

DEFINITIONS AND TEMPORAL POSITIONING OF THE CONCEPTS LINKED TO DECISION MAKING IN INDUSTRIAL PROJECT DESIGN - DIKCORAC

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1 Introduction

The quality of a project strongly depends on the quality of the decisions that have been made all along the project. Moreover, the decisions are made by human beings, named hereafter actors. Consequently, the performance of a project is narrowly correlated to the quality of the choice of the actors.

One proposes here an explicit model for choosing the actors of an industrial project of product design. Mastering this choice means to guarantee the economic control of the project. One thus suggests here to detail the decision concerning an actor's selection. This study is divided into two parts: a definition part and some considerations on temporal aspects of the model.

A decision is an interaction between various concepts: Data, Information, Knowledge, Skills, in connection with a Role, Actors and in the service of an Objective. The works existing in the literature on decision-making rarely consider the specific nature of the decision criteria in a project team composition. In the following, one calls these latter *concepts*, standing for, by instance, knowledge, piece of information, data, know-how.... However, the fact of distinguishing them could allow to clarify the process of decision.

This paper suggests then to look at the temporal aspects of each of these concepts in order to result in a decision-making tools. Indeed, if one puts in evidence a temporal relation between these various concepts, we improve the decision.

2 Structuring by the definitions of the decision-making in the choice of an actor

In a project an actor is selected to carry out an objective. He/she is selected according to his/her competences, he/she sees himself through the allocation to a role, a mission. For all these reasons, some definitions concerning the important terms must be defined.

We propose to transpose the definitions of terms frequently used in decision-making into the applicative domain of project: Data, Information, Knowledge, Competences, Objective, Role and Actor (DIKCORAC). These definitions are not provided in being context-free. They are

given within the context of engineering design and project management. Each definition is proposed in coherence with the others so as to build a solid framework for further dealing with the modeling and the analysis of the decision process.

Our goal is to help for decision-making, for choosing appropriate actors (considered as a human resource) able to achieve an objective.

2.1 Data definition

Data: facts

Property: must be identifiable, one speaks about items alphanumeric, numerical, of absolute data, relative data, of qualitative data, quantitative data, of statistical, probabilistic data...

Example: Mrs Martin speaks the MUNUKUTUBA1 (language derived from the kikongo of use in the south of Congo)

2.2 Information definition

Information: data with its mode of representation (of reading and writing) and its context

One speaks about data interpreted/interpretable, contextualized. Interpretation requires the knowledge of the mode of representation.

Properties: what gives meaning, information generally has one, or several transmitters (source, to appoint its creator, diffuser to appoint its shipper) and one, or several receivers (target, to designate its recipient). The transmitter sources interpret, contextualize, give direction, the diffusion transmitters distribute, make circulate, while the receivers perceive and adapt the direction.

Example: Mrs Martin stated (in her form) "to voluntarily speak the MUNUKUTUBA" about competence within the Total company which employs her. The data "Mrs Martin speaks the MUNUKUTUBA" has been represented in a card of competence which is being a working tool of the company Total (context), the data thus has become an information. Mrs Martin is the transmitter source, the Total company (which manages the cards) is the diffusion transmitter as well as the receiver (only the employees of Total company have access to these data).

2.3 Knowledge definition

Knowledge: interpreted information, contextualized by an individual (a group) according to his/her experience which confers a potential of decision to him/her, of action. Each individual (each group) has his/her/its own interpretation and own context of interpretation; it depends on his/her/its history and culture. One speaks about acquired knowledge. One adopts a quite similar definition than Nonaka's [1].

¹ In Munukutuba: hello Mbote, goodbye Mu me kuenda or Beno bikana mbote, thank you Matondo, How are you? Wa faso?

Properties: giving a potential of decision, the knowledge is specific to the individual (individual knowledge) or to the group (collective knowledge). It is necessary to distinguish the stage stages of the acquisition, the activation, the application and the loss of consciousness.

Example: Mrs. Martin speaks the MUNUKUTUBA (she owns the knowledge of the MUNUKUTUBA), which confers the potentiality to her (of action) to understand the MUNUKUTUBA. It is Mrs Martin who speaks (which has knowledge) the MUNUKUTUBA language. But when the person in charge for the personnel of the Total Company reads the information of the card of Mrs Martin and that he has already the knowledge of a new project of exploitation in Congo, he acquires a new knowledge (it interprets, contextualizes compared to his own knowledge). This new knowledge confers a new capacity of decision to him, (of action) relatively to his project (to employ Mrs. Martin on the project). Same information confers here to two individuals (Mrs Martin and with the person in charge for the personnel) the potentials of different decision and action (potential of decision of nomination on a mission for the person in charge for the personnel, potential of communication for Mrs. Martin).

