

SYSTEM ANALYSIS AND INFORMATION SYSTEM DEVELOPMENT FOR A SMART GRID

Mohamed Fathi Karoui
University of Carthage, Tunisia
E-mail: fathi.karoui@gmail.com

Jamel Ben Salem
University of Carthage, Tunisia
E-mail: bsj_jamel@yahoo.fr

Mohamed Najeh Lakhoua
ENICathage, University of Carthage, Tunisia
E-mail: MohamedNajeh.Lakhoua@ieee.org

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ABSTRACT

Because the systemic model of any organization is organized by matching an operating system and a decision system through an information system, the implementation of the information system and the effectiveness of its exploitability is an unavoidable operation. Indeed, its modeling allows us to have a tool of analysis and assistance in decision-making. The purpose of this paper is to present an application of a system approach based on the OOPP method for modeling an information system of an industrial company.

Keywords: System modeling, Information System, OOPP method

1. INTRODUCTION

The information system makes it possible to control service or industrial system (Lakhoua, 2008). Its main role is to link the system on the one hand and the environment with the company or the user on the other hand (Figure 1). Consequently, the accomplishment of the mission of each intervening depends closely on its characteristics: reliability, consistency, scalability, visibility and integrid (Lakhoua, 2009; AGCD, 1991).

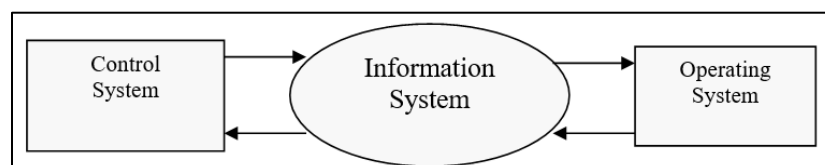


Figure 1: Global system scheme.

Thus, the performance of a production or service structure, however complex it may be, depends on the performance of its information system. Indeed, the establishment of an industrial system information system and the efficiency of its user-friendliness is an essential operation. It makes it possible to adapt the constraints of measurement and collection of information to those of processing and operation (Logical, 1999).

The modelling of such a system allows us to have an analysis and decision support tool. In this article, we propose an application of a systemic approach based on the use of the Oriented Objective Project Planning (OOPP method) to study a smart grid system. This article will be divided into three parts. First, we present the Smart Grid System and the objectives to be achieved through. Second, we present the OOP method and some works using this method. Third, presents the results of the modelling of the industrial or a service system.

2. THE SMART GRID SYSTEM

Integration of new information and communication technologies to networks will make them communicative and will take into account the actions of players in the electricity system, while ensuring more efficient, economically viable and secure electricity delivery, what puts us in front of a smart grid (Worighi et al., 2019).

The following figure shows the general structure of a smart grid system.

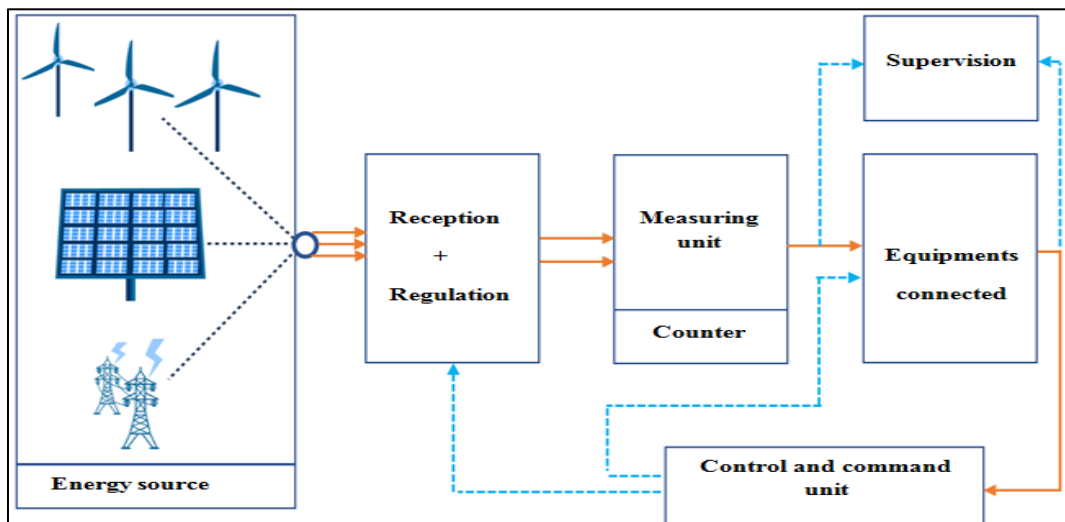


Figure 2: General architecture of a Smart Grid system

3. OBJECTIVES OF SYSTEM ANALYSIS AND INFORMATION SYSTEM DEVELOPMENT FOR A SMART GRID.

Energy consumption is still an economic challenge for several countries. Several issues push researchers to an Analysis and Information System Development to make the following goals:

