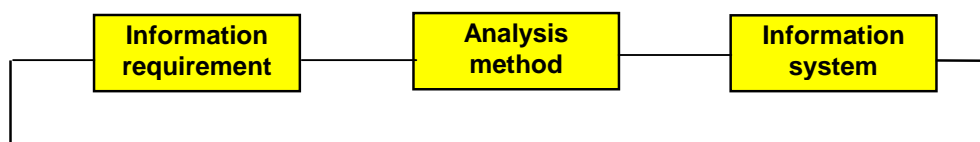


Figure 3: The IS has an effect on IR.

### ***2.1.2. The influence of the available technology, or when the lack of fulfillment result in the lack of need***

«The definition of requirements is also called "analysis" in order to express the details of everything the IS must do», say Davis et al. (1986, p.225). But when one defines what an IS must do, one should know that things can be done or cannot be done in accordance with the possibilities of the IT. According to Peaucelle, «IR are a non-technological description of the IS» (1977, p.12). But, when one describes the IR, even if trying not to think about the IT, one may describe it keeping in mind that it can be defined in technological terms. Therefore one is likely to think about the existing technology that allows the description of the needs.

So the technology has an effect on IR, as Peaucelle emphasizes:

«IR are the main raw material of the conception method. In reality, this is not totally true. Some people explicitly admit this. The available technology is a very powerful guide that one follows (even if it is implied) in order to say what is possible to do, hence what must be done.» (Peaucelle 1977, p.11, typography respected).

In a way, *the lack of fulfillment must result in the lack of need*. «Who worried about recording sounds a hundred years ago? » Alain wonders. According to him, the need of recording sounds did not exist before the fulfillment (the sound recorder) created the need of recording sounds (so the lack of fulfillment leads to the lack of need). But now that this fulfillment does exist, many people can express their needs which recording techniques can answer. Would these requirements have been expressed before the fulfillment had existed?

In the same way that the technology has an effect on IR, reciprocally the IR have an effect on the technology (b, figure 4). Actually this is because technological progress is (at least in part) conditioned by potential needs which it can answer.

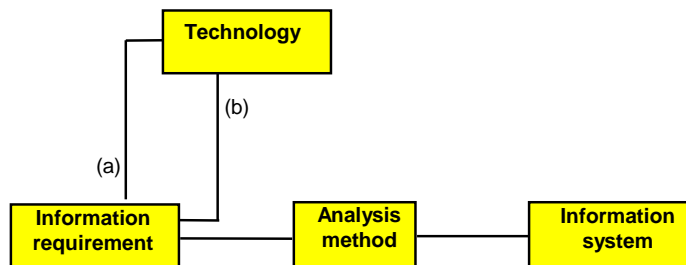


Figure 4: the technology has an effect on IR and reciprocally.

## 2.2. THE DEMAND LINKED TO THE ECONOMIC CONTEXT

As society is supposed to answer people's needs, the IS services are likely to answer users' IR the same way. So if the IS services need something, it is because users need something. Therefore the existence of the IS services is built on their customers' requirements. So it is in the interest of the IS services that the customers have needs.

In another way, some IS services develop particular products and abilities. When these IS services analyze their customers' requirements, is it not in their interest to act so that the users' requirements coincide with their products and abilities which are able to answer fulfill their requirements?

Therefore, there is an interaction between the IS services's requirements and the customers' requirements as the following figure shows:

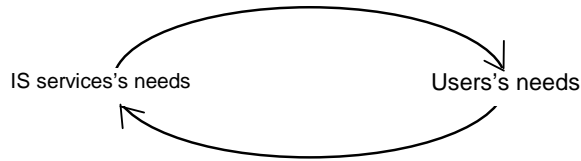


Figure 5: there is an interaction between IS services's requirements and users' requirements.