2.4 Competence definition

Competence: interpreted knowledge, contextualized by an individual (a group), which confers an aptitude of decision to him, of particular action (decision or action related to the context where it takes place: company, function within the company, project, process, activity). Compared to knowledge one passes from a potential of decision or action, to an aptitude (a capacity with), i.e. with the aspect capacity of setting in operation the decision-making, action to answer a question, to solve a problem, to achieve a goal. It is the sense (of this competence 's definition) accepted within the framework of the project of European Constitution².

Properties: in a given context specific to an individual (individual competence) or a group (collective competence). A competence is recognized if it is legitimated by a third party (an authority). It is necessary to distinguish the stage stages between acquisition, activation, application and loss of competence.

Example: Mrs Martin speaks the MUNUKUTUBA (she has the knowledge of the MUNUKUTUBA), Total, proposes her to acquire new competences.

2.5 Objective definition

Objective: target (result) to reach (by the decision, the action)

Properties: strategic, tactical, operational. Temporally in future. The quality of the expression of the objective mainly conditions the quality of the control which one will be able to exert to reach it.

² Article 1 Establishment of the Union : Reflecting the will of citizens and States of Europe to build a common future, this Constitution establishes the European Union, on which the Member States confer competences (*capacities to decide*) to attain objectives they have in common. The Union shall coordinate the policies by which the Member States aim to achieve these objectives, and shall exercise in the Community way the competences they confer on it.

Draft treaty establishing a Constitution for Europe adopted by consensus by European Convention on June 13 and 10 July 2003 given to the President of the European Council in Rome on July 18, 2003

Example: to make a successful the oil prospection project in the south of Congo

Figure 1 represents the symbolic system illustration of D.I.K.C.O. chain.

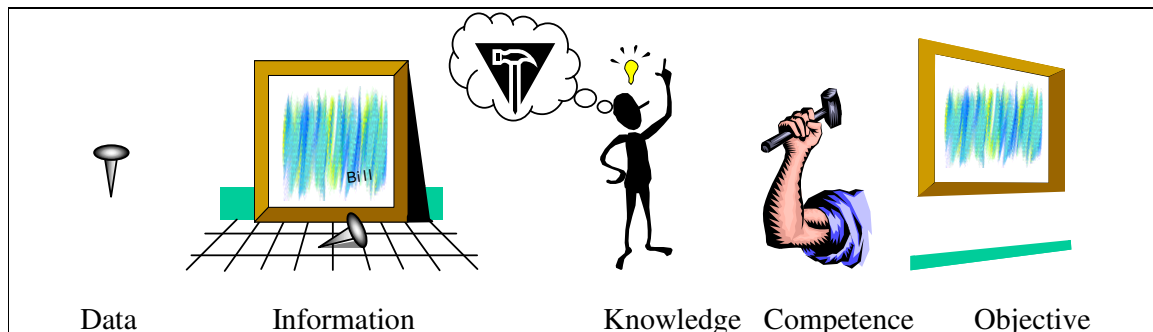


Figure 1. The symbolic system illustration of D.I.K.C.O. chain

2.6 Role definition

Role: framework of competence expression to make function (to decide, act, achieve the goal).

Properties: associated at objectives and goals to reach, the role is one of the elements of the organization (of the structure) to make function.

Example: The person in charge for human resources proposes to Mrs. Martin the role to be in charge (within the Total Company) of the communication between the local persons dealing with Congo and the persons in charge for the new project of oil exploitation of Total. While exerting this role Mrs. Martin will implement (by its decisions and its actions) its knowledge of the company and MUNUKUTUBA language within the framework of its company. Thus simultaneously she will develop (acquire) activate and apply new competences.

2.7 Actor definition

Actor: The association (role, competence) constitutes human resources, actor. He is likely to solve the problems (the objective) for which he is appointed (chosen).

Properties: individual if the role and competence are held by the same person, collective in the contrary case.

Example: Mrs. Martin (the actor) must acquire a new competence to hold her role of person in charge for the project communication. The acquisition of this new competence is facilitated by her knowledge of the MUNUKUTUBA language. Mrs. Martin will be named (appointed, chosen) for this role.

