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Fleur Nadine Ndjock

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From observation to decision-making: How an information system can improve strategic decision-making

NDJOCK Fleur Nadine

PhD in information and communication sciences

CNAM-France

Abstract :

To decide, we must understand, to understand, we must observe and analyze. In one way or another, intelligence is based on observation process. Decision comes after understanding his environment. Also, observation turns into knowledge with given meaning to things and determining what to do. Decision support tools are increasingly used, the example of information systems based on the concept of observatory and interpretation of data. How do we pass from observation to knowledge and knowledge to decision making through a support decision tool? We believe that decision process can be greatly optimized by observation, operation and interpretation of the behavior of indicators through an information system designed as an aid in the decision. To support our remarks, we will use concrete examples inspired by the Dynamic Observatory applied to Cameroon Educational System (DOES) which, like a dashboard, it is composed of a set of indicators. It allows to observe, monitor and alert on the environment of education.

Keys words : Observatory, decision-making, indicators, dashboard, information system, educational system, information visualization, big data.

Introduction

Today, more tools are being used to support decision-making process. It seems essential today to have appropriate tools to know, clarify and evaluate real situation of field in order to make appropriate decisions. Understanding environment, adapting means of action are the stakes of decision-making. Stakeholders such as decision-makers must be foundation of the observation. Through this practice, they have a capital of information and knowledge that enrich and inform decision-making.

Dynamic Observatory applied to Educational System (DOES) aims to be an effective and useful observation platform for decision-makers in charge of education in Cameroon. As part of their missions, they aspire to the performance of the whole system. Behind these stakes, the aim sought is a more appropriate decision-making and the strengthening of a general approach to prevent any deviance from the objectives set. We believe that with such a decision-making tool, decision-making process can be effectively optimized. The question is "how" such a tool can help to optimize decision making. To answer to this question and to support our comments, we will use concrete examples inspired by application of DOES. Our work is divided into three

parts: summary presentation of the tool followed by literature review; and finally, how the optimization of decision-making process takes place through use and interpretation of indicators on a dashboard.

Dynamic Observatory Applied to Educational System (DOES)

DOES is a decision-making tool that we have applied to the Cameroonian educational system. Conceptually, observatory consists of sensors to collect data. These are inserted in information system after necessary transformation or restructuring. Like a dashboard, it is made up of a set of indicators grouped together on one or more screens, each subdivided into two or more zones with extensive functionality for controlling certain elements of studied environment.

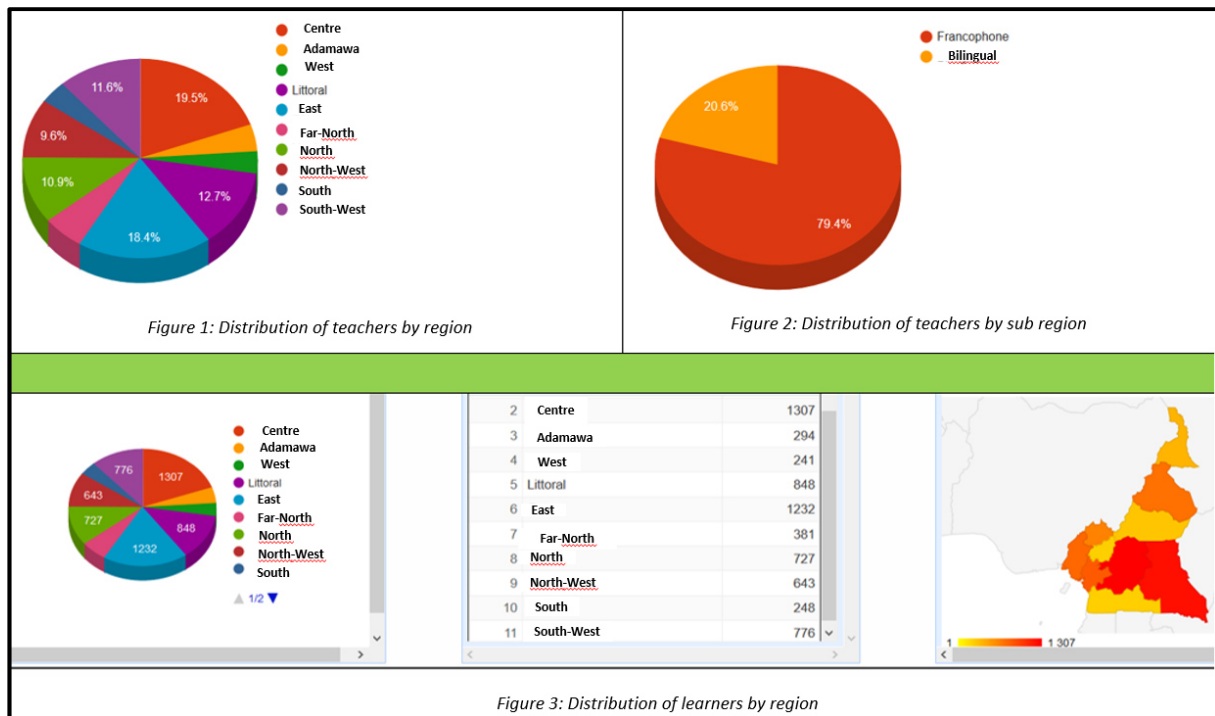


Figure 1 : Illustration of DOES Dashboard

A monitoring and control tool, it allows to observe, to monitor and to alert of the state of health of the educational system. This tool allows synthesis of information in form of visual data. It then becomes an observatory through which decision-maker observes, analyzes and guides his decision according to behavior of one or more indicators.

