

Full Length Research Paper

Investigation in the cooperation of systemic methods: Case study of an industrial process

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This article presents an application of specification techniques enabling the description of an industrial system in view to replicate it in a machine after possible modifications. Indeed, a cooperative approach of two systemic methods has been proposed on one hand and a case study of an industrial process has been applied on the other hand. It is about the storage system of cereals in Tunisia. This cooperative approach has been proposed in this work according to a methodology integrating two systemic methods OOPP (Objectives Oriented Project Planning) and MERISE (Méthode d'Etude et de Réalisation Informatique pour les Systèmes d'Entreprise) that can complete themselves and allows a global resolution of the problem of cereals management.

Key words: System approach, objectives oriented project planning, méthode d'Etude et de réalisation informatique pour les systèmes d'Entreprise, cooperation, cereals management.

INTRODUCTION

Systemic analysis or system approach is a methodology that organizes knowledge in order to optimize an action. The objective of the system approach is to map any complex, lead to a modeling to act on it, after understudying its hardware configuration and dynamic structure. Various known systemic analysis tools (AMS, causal analysis, SADT...) (Lakhoua, 2010) are used in order to response the relevant questions of a project:

What? Who? How? When? and Where?

Depending on the method and the tool we use, other parameters can be defined. The systemic method OOPP (objective oriented project planning) (AGCD, 1991; GTZ, 1988), has been used in a context of upgrading. This method has been refined and applied in various practical cases (upgrading project of a grain silo, analysis of financial activities, analysis of the grading system of cereals...). This method has been used in order to contribute to the deployment and development of an information system of various industrial enterprises. In order to manage a complex process as the storage system of cereals, it is useful to model it taking into account its behavior as well as its conduct rules. The

achieved model will enable putting in evidence dysfunctions of the system notably the aspects of the distribution of cereals in one hand, and to make simulations of new scripts of optimization and organization, in the other hand.

If we consider the complexity of the system and the different aspects according to which we want to model, it is necessary to make a simplification while defining for each of its components the degree of detail of the analysis (Landry and Banville., 2000; Nokes and Kelly, 2007; Van, 2006). The methods OOPP and SADT (structured analysis design technique) (Jaulent, 1989; Ryan and Heavey, 2006; Lakhoua, 2009) are used to express the needs, to realize the functional aspect of a load notebook, to communicate between a team's members, and known as methods of functional analysis of software, because the results gotten depend more on the analyst's expertise than of the rigor of the method. MERISE (Méthode d'Etude et de Réalisation Informatique pour les Systèmes d'Entreprise) (Strhmeir, 1996; Collongue, 1986) has been applied in order to elaborate a representation model of the cereals storage process. This computer method is more complex than SADT. It integrates different levels of abstraction.

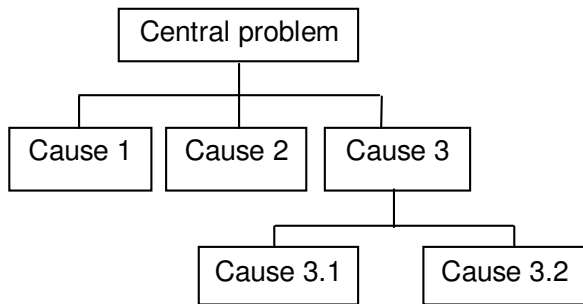


Figure 1. Problem tree of the OOPP method

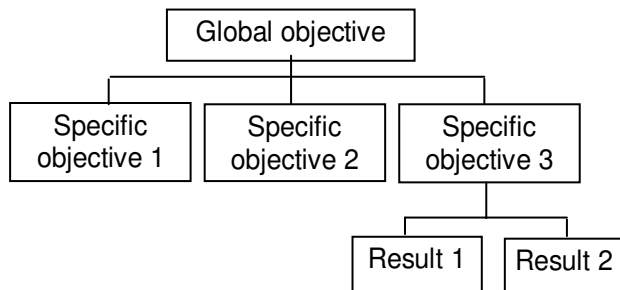


Figure 2. Objective tree of the OOPP method.

The vocation of MERISE is double:

MERISE represents a method of conception of the enterprises information system on one hand and proposes a methodological gait of information system development on the other hand (Banos and Malbosc, 1989; Gabay, 2004).