2.8 Choose

Choosing means it is necessary to decide between several alternatives, which are likely to answer the question (with the objective). For choosing a Human resource (for the achievement of an objective) it is necessary to build the couple (competence, role) and to evaluate all the

people (the alternatives ones), the good result of this choice is the person which exactly match with the couple.

It is necessary to distinguish who's chooses as who's is chosen, or the one who makes (M) to the one who makes doing (MD).

For Mrs Martin it is the person in charge for human resources who chooses Mrs Martin to be responsible for the communication of the project

Once, all the terms are defined, we propose to position them on a temporal axis where the decision process is represented. This enables us to know when we need a data, when an information is required, at what time a competence is needed for what kind of action...

3 Decision processes along time axis

This paper deals with decision-making processes [2] of choice to establish the couple (objective, actor) in an organization (a management) of project [3],[4]. It is necessary thus to be interested here more precisely in the contents of decision flows, i.e. in the flow of decisions related to the objectives of the project (with their specification, their piloting), to the activities of management even of the project (piloting of the processes project) and to deliverable to the awaited results of the project (with their specification, with their piloting).

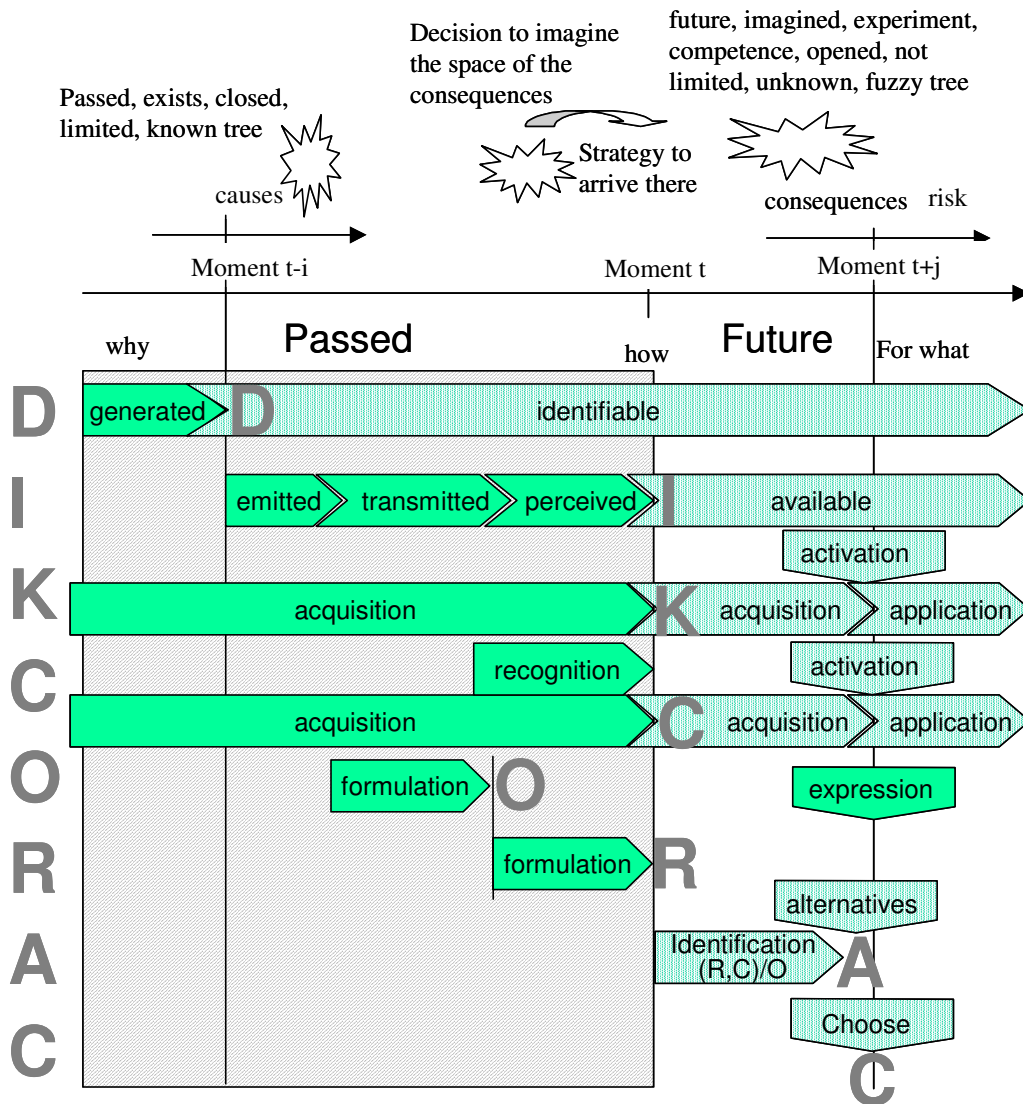


Figure 2. The contributing processes to the choice of a project actor

Figure 2 formalizes along the time axis the processes, which contribute to the decision (decision for the choice of an actor for the achievement of an objective). The time-constants are very different between the acquisition from competence and the formulation of a role by example. The formulation of the couple competence, role (which defines the actor) must be in coherence with the formulated objective. It is indeed starting from this choice that the actor is chosen, actor with whom one will give the objective to be reached.

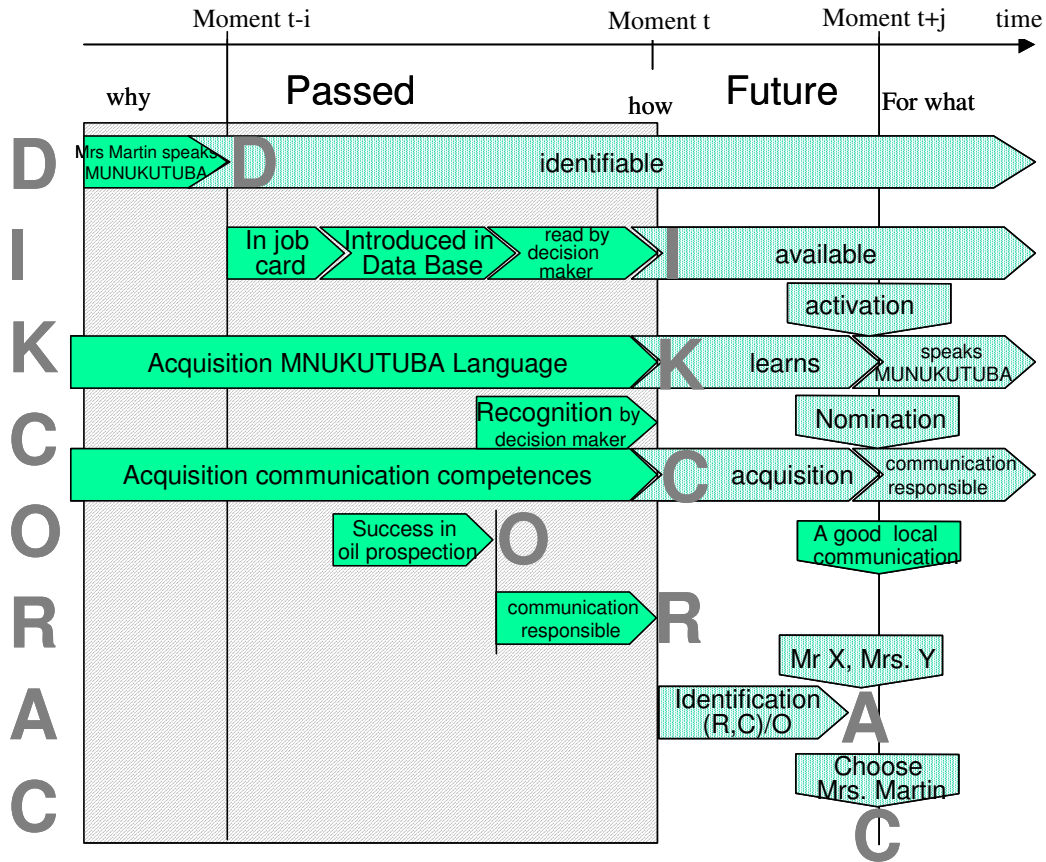


Figure 3. Example: the choice processes of Mrs. Martin

4 Specification of a decision-making aiding tool for the choice of an actor

From the structuring of the definitions of part 2 and organization of the decision-making processes of part 3, one now wishes to specify a tool of assistance for making a good decision of assignment of an actor to an objective in a project.