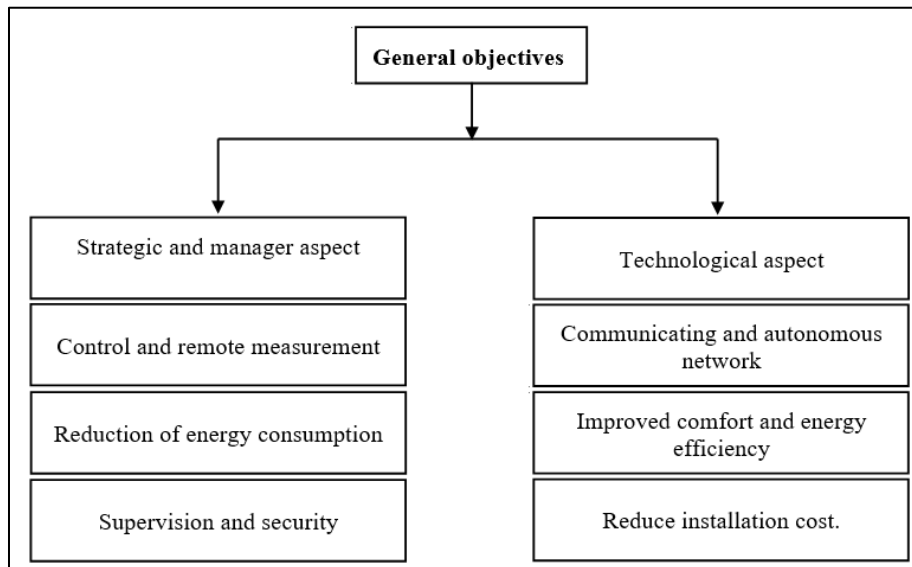


Figure 3: Objectives of analysis and information system of a smart Grid

In order to achieve these objectives, several researchers have designed and used systemic analysis methods. This article proposes an information system analysis of a smart grid network of the Objective Orientated Project Planning in the following a general presentation of this analysis tool.

4. PRESENTATION OF THE OOPP METHOD

Several countries like Germany, Canada and Belgium used the OOPP method (Figure 2) to plan upgrade projects such as vocational training and employment (MANFORME) or the environment or for certain agro-food sectors. It was also used to restructure various private and public companies and was also adopted to plan and implement the project to organize the Mediterranean Games in Tunis 2001. It was also adopted by the Council of the Order of Engineers to initiate and continue the common reflection on the training of engineers (GTZ, 1991).

The two key steps in the development of the restructuring strategy are:

- The Project Planning Scheme (PPS), which consists of establishing a comprehensive

diagnosis of the situation by developing a Problem Tree using logic Causal.

- The Business Planning Scheme (SPA) which, according to "means -end" logic, results to be achieved by developing a Tree of Goals.

These steps are in fact a prerequisite for any implementation of the Project that requires a Monitoring and Evaluation System (SSE).

According to (Potts, 2002), the approach starts with analysis of four crucial aspects such as participation analysis, problem analysis, objective analysis, and alternative analysis. He also stated that the logical framework is the ultimate step in this process (Figure 4) and it is contributed to the project design.

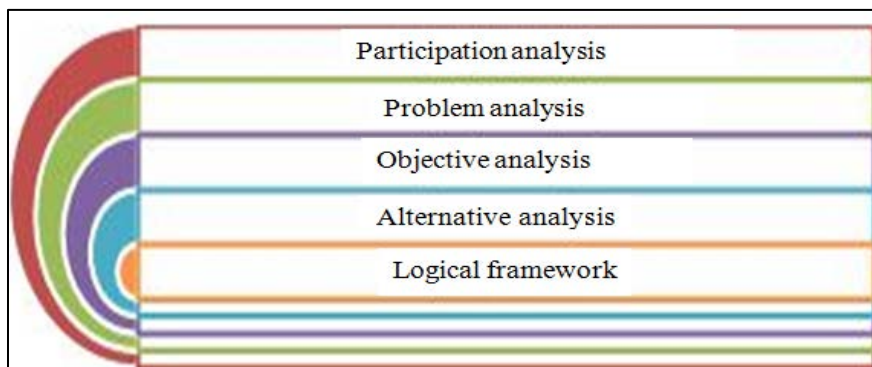


Figure 4: Different steps of OOPP approach
 Source: adapted from Potts (2002)