The objective of this paper is to present an application of the method MERISE in a context of cooperation with the OOPP method for the modeling of an information system of an enterprise.

PRESENTATION OF THE OOPP METHOD

The OOPP method (Walter, 1998; Lakhoua, 2006; Annabi, 2003) also referred to as logical framework approach (LFA), is a structured meeting process. This approach seeks to identify the major current problems using cause-effect analysis and search for the best strategy to alleviate those identified problems. OOPP method has become the standard for the International Development Project Design. Team Technologies have continued to refine the approach into TeamUP (Killich, 2002). The design methodology of the OOPP method (AGCD, 1991; Killich and Luczak, 2002) is a rigorous process, which if used as intended by the creators will impose a logical discipline on the project design team. If the process is used with integrity the result will be a high quality project design. The method is not without its limitations, but most of these can be avoided with careful use of ancillary techniques. Many things can go wrong in the implementation phase of a project, but if the design is flawed, implementation starts with a severe handicap.

The first few steps of the LFA are:

Situation analysis; stakeholder analysis; problems analysis (Peffer Tunanen, 2005; Bouchoucha et al., 2006; Team technologies, 1991).

The document of "situation analysis" describes the situation surrounding the problem. The source could be a feasibility study, a pre-appraisal report, or be a compilation done specifically for the project design workshop. Typically, the document describes the problem situation in detail, identifies the stakeholders and describes the effects of the problems on them. The stage of "stakeholder or participation analysis" is an analysis of the people, groups, or organizations that may influence or be influenced by the problem or a potential solution to the problem. This is the first step to understanding the problem. We might say, without people or interest groups there would be no problem. So to understand the problem, we must first understand the stakeholders. The objectives of this step are to reveal and discuss the interest and expectations of persons and groups that are important to the success of the project. If there is no agreement between participants on the statement of the problem, it is unlikely there will be agreement on the solution. This stage of "problem analysis" therefore seeks to get consensus on the detailed aspects of the problem. The first procedure in problem analysis is brainstorming. All participants are invited to write their problem ideas on small cards. The participants may write as many cards as they wish. The participants group the cards or look for cause-effect relationship between the themes on the cards by arranging the cards to form a problem tree (Figure 1).

In the step of "objectives analysis" the problem statements are converted into objective statements and if possible into an objective tree (Figure 2). Just as the problem tree shows cause-effect relationships, the objective tree shows means-end relationships. The means-end relationships show the means by which the project can achieve the desired ends or future desirable conditions. Frequently there are many possible areas that could be the focus of an "intervention" or development project. The next step addresses those choices. The objective tree usually shows the large number of possible strategies or means-end links that could contribute to a solution to the problem. Since there will be a limit to the resources that can be applied to the project, it is necessary for the participants to examine these alternatives and select the most promising strategy. This step is called "alternatives analysis". After selection of the decision criteria, these are applied in order to select one or more means-end chains to become the set of objectives that will form the project strategy. After defining the objectives and specifying how they will be measured (OVIs) and where and how that information will be found (MOVs) we get to the detailed planning phase: "activities planning". We determine what activities are required to achieve each objective.

It is tempting to say; always start at the situation analysis stage, and from there determine who are the stakeholders (Lakhoua et al., 2010).

MOTIVATION OF COOPERATION

OOPP - MERISE

Of the fact of its character structured and participative (adherence and communication of the various concerned by the project), we consider the OOPP method extensively evolutionary and adaptive. This is why our research team invested itself in view to develop some convivial and functional tools for the extended OOPP method, definite under the denomination MISDIP (method integrated of specification, development and

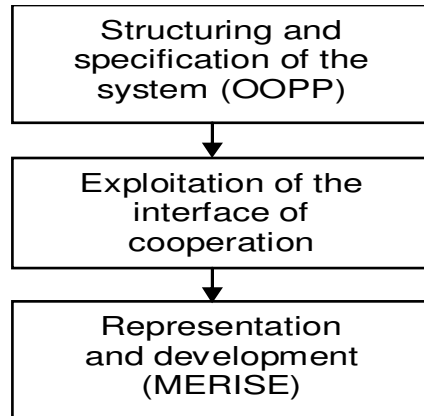


Figure 3. Methodology of cooperation.

implantation of project) (Annabi, 2003; Lakhoua, 2008). This new method, under development and normalization, present today a limit as for its environment of utilization. Hence, of our motivation to offer an environment of help to the development, we tempted to make cooperation between the OOPP method and MERISE, that profit today of a more functional environment (tools, formalism, culture...). The objective of this cooperation is to exploit the structuring and participative and specification aspect of the OOPP method on one hand and the convivial tools of the environment MERISE, on the other hand.