Along chains DIKCORAC, only Data, Information, Knowledge, Competence (DIKC) are known at the moment when one need to decide for a couple (objective, actor). In considering again figures 2 and 3, one notes that the decision maker (the one who makes doing: MD) must

initially decide objective (that which one wishes to entrust to somebody, the one who will make: M). In the second time the decision maker must choose actor A (thus the couple role, competence) who can meet the need for resolution of the previously defined objective. Finally according to the availability or not of an actor, to his adequacy or not to the needs, to his adhesion or not to the project, the decision maker must readjust his choices to stabilize a robust couple objective, actor (presenting the minimum of risk).

The Decision Life Cycle can be decomposed into three stage stages:

1. Identification of the "need": existence of an objective
2. Assignment of an actor to an objective
3. Stabilization of the couple (Objective, Actor)

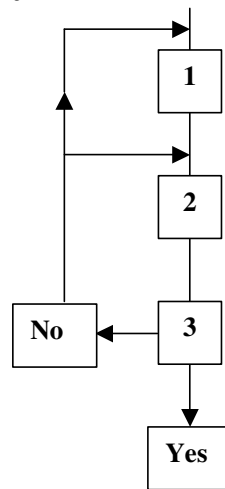


Figure 4. Decision Life Cycle

We want to develop an assistance tool, which takes all the decision cycle into account. We thus will rigorously apply Value Analysis to each stage stages of this lifecycle.

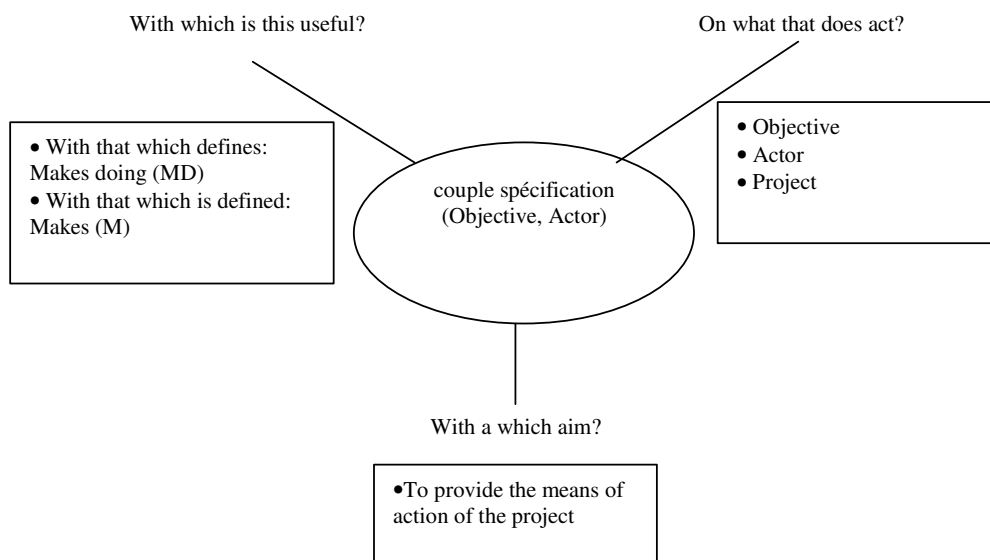


Figure 5. Value Analysis of a tool for aiding to decide of the objective and Actor specifications

By way of example, let us take the first stage and implement the first functions of this stage. The surrounding ones of the tool that we wish to develop are: the one who Make Doing (MD), the project (for which one seeks the couple: objective, actor), the culture and the strategy of the company, and finally the total objective to reach (the objective of higher level).

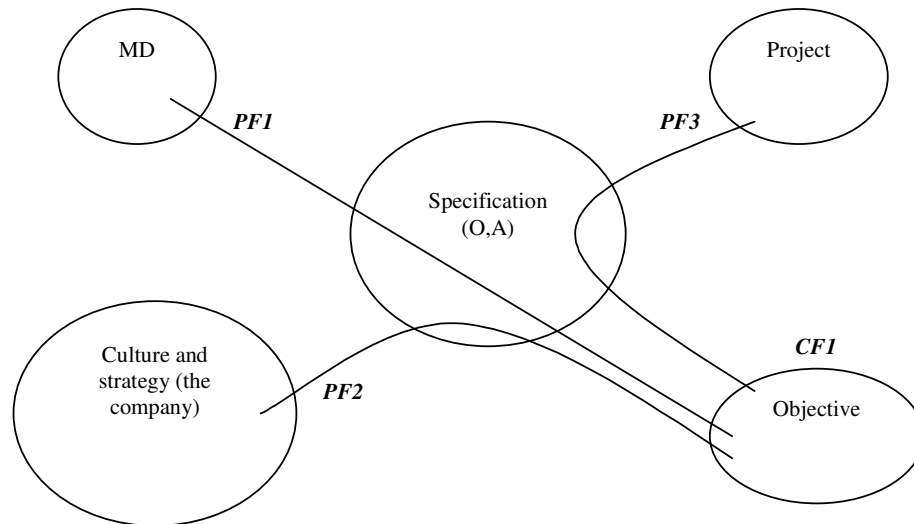


Figure 6. Value Analysis of the stage 1: Identification of the "need"