Moreover one can conceive that the analysts who have to "detect" the users' IR, may turn these requirements more or less into the category of problems that they are able to work out. Generally speaking, it is in the analysts' interest to lead the users' IR so that the available technical solution allows them to satisfy their own purposes. So, the analysts may turn the users' needs into deliverables which they are the most qualified to answer. In the same way, they may turn these requirements into solutions that require abilities that they do not have because they need these abilities to remain competitive in their employment market. Thus, the users' requirements turned a bit into their own concerns may offer them the opportunity to gain new abilities, hence to answer their own interests.

In that way, the economic context may have an effect on the IR and vice versa. Actually, if the economic context linked to the IS leans on the requirements, one can say that the opposite may be likely too, that is to say that the economic context linked to the IS may have an effect on the requirements (a, figure 6).

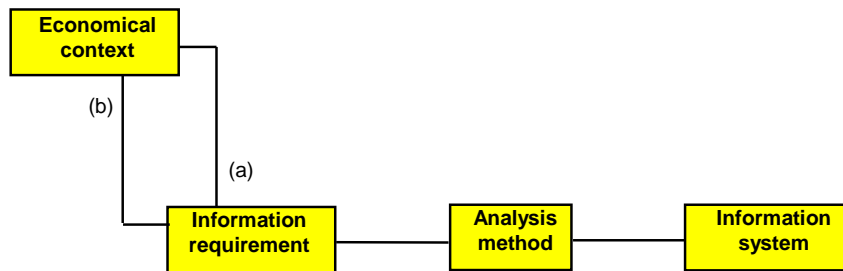


Figure 6: the economic context has an effect on the IR, and vice versa.

### 2.3. THE UNAVOIDABLE ANALYST'S SUBJECTIVITY

The previous paragraph asserts that users' IR may be influenced by the analysts (*b*, figure 7). These can also influence the choice of the analysis method according to their abilities and preferences (*a*, figure 7). Bernier (1995) observes that some authors followed the tracks proposed by Mason and Mittroff in 1973. These reveal that the research in IS may benefit from a reflection on the way the analyst's psychological type effects on the way he conceives the systems. Since then, some authors state that analysts may act according to their beliefs and *models* (the user's model, the organization's model...) they made up from experience (Bostrom and Heinen 1977, Malhotra et al. 1980, Dagwell and Weber 1983, Banbury 1987, Turner 1987, Green 1989, Watson 1990, Bernier 1995).

After reading these articles, is it still possible to believe in the analyst's neutrality? Certainly not, at least according to Land, who states:

«[...] a major hidden assumption of the conventional analysis process is that the analyst is neutral. Studies [...] have shown this is not so. They found that many professional DP people have beliefs and values which significantly affect the way they set about the analysis process, which distort their model of what the real world is like, and which influences the designs they prefer.» (Land 1982, p.63).

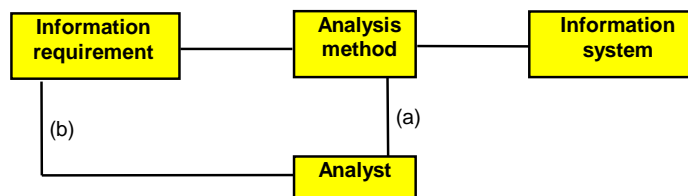


Figure 7: The analyst's influence.

## 2.4. THE LACK OF NEUTRALITY OF THE ANALYSIS METHODS

Are the analysis methods used to elaborate the IR neutral with regard to the requirements? Observing the working of the prototyping process shown in paragraph 1.1.1., the answer is in the negative because the prototyping method can have an effect on the users' requirements. More generally, Leifer et al. emphasize that the analysis methods do have an effect on the collected information: «it should be no surprise that techniques of gathering information determine the kinds of information gathered» (Leifer et al. 1994, p.276). And I think that this

information should reciprocally have an effect on the users' requirements at different moments during the analysis process. For example, when the users discover the list elaborated by the analyst which is supposed to fit with their requirements, their vision of their IR is likely to evolve in accordance with this list elaborated by an IS specialist (figure 8).