As any decision-making tool is intended to inform decision-maker in the decision-making process for a rapid and risk-free positioning or at least by minimizing uncertainty in decision-making and offering transparency in processing, clarity in the process of collection and communication of information and accuracy in decision-making that is based on reliable and neutral information (free from any constraint).

It was set up for Cameroon's educational system after the Growth and Employment Strategy Paper (GESP), a roadmap for Cameroon's vision for 2035, lays the groundwork for the main pillars on which establish an

effective educational system and assign objectives to the various ministerial departments in charge of education in Cameroon. In the absence of a monitoring and control tool for the achievement of objectives, we felt. It was essential to develop this decision-making tool, which is the DOES. The derivation of observation to knowledge and knowledge to decision-making requires the accumulation or storage of information which will be like a sum of experiences. To draw intelligence from this accumulation of information, we follow the footsteps of predecessors (David, 2016, p 14) by proposing the use of the information system based on the data warehouse concept, and observatory. The concept of data warehouse is the foundation for the modeling of the data of our information system whereas the concept of observatory is the basis of visualization of the information.

Literature review

Some authors consider that the fields of application of observations are varied. They range from philosophy to predictive analyzes and strategic management decisions. Reason for which observations may relate to the past and stored punctually or accumulated over a period of time or simply relate to the present. According to (Paulhac, 2007, p. 4) "It seems that knowledge of history can thus effectively guide the understanding of the present and guide future action, not as exact science, the shortcomings of forecasting and historical analogy, but as empirical data rich in meaning and teaching. " Similarly, (Nyce, 2016, 30) explains that "Predictive analysis is a set of competitive intelligence techniques that expose relationships and models within a large volume of data that can be used to Predicting behavior and events. Unlike other competitive intelligence technologies, predictive analysis looks to the future to research, using past events to anticipate the future "

Most recent and very close to our field of application are the works of David Amos (2016) who return on the process of relational decision making and the transition from information to intelligence. Indeed, author confirms that the decision-making process is closely linked to the use that is made of information and the mode of its implementation: "Relational decision making process depends heavily on the use of information". It specifies, however, that if intelligence which is defined as "a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehended complex ideas, learn quickly and learn from experience "(MSI, 2012, p.13-23), individuals differ in their ability to understand complex ideas, effectively adapt to the environment, learn from experience, engage in various forms of reasoning or to overcome obstacles. Although these individual differences may be considerable, they are never fully compatible: intellectual performance of a given person varies on different occasions, in different fields, as judged by different criteria. Author deduces from this that it is evident that intelligence in one way or another is based on observation process (understanding of our environment) and ensures that observation is transformed into knowledge (capture Images, giving meaning to things and determining what to do).

Problem of investigation and problem solving (Neckerson, Yen, & Mohaney, 2012, pp. 35-45) poses three interrelated questions:

- How can managers find, frame and formulate problems and how to resolve them allows their organizations to create added value?
- How can leaders organize fixed knowledge to efficiently search for solutions for each problem?
- How can leaders effectively implement solutions to create value?

Research for a solution to a problem posed revolves around the identification of the characteristics of this problem and the difficulties corresponding to its activity as well as the implementation of the solution. For the decision-maker, two main phases can be distinguished:

- Determine the problem he / she thinks he / she is facing;
- Find solutions to the problem.

It is not unusual for the decision-maker to resolve a problem when:

- Reformulate the initial problem for better understanding;
- Break down into several micro steps, the steps of resolving a problem including:
 - Collection of information,
 - Analysis of this information and the creation of potential solutions,
 - Choice of a solution in the list of alternatives.

According to a study carried out in 2009 by Falque and Bougon and revised in 2013, the steps of rational method of decision-making are as follows:

1. Recognize the need for decision-making;
2. Diagnose the problem and set an objective ;
3. Identify alternatives;
4. Collecting information;
5. Adapt a criteria weighting methodology;
6. Assign the coefficients to the selected criteria;
7. Assign a grade, grade for each option considered
8. Choose an option ;
9. Implement the decision and ensure its follow-up.

Decision-making process thus becomes more or less rational, due to intrusion of cognitive and emotional biases in each phase.

As the studies focus on the implementation of decision-making tools, we want to present here how the transition from observation to knowledge and knowledge is made to decision-making by the using DOES tool.

Methodology

The following figure, inspired by the work of (David, 2016, pp. 20-21), shows the important elements of the extended information system architecture we propose (TOKI, 2014, p.157).