Two kinds of functions are distinguished, the Principal Functions (PF) and the Constraint Functions (CF).

- PF1: The system must make it possible MD to identify the objective.
- PF2: The system must make it possible the objective to respect the strategy and the culture of company.
- PF3: The system must make it possible the objective to contribute to the resolution of the project.
- CF1: The system must make it possible the objective to be coherent with the other objectives.

With the same approaches one can define the functions of stages 2 and 3 (Assignment of an actor to an objective Stabilization of the couple). We obtain the next functions.

- PF4: The system must make it possible MD to choose M
- PF5: The system must make it possible MD to convince M
- PF6: The system must make it possible to respect the constraints of the company in the choice of M
- PF7: The system must make it possible to validate that M is qualified to carry out the objective.
- PF8: The system must make it possible to validate that M is compatible with the resources in hand of the project
- PF9: The system must make it possible MD to have a stable couple (O,A).

- PF10: The system must make it possible D to express its compatibility with the objective (negotiation)
- PF11: The system must make it possible couple (O,A) to respect the project.
- PF12: The system must make it possible couple (O,A) to respect the remainder of the company.
- PF13: The system must make it possible MD to express a not-stability of couple (O, A). (re-identification, or reassignment)

For each Function one considers the action, which realizes the function and their two surroundings that one declines in time, energy, material, information and cost (see table 1 for the example of the function PF1)

Table 1. Example of the function PF1 (The system must make it possible MD to identify the objective)

PF1	To Identify	Objective	MD
Time	From fact release to the existence of the objective	Useful life of the objective	
Energy	MD		
Matter		One of the targets to reach for the project	An actor responsible for the couple (O,A)
Information	Expression of the definite objective	Existence of the previously defined objectives, the results previously obtained (state of the project)	
Cost	Cost due to the time put by MD to identify	The objective induces the cost to reach it	
PF2	To respect	Objective	Culture and strategy of the company
Time			
Energy			
Material			
Information			
Cost			

Such specifications of function 1 allow on the example of Mrs. Martin of:

Table 2. The function PF1 with Mrs. Martin Example

PF1	To Identify	Objective	MD
Time	From the moment when one identifies in the Information System that one seeks for the project a person in charge communication	Until the end of the project	
Energy	The project manager		
Material		The oil prospection project is at the south of Congo	The responsible project manager for the couple (O,A)
Information	To ensure for the project the communication with the local populations	One seeks for the project a person in charge communication	

Cost	Cost due to the time put by the project manager to identify the objective	The objective induces the cost to reach it (x Human / months to ensure the communication with the south of Congo)	
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So with these toll specifications we realize successively (see the Julie Stal-Le Cardinal and Jean-Claude Bocquet Paper in this ICED05 Conference [5]):

- FMEA (Failure Modes and Effects Analysis): allows for every function stemming from the Functional Analysis, to analyse and to detail the failures, their effects, their causes and their consequences. One identifies critical decisions.
- In using the decision processes along time axis (see in 3) for the identified critically decision, one defines the Chains of Markov which allows to put in evidence the dysfunctions of the functions.
- Realization of the tool: decision-making tool based on the treatment of the chains of Markov, and a dynamic Model [6].

5 Conclusions

We have proposed clear definitions of several concepts: Data, Information, Knowledge, Competences, Objective, Role and Actor (DIKCORAC). These definitions have been given within the context of engineering design and project management.

Theses concepts are organized in time by the decision-making processes modeling. A focus has been made on the decision for the choice of an actor having to carry out an objective of a project.

With a Value Analysis we have specified the functionalities of a tool, which helps with the decision-making for the establishment of an (objective, actor) couple.

From this temporal organization of the concepts and the expression of the decision-aided functions, we have built the framework of a processing of the decision process, which is presented in another ICED 2005 paper.

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