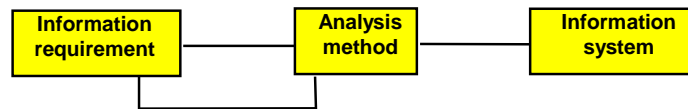


Figure 8: The analysis method has an effect on the IR and vice versa.

After presenting the «constructive factors of the IR », now it is advisable to wonder about the word *analysis*. Considering that the requirement is a construction, it is awkward to keep the word *analysis*, connoted in a decisive manner by the four precepts of the Discourse on Method by Descartes, as Le Moigne remarks. So we prefer to use the word *construction* rather than the word *analysis*.

### 3. FROM THE ANALYSIS OF DATA TO THE CONSTRUCTION OF A REPRESENTATION CONSIDERED AS SATISFACTORY

The classical science with its analytical approach formalized by Descartes in his Discourse on Method published in 1637 explained lots of phenomena. But this approach recently failed in different domains (Le Moigne 1990b). The analytical method can be used for the solution of complicated problems but not complex ones<sup>3</sup>. When it is applied to complex problems, it makes them even more difficult to remove.

The analytical approach is based on the four precepts of the Discourse on Method which allows to «search the truth in sciences » (sub-title of the Discourse):

«...so, in place of the large number of precepts of which logic is composed, I believed that I would have enough with the following four, provided that I were to make a firm and constant resolution not to fail, even a single time, to observe them.

The first was never to accept anything as true that I did not evidently know to be such: that is to say, carefully to avoid precipitation and prejudice; and to include in my judgments nothing more than that which would present itself to my mind so clearly and so distinctly that I were to have no occasion to put it in doubt.

The second, to divide each of the difficulties that I would examine into as many parts as would be possible and as would be required in order to better to resolve them.

The third, to conduct my thoughts in an orderly manner, by beginning with those objects the most simple and the most easy to know, in order to ascend little by little, as by degrees, to the knowledge of the most composite ones; and by supposing an order even among those which do not naturally precede one another.

And the last, everywhere to make enumerations so complete and reviews so general that I were assured of omitting nothing.

Those long chains of totally simple and easy reasonings of which the geometers are accustomed to make use in order to arrive at their most difficult demonstrations had given me occasion to imagine that all those things which can fall under the knowledge of men follow from each other in the same fashion, and that, provided only that one abstain from accepting any of them as true that not be, and that one always keep to the order that is necessary in order to deduce the ones from the others, there can be none so remote that one not finally reach them, nor so hidden that one not discover them. ».

(Descartes, *Discourse on Method*, 1637, p.35 in the 1994 edition of University of Notre Dame Press).

The first precept points out that the truth and the proof are based on its **obviousness**. The second one advises to decompose the difficulties in as many particles as necessary in order to remove them. Then, it is a question of practicing the **reductionism** (the decomposition) in order to analyze the problems. The third one explains that the comprehension of the problem is based on the principle of **causality**. Then the fourth one shows that to explain a phenomenon, it is necessary to make a complete description: this is the precept of **exhaustivity** of the analysis.

Le Moigne harshly criticizes these four precepts and prefers four others that, according to him, seem «to be more adjusted today to the practice of the intelligence» (Le Moigne 1990a). Le Moigne had criticize these four precepts in general terms. Our aim is to look in these precepts with a MIS perspective.

The objective of the following point is to present the alternative for each precept and to examine it in the IR point of view (3.1.). This will result in the proposition of the word *construction* as substitute for the word *analysis* (3.2.).