The OOPP method constitutes a tool of a global systemic modeling enabling to analyze a complex situation by a hierarchically decomposition until reaching an elementary level allowing an operational planning. This method, widely used in the planning of complex projects, involves many operators and partners (Lakhoua & Ben Jouida, 2011a)

Several researchers have used the OOPP method to plan or to study the information of a system or a project. In the following some works in the literature.

The researcher Lakhoua (2011) used the OOPP method to introduce a method of informational analysis by objectives (MIAO) based on the OOPP method. He managed to present the logical and functional rules associated with the MIAO (Lakhoua & Ben Jouida, 2011a).

The researcher Moussa illustrated the objective Oriented Project Planning (OOPP) in developing the Environmental Strategic Plan in consideration of the Egyptian Environmental Affairs Agency to collect, process, produce, and distribute environmental information

(Moussa, 2008).

The researcher Salam (2015) presented the effectiveness of the OOPP method for the design of projects, he studied the contribution of each step of the method and the relationship between them (Salam, 2015).

5. RESULTS OF MODELING OF AN INFORMATION SYSTEM

Due to the complexity and sensitivity of the modeling adopted from the information system will use the OOPP method (Lakhoua, 2011b; Lakhoua & Khanchel, 2016), which is a global systemic modeling tool to analyze a complex situation by breaking it down from and reducing it to basic situations leading to basic operational planning. This method, widely Due to the complexity and sensitivity of the modeling adopted from the information system will use the OOPP method (Lakhoua, 2019), which is a global systemic modeling tool to analyze a complex situation by breaking it down from and reducing it to basic situations leading to basic operational planning (Lakoua, 2011c; Guangshu & Songjiang, 2010).

The development of specific objectives (OS) in results in intermediate results, activities, under activities, tasks and under tasks.

The model presented below illustrates four specific objectives to achieve the overall objective (GO) of a smart grid system.

The specific objectives identified are:

- OS1: Measurement and collection of information assured.
- OS2: Transmission of the information assured.
- OS3: Treatment and exploitation of the information assured.
- OS4: Management of the system of information assured.

