

ORGANIZATION @NTPROPTTECHNOLOGIE

CONTINGENCIES

WISNER

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# HUMAN FACTORS IN ORGANIZATIONAL DESIGN AND MANAGEMENT – IV

**Development, Introduction and Use of New Technology –  
Challenges for Human Organization and Human Resource  
Development in a Changing World**

Proceedings of the Fourth International Symposium on  
Human Factors in Organizational Design and Management  
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## ORGANIZATION ANTHROPOTECHNOLOGICAL CONTINGENCIES AN ANALYTICAL APPROACH

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The approach to the relations between the operator(s) and the technical system has been the subject of considerable work over the last 50 years. The appearance of ergonomics/human factors was a great stage for us since it meant that engineers who design technical systems could find out about the properties of the human body: anthropometric, physiological and psychological properties. The statistical study and experimentation guided by conceptions of behaviourism constituted and still constitute approaches which are clearly situated from the epistemological viewpoints and have a rather favourable relation with engineers' positivist way of thinking.

Twenty years after ergonomics, another major scientific movement appeared -sociotechnics - which showed that the technical system could not be designed effectively unless an analysis was made of its relations with the micro-society constituted by the operators who use the system in the context of the whole of contemporary industrial society.

The merit of H. Hendrick (1987) and his colleagues was to show that these two movements should join to constitute what they called macroergonomics. In a more general way, they introduced a concept of relativity and choice in the field of work design. This is the work field of the O.D.A.M. group which brings us together. From the outset, H. Hendrick shows that it was the increasing complication of production means which demanded this regrouping, the fundamental aim of which is to encourage the exercise of an increasingly complex operational cognition. The cognitivist movement gave a conceptual unity to this new stage of our reflection by singling out the concept of socially shared cognition (Resnick et coll., 1992).

### ERGONOMIC WORK ANALYSIS

The specific contribution made by the French-speaking school of ergonomics was that of proposing a clearly formalized methodology: Ergonomic Work Analysis (E.W.A.). This approach tends to understand what happens in the operational activity at its most intricate level. It collects behaviours of action, observation and communication and groups them in sequences, the significance of which is enlightened through self-confrontation. When the operator discovers the description of his own behaviour, he makes remarks about the way it is described and gives explanations of the anomalies which the ergonomist may have discovered. In this case, it is no longer a matter of using the properties of the human body, but that of discovering how they are implemented by the operator himself according to strategies linked to his own status and the real work situation. After this analysis, it is possible to understand how operators build the problems which they have to tackle and the pragmatic obstacles they encounter in this construction (Wisner, 1994). It is then possible to suggest modifications to the technical system and/or organization and training. It is also possible to constitute models of the behaviour observed. These computerized models may be tested and used in critical situations in order to prevent the appearance of dangerous behaviour. In all cases, it is possible and practical to build a tree of causes which helps understand the critical points - usually

multiple - whose existence prevents the technical system from working properly on a permanent basis. Thanks to the tree of causes, it is possible to identify the aspects of the situation which may be transformed in an effective and inexpensive way.

### ANTHROPOTECHNOLOGY

The need to correct the poor results of technology transfers led to an analysis being made of the causes of operating differences in the same technical system in the seller and buyer countries. Initially, cultural differences were explored (Chapanis et coll., 1975; Hofstede, 1980). In fact, the operating conditions of technical systems are influenced by geography, economics, demography and sociology as well as by ethnical diversity. The influence of these various factors on operation of the technical system and the resources available to correct operating defects constitute anthropotechnology (Wisner, 1976, 1984a).

The expression "anthropotechnology" was created in order to distinguish the field it covers from the more restricted field of ergonomics. Although ergonomics tends to use and create knowledge about man, knowledge which may enable the design and operation of technical systems, anthropotechnology makes use of all the human sciences with the same aim of improving the operation of technical systems. It appeared necessary for this epistemological leap to be marked out in words, although both ergonomics and anthropotechnology benefit from E.W.A. However, it is obvious that the causes attached to the field of anthropotechnology are located much further in the tree of causes and need remedies of another type.