### 3.1. CRITIQUE OF THE FOUR PRECEPTS OF DESCARTES' METHOD

#### 3.1.1. *The precept of OBVIOUSNESS, or the negation of representations*

What is **obviousness**? Le Moigne (1990b) speaks ironically: to Plato, it was certainly obvious that a society was composed of citizens and slaves. Since any obviousness must be replaced in a given ideology, that is to say in the context of the representations that built it. Can a human thought be impervious to the influence of its social context (which contains ideology)? Mannheim (in Berger and Luckmann 1966) does not think so. A given objective obviousness independent of the observer does not exist. That is why Le Moigne prefers the concept of **PERTINENCE** rather than the one of evidence. This concept allows to relativity:

« It is in relation to some finality that our perceptive (and more generally cognitive) intelligence practices. The equal sign does not have the same obviousness for the mathematician writing  $2+2=4$  than for the computer scientist writing  $N=N+1$ , but for both of them, this sign is pertinent in relation to their current project.» (Le Moigne 1990a, p.33).

The problem of the requirements leads us to wonder if the requirements are obvious. Many economists take a positive point of view about the notion of requirement (Albou 1976); according to them, the requirements do exist. They impose themselves on us. And that is how Bernard-Bécharies (1970) states: « Let us consider the act of fulfillment and the need as positive data about which one does not have to wonder ». There is no use in wondering! The needs are obvious; they are given. As such, for Bernard-Bécharies as well as for many other economists, the data that the needs represent must «be taken as they are, as one directly understand them in the concrete» (Albou 1976, p.22).

«So, there is objective obviousness, that is independent of the observer...» says Le Moigne (1990b, p.18), after having presented Descartes' four precepts. According to the economists quoted by Albou, the needs are really objective obviousness, independent of the observer. On the contrary, we think that the needs are constructions. If they are built by the subject, they are likely to come not only under the influence of the subject's environment in general, but also particularly under the influence of the subject who tries to gather these needs.

So, the needs are subjective data built by the subject according to a complex game of interactions with the environment.

Thus, it becomes difficult to take the needs «as we directly understand them in the concrete». We prefer the precept of pertinence proposed by Le Moigne rather than the one of obviousness. For example, it could be relevant for a selling manager who wants to evaluate his representatives' job, to need an analysis of the turnover realized by each of his representatives. In relation to his project this piece of information seems to be relevant (but not obvious !) because it helps him to accomplish his task.

### ***3.1.2. The maladjustment of the precept of REDUCTIONISM to complex problems***

The first difficulties of the analytical approach appeared in the science of the living being, because of the precept of **reductionism**, when it was about to explain the working of live objects, which is governed by interactions between the elements. It was a biologist, Von Bertalanffy, who was the first one to lay down the basis of systems theory.

The application of reductionism in the analytical process needs two conditions:

- first, the interactions between the parts must be non-existent or weak enough to be neglected. Only in that case can the parts really be isolated and then gathered together;
- secondly, the relationships that describe the behavior of the parts must be identical. Only in that case can the equation of the behavior of the whole have the same form as the ones of the parts.

Now, as far as the live objects are concerned, these two conditions are not filled. More generally, these two conditions are not filled as soon as one no longer tries to describe a complicated object (which can be analytically decomposable even if it is composed by many varied elements) but a complex object. It is impossible to decompose when the links between the parts are defineable. That means that the behavior of the object depends essentially on the links between the parts rather than the parts themselves and moreover that these links unify the whole itself. Therefore, the whole becomes more than the sum of its parts and the global approach

should be preferred to the reductionist one. That is why Le Moigne substitutes the precept of **GLOBALISM** for Descartes' precept of reductionism<sup>4</sup>.

Should the individual's, society's or group of people's needs as a whole be considered as a simple field? Or, on the contrary, must one envisage the individual's needs as a whole like a system, where the links between the needs are defineable? The pertinence of the application of the reductionist approach depends on the answer to this question. If the field of needs is simple, it becomes possible to study one need independently of the other ones. The needs as a whole can be cut or as Le Moigne says «tied up like a sausage» in particles, without attending to the links between them. On the other hand, if the field of the needs, field of representations is, as we think, a complex field where the elements are neither given nor stable, then the global approach should be preferred to the reductionist one.