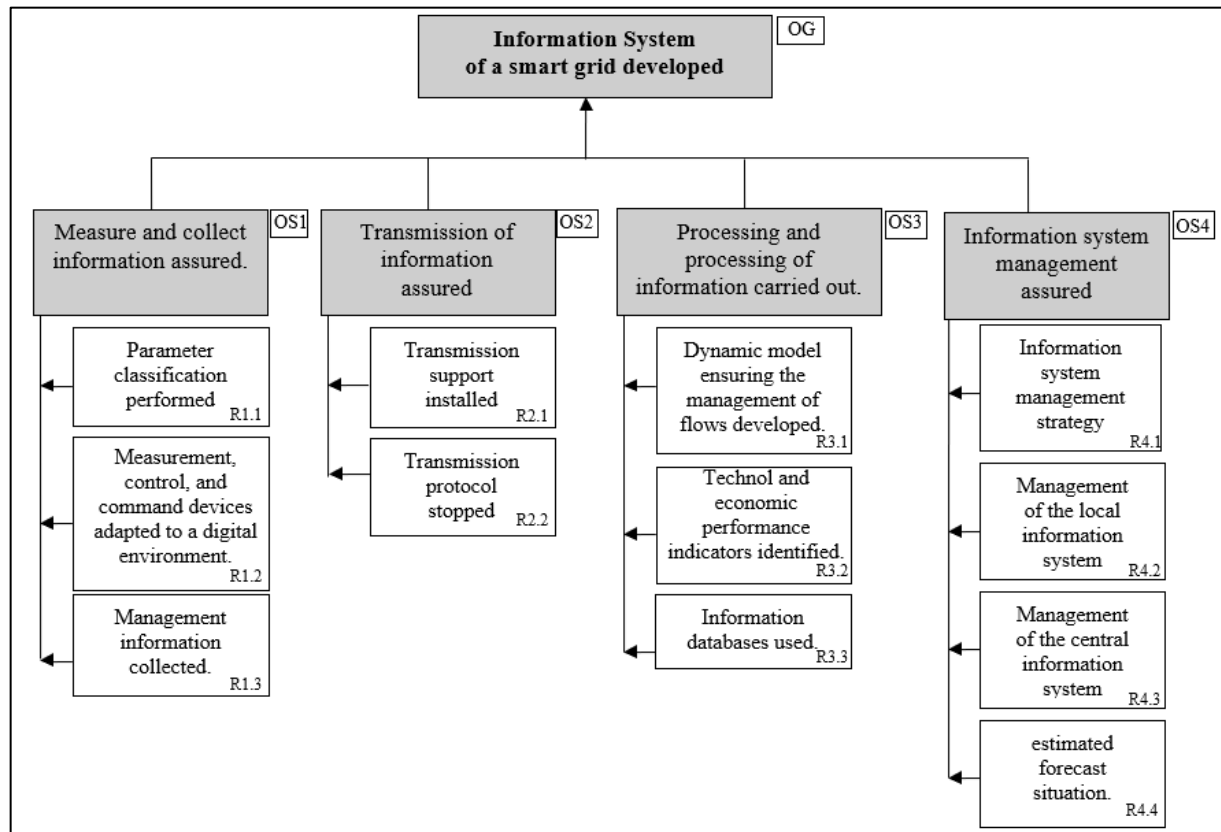


Figure 3: OOPP model of an Information System development.

The system method used for the analysis of the activities of a production system is the OOPP method for the specifications of the equipment of the production system (Annabi, 2003; Killich & Luczak, 2002).

The OOPP method is based on a structuring gait and is hierarchized. Once identification of the OG of the project that one intends to analyze, we determine the Specific Objectives to reach previously and, according to the same logic, one specifies the lower levels.

The model presented (TABLE) illustrates eight specific objectives (OS) to achieve the global objective (OG): Information System of a production system defined.

The Specific Objectives identified are:

- OS1: Management of the Information System;
- OS2: Security of the Information System;
- OS3: Circulation of the information;
- OS4: Appropriate information media;
- OS5: Analysis of effective information;

- OS6: Efficient information processing;
- OS7: Archive information;
- OS8: Characterization (properties / elements) of the information.

Table 1: OOPP model of Information System of a Smart grid

	Code	Activity
1	OG	Information System of the smart grid system defined
2	OS1	Management of the Information System assured
3	R1.1	Improvement of the Information System assured
4	R1.2	Assessment of the Information System assured
5	R1.3	Control of the Information System assured
6	R1.4	Maintenance of the Information System assured
7	R1.5	Functioning of the Information System assured
8	OS2	Security of the Information System assured
9	R2.1	Security of the information assured
10	R2.2	Confidentiality of the information assured
11	OS3	Circulation of the information assured
12	R3.1	Implementation of a secure information flow circuit assured
13	R3.2	Availability of timely information assured
14	OS4	Appropriate information media assured
15	R4.1	Operation of information media assured
16	R4.2	Conviviality of supports assured
17	R4.3	Availability of supports assured
18	R4.4	Supports of the information identified
19	OS5	Analysis of effective information assured
20	R5.1	Actions of Improvement proposed
21	R5.2	Causes of failure identified
22	R5.3	Failures detected
23	R5.4	Information treated interpreted
24	OS6	Efficient information processing assured
25	R6.1	Efficiency of the treatment system assured
26	R6.2	Information registered
27	R6.3	Information collected
28	OS7	Archive information assured
29	R7.1	Security of archived information assured
30	R7.2	Locations of archival information identified
31	R7.3	Supports of archival information identified
32	R7.4	Duration of archival information determined
33	R7.5	Archival information identified
34	OS8	Characterization (properties / elements) of the information assured
35	R8.1	Information need identified
36	R8.2	Information source defined
37	R8.3	Destinations for the information defined

6. CONCLUSION

The Oriented Objective Project Planning model was developed to analyze the information system of a smart grid system by breaking it down in a hierarchical manner and bringing it back to basic situations leading to operational planning. The validation of the model

was done with the production managers.

The methodology adopted by its participative nature and systemic also leaning on a large discussion of the documentary resources (proceeding, internet, specialized magazines) a variety of innovating actions have been proposed.

Starting from this study of the application of the system approach on an information system of a smart grid presented in this paper, we will extend the analysis and modeling methodology on the basis of different methods and languages.

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