In certain cases, difficulties are avoided by the constitution of "anthropotechnological islands" (Wisner, 1984b) where everything operates just like in the seller country thanks to considerable expenditure in investment and operation which is justified by technological characteristics (Civil Aviation) or the market (luxury tourism, international sale products). Most of the time, there is still a significant difference, and a considerable one, between the exporter and importer country. In the importer country, the operating defects may become serious and lead to operation in downgraded mode or even the stoppage of production. The origin of these problems is found, for example, in power cuts and the salinity of water available (Aw, 1989), wrong location of the plant and the presence of sand in the water (Kerbal, 1989), staff turnover and loss of skills (Sahbi, 1984; Sagar, 1989), the use of an unfavourable production organization (Abrahao, 1986) and serious clashes between traditional and industrial cultures as regards know-how, age and private life (Madi, 1994).

However, these unfavourable tendencies can still be fought - often successfully - through the choice of another organization method (Abraho, 1986), by the skill of operators (Meckassoua, 1986) and, better still, by good relations between the skills of the companies and those of operators (Rubio, 1990).

### THE WORK OF THE MANAGER: A VERBAL ACTIVITY

In an attempt to systemize the approach to a concrete industrial situation, it appeared that E.W.A. of a manager in charge of a production workshop could be useful. In effect, this manager was in relation with all members of the management and with all the operators in charge of production, either directly or through workshop managers. In a way, he was at the node of the organization (Langa, 1994), (Langa and Wisner, 1994).

However, E.W.A. of a manager has all the essential particularities which make it difficult to do. First of all, it is a mainly verbal activity, as is increasingly the case with work activities in the services sector and in other parts of the economy. In addition, this verbal activity reflects the role of the manager in multiple and complex activities! The origin and meaning of verbalizations are not obvious and, in order to be understood, require explanations which are linked to all the aspects of the company. That is why P. Langa proposed a methodology which

includes at least three stages of analysis: transcription of the verbalizations, written self-confrontation and interviews guided by facts. An analysis of the results obtained as such shows categories of explanatory elements which were identified previously (geographic, economic, social and anthropological determinants), all the more so since P. Langa also analyzed the work of a manager situated at the same level as the manager in Zaïre, but in a company, operating in France, which used the same technology.

The fact that Zaïre is supplied with oil by large-capacity oil tankers which arrive in port at rather unexpected dates - due to the freight and navigation conditions - is combined with the port's low storage capacity and the irregular operation of the railway line which links the port and Kinshasa, where the plant is located, in such a way that periods when there is a lack of raw materials alternate with periods when any sort container is sought for oil storage. This is considerable supplementary work which the manager has to do.

Trade relations are also difficult in view of the plant's low storage capacity and the unexpected characteristic of orders. Due to this, the manager tries to foresee the orders which will arrive by finding out the state of customers' stocks. In effect, the customers themselves keep low stocks and there is a risk of them turning to a rival supplier if the specific product they need is not available, despite their lack of foresight. If the manager simply relies on his company's bureaucratic system, he will lose his customers, or at least a good part of the order.

A third example is linked to the unexpected character of operator absenteeism. The power of the traditional social system is such that they must go to their village if a relative dies. This must be done immediately since the funeral takes place the day after the death. On the other hand, the modern social system is poor and the operator has to take care of his own social or health problems or those of his family since there is no dispensary or welfare office nearby. In addition, the operator has no phone and cannot give warning of the time or length of his absence.

### ADVANTAGES AND DRAWBACKS OF THE TRANSFER SITUATION

P. Langa's observations show that Zaïrian society and the geographic, economic and social conditions which prevail in Zaïre don't just have negative effects like those mentioned previously. As such, absenteeism without warning has an anthropological link with the great flexibility of staff employment. When the manager needs to make operators work several hours overtime, this generally takes place without any major difficulties and without any warning for the family since the lack of telephones also modifies the representation which the family may have of an operator's unexpected delay. It is not an accident which is mentioned immediately, as could be the case in Europe, Japan or the United States, but a delay with an accepted social origin, a "normal" delay. However, it should be noted that the operator negotiates an additional free meal as a bonus for working overtime.