### ***3.1.3. When the precept of CAUSALITY does not allow to explain the behavior of an object by its finality***

Le Moigne regrets that the precept of causality linked to the «determinist assumption» which still governs the scientific institution today (Le Moigne 1994), is considered a universal principle. He prefers to substitute for this precept the principle of **TELEOLOGY**, which aims at understanding the object's behavior thanks to its projects, or more exactly thanks to the projects that the observer or the modeler assigns to the object, rather than as a result of laws. In other words, to bring us nearer to the understanding of an object, Le Moigne prefers to be connected to the «in order to» rather than to the «because»<sup>5</sup>:

«The intelligence substitutes then, for the "cause-effect explanation", "the interpretation (or the understanding) behavior-finality". I substitute the precept of teleology for the precept of causality. According to the precept of teleology, the thought about the finality of an object to be known, is one of the keyholes of the device of rational intelligence. » (Le Moigne 1990a, p.39).

This principle of teleology seems to correspond to the process of IR research. One may say that it is *in order* to evaluate his representatives that the sales manager needs the information concerning the turnover realized by each one. More generally, one may say that an entity's IR can be researched according to the finality he desired. This is how one begins to understand an entity's finality before undertaking any research of IR.

#### ***3.1.4. The myth of the precept of EXHAUSTIVITY***

How can this precept be applied today? How can one create such rigorous enumerations and such general surveys and be assured of not omitting anything? Le Moigne affirms that it is «in practice... impracticable ». To lead to the understanding of an object, Le Moigne proposes omission, to select some groups of data, and thus to choose aggregates, so to practice **AGREGATIVITY**.

Is it possible, as the authors in IR fields recommend, to take a census of the IR as an exhaustive whole? Perhaps the discourse can be moderated according to the studied subject. For example, the problem of exhaustivity can be differently envisaged depending on whether one is interested by the research of a manager's IR who wants to evaluate his subordinates, or if one studies the IR for an automation such as the pay. In the second case, if one only wants to reproduce in an automatized way an activity which has been up to now accomplished in a manual way, then one may possibly admit the use of the word *exhaustivity*. Actually the exhaustivity is reached when the automatized system allows this accomplishment strictly in the same way as the manual process does. Nevertheless do such situations often happen? Is not automation often the occasion to modify a bit procedure? We think that the principle of exhaustivity is a delusion in as much as the needs are not strictly conformed by the reproduction of a manual process with an automatized process. Henceforth, individuals and their interpretation of reality are concerned with this matter (when they are in a schematic way hypothetically absent in a process which aims at reproducing strictly a manual process in an automatized process). When is it possible to say, for the research of the manager's IR who wants to evaluate his subordinates, that an exhaustive list of his need is obtained? We don't have the answer to this question since its formulation itself has no relevance to us. Perhaps it is possible to obtain a list of pieces of information that would satisfy the manager at a given moment, but under no circumstances can one say that an exhaustive list of the manager's needs could have been obtained.

### **3.2. PROPOSITION OF SUBSTITUTION: CONSTRUCTION AGAINST ANALYSIS**

All in all, the word analysis is connoted the following way:

«[...] there is objective obviousness independent of the observer to which one has access by decomposition or division: the analysis. These stable evidences are connected by cause-effect relationships that one can identify as soon as one proceeds to the exhaustive census closing the model.» (Le Moigne, 1990b, p.18).

Thus, the IR:

- **are not obvious, nor given;**
- **are constructions, in permanent evolution, hence they are not stable;**
- **are not independent of the method used by the observer to identify them;**
- **are not independent of the observer's beliefs;**
- **are not determined;**
- **cannot be recorded in an exhaustive way.**

So it becomes a delicate issue to use the word *analysis* associated with *requirements*. What word can be better to use? One should prefer the word *research* of IR, but this implies that the requirements are hidden somewhere and that the analyst's task is to find them, such as one can look for a precious metal in a variety of places. The word *collection* could be chosen. But this one implies too that the requirements exist independently of the process which leads to writing down in black and white a list of requirements.