MERISE is kept as being a standard, and an important tool for the survey and the development of a computer application. Its representation arranges numerous qualities as:

- i) A very good legibility thanks to the clarity of its diagrams,
- ii) A hierarchical structure and no formalized,
- iii) A recognition of synchronizations as basis concept...

The methodology of this cooperation consist of the exploitation of the OOPP method in the phase of the structuring and the specification of the system to develop the exploitation of an interfacing of cooperation between the two methods and the exploitation of MERISE for the representation and the development (Figure 3). The methodology of the cooperation OOPP - MERISE is based on three phases:

The first concerns the system with its various processes, the second relates to the process of cooperation and the third to the state of exit.

1st phase

Structuring and specification of the system

- a) To delimit the process, object of the development, and

to represent it by a simplified diagram block limited to the first levels of the analysis.

- b) To analyze by OOPP the system by a hierarchical manner.

- c) To identify the informational environment of every entity "activity".

- d) To establish the matrix of information that enables to determine ties between the entities "activity". These information also regrouped them by entity "Information".

2th phase

Exploitation of the interface of cooperation

- a) To consider these information as a data structured constituent according the dictionary of MERISE.

- b) To define objects of MERISE according to a logical appreciation of entities as "activity" of that "information".

- c) To establish relations between objects while exploiting the entities "activity" on one hand and on the other hand the free ties of the "information" matrix.

3th phase

Exploitation of MERISE

- a) The whole of these elements (dictionary of data, objects, relations, events, operations, and results) constitutes the specification of the system.

- b) To exploit the environment of representation, modeling and development of MERISE to develop the project.

From the list of properties and the rules managing the system, we determined in a first time the objects (corresponding often according to the OOPP Results) while specifying for each of them identifying (corresponding for the OOPP method to information the more representative and most applicable). In the same way, we determined relations (correspondent for the OOPP method to the entity "activity") and cardinality from the observation of the system and its working and the OOPP analysis done. In the MISDIP model, the matrix of information, of by its constitution, can be considered like a support illustrating relations between information imported by an entity "activity" and information produced by this last; these last information are considered then as the transformation of information imported by the entity "activity". The relation between the produced information and the information imported by an entity "activity" constitutes a treatment can give the MCT of MERISE. A treatment can be very elementary as one of a registration of information considered like an event that triggers an operation to generate a result constituting another event triggering the following operation. Thus, the event whole - operation - result can constitute a basis entity of the representation of the MCT. To make sure of the quality of the

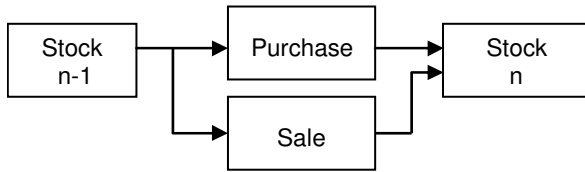


Figure 4. Process the storage system of cereals.

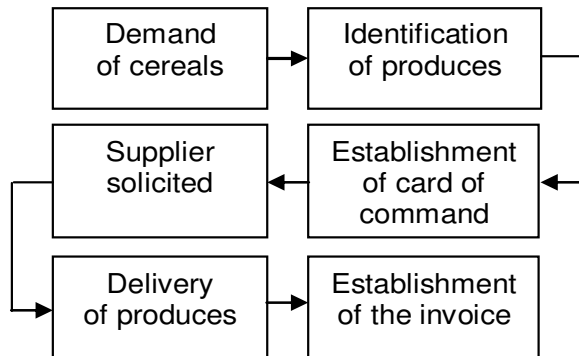


Figure 5. Under process "purchase of cereals".