Another example of the double role of society in the work activity is given by the forecasting of orders. It has been seen that orders arrive late and unexpectedly through the administrative channel, with the risk of not being delivered and business being lost. But Zaïrian society is fairly tolerant in regard to the manager seeking information from different people, in particular tank-truck drivers about stocks which customers still have, and even from rival companies. Here again, difficulties due to the company's lack of planning are offset by a powerful social system which reduces the importance of secrecy and enables a lot of barriers to be overcome.

Thus, in an industry like the production of oil mixtures, we see that the same social rules which determine difficulties also make them easier to solve on condition, however, that the organization which comes from another country does not oppose this operation. If this foreign organization is respected, as it tends to be by the company's administrative officers, production

suffers from all sorts of difficulties in the local situation, without benefiting from the facilities at the disposal of the same situation. The organization chart of the activities of managers in Zaïre and France clearly describes these negative and positive differences.

But should a very different organization be accepted definitively in Zaïre and in France and, in particular an informal organization in Zaïre and a very rigid one in France. It might mean that, in Zaïre, organization has to evolve towards a more formalized functioning which, in particular, would be successful with managers who are less talented and don't work as hard as the one observed by P. Langa. However, it should not be forgotten that the material conditions which explain the Zaïrian organization cannot be neglected. These are the conditions which create the instability that Perrow (1967) characterized by the variability of the task and the difficulty of foreseeing these variations. In all cases of great instability, Perrow recommended an organization that is less centralized, less complex and less formalized than that which would be desirable in a more stable situation. This is what was noted by Abrahao (1986) in Brazilian distilleries and by Langa (1994) in Zaïrese and French oil mixing plants. As long as the oil tankers arrive in port unexpectedly and stocks remain insufficient - both at the port and in each company - and as long as the railway line remains insufficient and overloaded and the country's economy suffers sharp variations, organization must allow for adapted management. We consider that this is a new category of contingency to be taken into account in the theory of organizations: *anthropotechnological contingencies*, contingencies which, as we have seen, can be analyzed and modified if we have the necessary financial means. For example, in our case, an increase in the plant's storage capacity would lead to an organization that is less dependent on anthropotechnological contingencies. However, this example, taken from technical-economic conditions, should not lead to more anthropological contingencies being neglected: skills, social standards of relations, informal information circuits, etc.

#### A LIVING ORGANIZATION

Another interesting question is that of the conditions under which a switch is made from one organization to another, if such a change turns out to be possible and necessary, for example after an increase in the plant's storage capacity which would lead to work planning that is more accurate and more respected. In this field, the work of Garfinkel (1967) contributes very useful concepts of ethnomethodology. In effect, in a new organizational situation, the pooling and sharing procedures change. All the practices of actions and roles are transformed in the perspective of changes in "socially-shared" knowledge, knowledge which may thus be confirmed, modified or increased. With this in mind, it would be interesting to note how the relational practices, which we can study thanks to a certain form of ergonomic work analysis, evolve before and after a technical and/or organizational change. This is one of the living fields of organization in which ODAM is interested.

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### A LIVING ORGANIZATION

Another interesting question is that of the conditions under which a switch is made from one organization to another, if such a change turns out to be possible and necessary, for example after an increase in the plant's storage capacity which would lead to work planning that is more accurate and more respected. In this field, the work of Garfinkel (1967) contributes very useful concepts of ethnomethodology. In effect, in a new organizational situation, the pooling and sharing procedures change. All the practices of actions and roles are transformed in the perspective of changes in "socially-shared" knowledge, knowledge which may thus be confirmed, modified or increased. With this in mind, it would be interesting to note how the relational practices, which we can study thanks to a certain form of ergonomic work analysis, evolve before and after a technical and/or organizational change. This is one of the living fields of organization in which ODAM is interested.

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