We don't think that the requirements are stated in the individual's mind and that the computer scientist's task is to extract them. The computer scientist is not neutral. In the list of requirements he has to write down, his influence and the one of the method used are rediscovered. It's impossible for him and for the method not to have an effect on the final result. That is why we prefer talking about *construction* of IR. The process of construction is the one that results in a list of IR. In this process, the interviewee and the interviewer work together to elaborate this list.

## CONCLUSION

The aim of this article was to discuss the «real » aspect of the IR. From the literature on IR and from the researchers' discourse, the IR is considered as real data. And that is how the phase of analysis of the IR aims at succeeding in taking the *census* of the *real* requirements as a

*comprehensive whole*. To use the words *census*, *comprehensive*, and above all *real* is to believe in the positive aspect of the requirement. After criticizing the real aspect of the IR, we came to the conclusion that the IR can easily be considered as a construction. The IR is constructed in relation to the way the actor interprets the events, that is to say in relation to his or her interpretations. The IR is constructed too in relation to the five constructive factors displayed in the following figure which proposes a recapitulation:

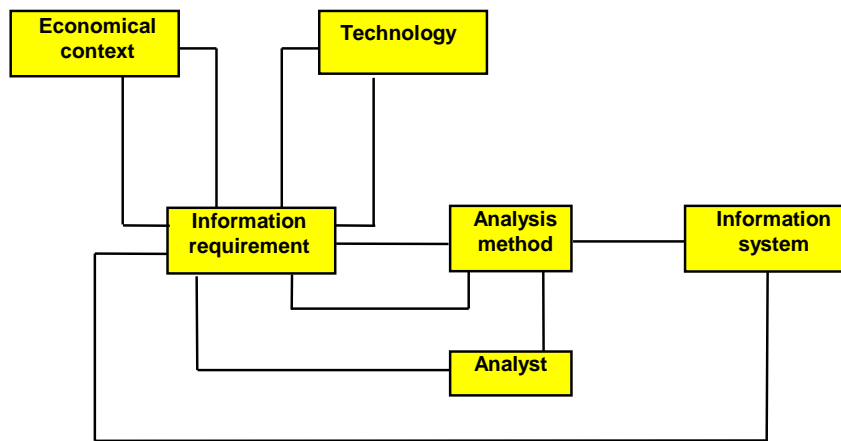


Figure 9: The constructor factors of IR.

Now that the requirement is considered as a construction, it is no more possible to use the words *exhaustive*, *census* or users' *real* requirements. The following board shows the differences that have been made between the approach considering the requirement as positive data and the approach considering the requirement as a construction.

|   | <i>positivist approach</i>   | <i>constructivist approach</i>   |
|---|--|--|
| <b>Aim of the phase of analysis of IR</b> | To take a census of the users' real requirements as a comprehensive whole. | To build a list of IR that leads to the elaboration of an IS satisfying the users. |
| <b>The analyst's aim</b>                  | To remove his or her influence.  | To minimize his or her influence.  |
| <b>Terminology chosen</b>                 | Analysis of IR   | Construction of IR..   |

Board 1: Differences between the statement approach and the construct one.

The last line of the board reveals that in the constructivist approach, the word construction is preferred to analysis in order to qualify the phase of determination of the IR. We

dislike the use of the word analysis because of its strong connotation noted by Le Moigne (1990a and 1990b) in Descartes' Discourse on Method. It seems to be inappropriate as soon as the requirement is considered as a construction, not as positive data (positivist approach).