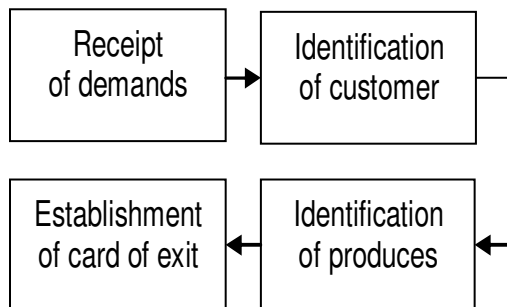


Figure 6. Under process "sale of cereals".

information system, we define some logic-functional rules reflecting the coherence, the reliability and the comprehensiveness of the analysis by an information matrix in which the rows are relating to activities and the columns to information. This matrix is conceived as follows:

- i) The first row is reserved to the first activity A1,
- ii) The first column is reserved to the first information If1 associated to this activity,
- iii) If If1 is imported by A1, we note « 0 » in the corresponding box, if it's produced by A1, we note « 1 »,
- iv) We move after that to the second information If2 and we associate the corresponding binary character: « 0 » if the information is imported by the activity A1 and « 1 » if it's produced by the same activity,
- v) We proceed in the same way until all the information

concerning A1 are exhausted,
 vi) We move after that to the second row corresponding to the second activity A2,
 vii) If If1 relates to A2, we note the corresponding binary number (0 or 1 according to this information is imported or produced), otherwise, we leave a blank in the corresponding box, then we add the new information that concerns the current activity,
 viii) We follow the same step as far as exhausting all the activities and all the corresponding information.

Finally we progressively construct a large matrix when the system is complex; it's made of « 0 », « 1 » and « blank ». The defined information matrix enables us to establish a correlation between the activities and their information. This matrix was used in order to specify the information exchanged between the different elements of a system.

PRACTICAL CASE OF AN INDUSTRIAL PROCESS

The analysis of the system of receipt, storage and expedition of cereals clears a part relating to data manipulated representing the information system and a part relating to the treatment of the process on one hand and to its management and its conduct, on the other hand. Considering the fixed objectives and the results of simulation waited, our interest is the rules of management of the system and to its conduct. We suppose that the handling system is dimensioned in order not to complicate the modeling, in the same way one won't retail the system of provision that is governed by the complex procedures.

Management of the cereals storage system

In order to present a simplified model of the management process of the activities of storage system of cereals (Figure 4), we used a block diagram representation and while retailing the two coins in a particular process (Figure 5) purchase and sale of cereals (Figure 6).

Specification of the elements of MERISE

In order to specify the various elements of the graphic formalism used by MERISE, and the information associated to the management process and rules of conduct we exploited the OOPP method (Table 1). In order to specify this information, we define an information matrix associated to OOPP analysis enabling to determine the relations between the activities or between the concerned structures identify the information sources, determine the manner in which the information is exploited. We represent on this same matrix, in its last column, the correspondence of the entities "object" of MERISE (Tables 2 and 3).

Table 1. Information matrix of the OOPP method.

N°	Code	Activity	Code entity activity	Information						
				If1	If2	If3	If4	If5	If6	If7
1	OS1		EA1	0	0	1	1			
2	R1.1		EA2		0	0		1	0	
3	A1.1.1		EA3	1	0	0	0		0	0
4	A1.1.2		EA4		1	0			0	0
	A1.1.3		EA5	0		0		0	1	0

Table 2. Results of the OOPP analysis.

N°	Code	Designation
1	GO	Process of the cereals movement analyzed.
2	SO1	Extern information of the process of the movement of cereals identified.
3	R1.1	Extern information relative to the produce identified.
4	R1.2	Extern information relative to the card of command identified.
5	R1.3	Extern information relative to the supplier identified.
6	R1.4	Extern information relative to the client identified.
7	R1.5	Extern information relative to the cart of exit identified.
8	R1.6	Extern information relative to the stock identified.
9	SO2	Process of purchase of cereals analyzed.
10	R1.1	Produce identified.
11	R1.2	Cart of command established.
12	R1.3	Supplier solicited.
13	R1.4	Cart of exit established.
14	R1.5	Reception assured.
15	R1.6	Invoice established.
16	SO3	Process of sale of cereals analyzed.
17	R1.1	Demand of the client assured.
18	R1.2	Identification of the client assured.
19	R1.3	Cereals to sale identified.
20	R1.4	Cart of exit established.
21	SO4	Process of storage of cereals analyzed.
22	R1.1	Previous stock identified.
23	R1.2	Fiche of the stock assured.