The purpose of this article is not at all to criticize or to modify practices. It only aims at showing that a constructivist epistemology is useful in the problematic of IR. Even if the *construction* aspect transpires in a lot of authors' talks, they often refer to a positivist epistemology. We think that this paradox can be solved. One has only to explicitly recognize the *construct* aspect of the IR.

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<sup>1</sup> Criticizing the CSF method proposed by Rockart, Davis says: « The possibilities of failure with the method center on the ability of executives to respond with critical success factors that are correct, complete, and sufficient. » (Davis 1979, p.57). This means that *a comprehensive whole of CSF does exist somewhere*. The analyst's task is to find that whole. To my mind *a comprehensive whole of CSF does not exist*. What does exist are managers who have a vision of their organization. The analyst's task is not to lead the managers to « The Way », the one and only list of the real CSF, but to determine a list of CSF which results in the elaboration of an IS which suits the user.

<sup>2</sup> Let's state that what I call constructivism is a point of view that shows how the radical distinction between subject and object can cancel out. My own conception of constructivism comes particularly from the reading of the Palo Alto Schoolmen's literature where the three most important key words are: **tolerance**, **responsibility** and **freedom**. In the book coordinated by Paul Watzlawick (1984): *The Invented Reality*, the authors (and particularly Watzlawick and Varela) suggest that the individual who agrees with the fact that the reality he perceives is an invention, his own invention, will be likely to follow the tracks that lead to tolerance, responsibility and freedom. If the individual acknowledges that he does not have access to the absolute reality, but that all the realities are made up (his own like the others' reality), he is not likely to reject his counterparts' conception without any further ceremony. The realities that the others invent or build themselves are as respectable as his, from which comes the idea of tolerance. Then, as the individual knows that his actions and decisions depend partly on the realities he invents can have an effect on the environment, he can't reject this environment but must recognize his contribution to its construction, from which comes the idea of responsibility. This individual doesn't fall into the trap of self-fulfilling prophecies. Now the individual knows that he is able to build his own representations (realities): he has access to the meta-knowledge, that is to say to the understanding of how he acts to know. So now, he can build adequate representations in relation to his project, and he does it better than other people who don't have access to this knowledge. As Watzlawick emphasizes (in the epilogue of *The Invented reality*), now the individual can choose:

« This total responsibility would mean total *freedom*. Whoever is conscious of being the architect of his or her own reality would be equally aware of the ever-present possibility of constructing it differently. In the truest sense of the word, this person would be a heretic, that is, one who knows that choice is possible. » (p.327).

<sup>3</sup> According to Le Moigne, a complicated system is made up of many processors connected only by arborescent relationships. (This is worth nothing that Le Moigne prefers the use of the word processor rather than element because the object or the system is active, what's characterized by a behavior. The word *processor* suggests activity more than the word *element*).

As for the complex systems, they are made up of processors, not many necessarily, which keep up not only with potential arborescent relationships but also feed-back relationship as well.

<sup>4</sup> Let's explain that Le Moigne does not reject the principle of reductionism. He only states that it is not adapted to situations with complex problems, but it can be perfectly appropriate in many other situations:

« Considering these complex problems as complicated ones and dealing with them by the analytical methods, they are made even more complex.

« The failures in the processing of complex problems that one tries to model by analytical methods are numerous and cruel. Some present-day examples: juvenile delinquency, road safety, the crisis of agricultural surplus, world hunger, desertification of land, the desperate growth of unemployment, the mastery of nuclear energy... » (Le Moigne 1990b, p.19).

<sup>5</sup> Let's state that if I write that Le Moigne prefers to be connected to the « in order to » rather than to the « because », it does not mean that he proscribes any research of an object's understanding thanks to the causal explanation. What he rejects is the assumption according to which the causal principle is unique and universal, which he explains with these words: « the new discourse includes the former one without

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repudiating anything but its pretention to universality and to the monopoly of rationality. » (Le Moigne 1990a, p.39).