EXPLOITATION OF THE TOOLS OF MERISE

The practical case of the cereals storage system and the relative phase of data compilation of this system brought us to conclude that this system is composed of a lot of data and interventions since its entrance until its exit. For these different reasons, we considered the cereals storage system as an information system, for which MERISE is well adapted. This is why we present two models of MERISE:

Conceptual model of data (MCD) and conceptual model of treatments (MCT).

Development of the MCD of MERISE

Considering the presented elements, we elaborated the

MCD model (Figure 5). To facilitate the reading of the model, we specified by verbs the nature of relations. From the introverted data on the cereal storage system, we cleared the necessary properties for the development of the model. We kept properties that enter in the setting of rules of management of the system. We mention to indicative title, the list of properties representing the Lexicon of the picture 4 under denomination "information". For example:

N° of the card of command, code produces to receive, designation of the product, origin, quality and quantity, received quantity, received quality, client N° demand, asked quantity, N° card of exit, date of establishment of the card of exit, quantity exit, quality exit,...

From the list of properties and rules managing the system, we determined in a first time objects

Table 3. Specification of graphic formalism of MERISE.

N°	Code	Designation	Imp Inf	Prod Inf	Entity MERISE
1	R1.1	Produce identified			Produce
2	A1.1.1	To identify the number of purchase operations		NbPur,	
3	A1.1.2	To identify the code of the cereals		CdCer	CdCer
4	A1.1.3	To identify the nature of the cereals	NatCer		NatCer
5	A1.1.4	To identify the origin of the cereals	OrCer		OrCer
6	A1.1.5	To identify the quality of the cereals	QlCer		QlCer
7	R1.2	Card of the command established	CdInv		Card of command
8	A1.2.1	To identify the N° of the card of command		N°Cc	N°Cc
9	A1.2.2	To identify the date of the card of command		DtCc	DtCc
10	A1.2.3	To identify the quantity of the cereals		QtCer	QtCer
11	A1.2.4	To identify the code of the cereals	CdCer		AutCc
12	A1.2.5	To identify the author of the card of command		AutCc	CdCer
13	R1.3	Supplier solicited			Supplier
14	A1.3.1	To identify the noun of the supplier	NSup		CdSup
15	A1.3.2	To identify the code of the supplier		CdSup	NSup
16	A1.3.3	To identify the noun of the demander		NDem	NDem
17	A1.3.4	To identify the date of the solicitation		Dtsol	Dtsol
18	R1.4	Card of exit established	N°CE		Card of exit
19	A1.4.1	To identify the N° of the card of exit		N°CE	N°CE
20	A1.4.2	To identify the date of the card of exit		DtCE	DtCE
21	A1.4.3	To identify the author of the card of exit		AutCE	AutCE
22	R1.5	Invoice established	N°Inv		Invoice
23	A1.5.1	To identify the N° of the invoice		N°Inv	N°Inv
24	A1.5.2	To identify the date of the invoice		DtInv	DtInv
25	A1.5.3	To identify the author of the invoice		AutInv	AutInv

(correspondent often according to OOPP to result) while specifying for each of them identifying him (correspondent for OOPP to information the more representative and most applicable). In the same way, we determined relations (correspondent for OOPP to the entity "activity") and cardinality from the observation of the system and its working and the OOPP analysis done.

Development of the MCT of MERISE

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of information considered like an event that triggers an operation to generate a result constituting another event triggering the following operation. Thus, the event whole - operation - result can constitute a basis entity of the representation of the MCT. To specify the system with only one method comes back to only treat certain measurements of the system. It can be sufficient in some very precise cases. One would not know how to satisfy itself of it in the general case. Since it is difficult to have a universal method, there is place to study the system according to various methods; each adopting a point of view covers some measurements.

We have presented in this work, several problems of the management system of the activities of cereal storage. This is why we identified the need of a tool of integration of the two methods OOPP and MERISE.

Conclusion

In this paper, a methodology of cooperation of two

systemic methods OOPP and MERISE and a practical case of the cereals storage system are presented. In order to validate this methodology, we presented a model of representation of the cereals storage system while exploiting the cooperative approach OOPP - MERISE. In fact, we especially surrounded the parameters of the two methods OOPP and MERISE and we established the correspondences between them in order to make them complete mutually.

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