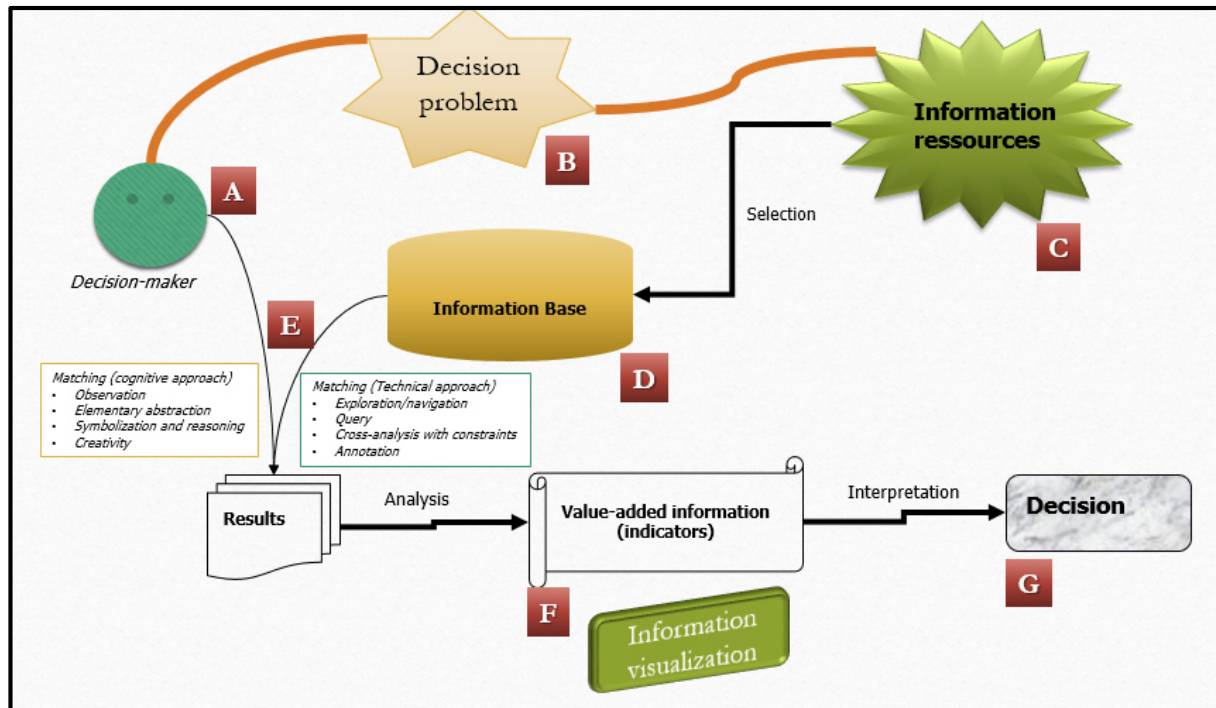


Figure 2 : Architecture of an extended information system

– A-B-C: Information to be managed by the system is determined by the set of decision-making problems as specified by the decision-maker. As seen above with respect to rational decision-making and in the competitive intelligence process, this part is the most important part of the system. It will determine the appropriateness of the information to be collected;

– C-D: After collection, information very often needs a processing in order to allow the integration in the database (data warehouse) and prepare information for visualization of the results of the system;

– A-E-D: These components correspond to how the end user retrieves a subset of information from the system. This corresponds to the operation in information retrieval systems. We were inspired by the cognitive approach of human learning: observation, elementary abstraction, symbolization and annotation. We have implemented these approaches in the system we have proposed.

– F: In terms of knowledge discovery and the creation of intelligence, this component is the most important. We proposed different forms of retrospective analysis, as well as various forms of visualization of the results (graphics, maps) with the possibility of dynamically varying the visual presentation mode. The concept of observatory guided our approach;

– G: This corresponds to the interpretation phase and the decision phase in the decision-making process. We believe that this phase must be carried out by the decision-maker in the same way that it has determined and clarified the decision-making problem at the start of the process.

Transforming this process to our case study, we believe that problem posed here is "the performance of the Cameroonian educational system". This performance requires a good mastery of the educational environment. DOES provides decision maker with reliable and up-to-date information about the study area. - It is important to note here that we present the result of the implementation and not the design phase. This is why we will not discuss the technical aspect of the process of gathering and putting information in place. We simply highlight the results of the implementation phase. - It is a question of presenting how the decision-maker uses the observatory to optimize decisions regarding the different situations on the ground in order to achieve the objectives set. Objective decisions were taken on the basis of the data presented by the dynamic observatory applied to the education system.

The figures below present respectively the list of teachers with at least 10 years' seniority in the current post (1519 teachers concerned in the Center region only), the national distribution of teachers throughout the country and the list of teachers in office but who have exceeded the retirement age set at the Ministry of Secondary Education at the age of 60. There are 148 teachers in a single department, that of Mfoundi in the Central Region.

List of teachers at least 10 years in the current position

Total : 1519 teachers

N°	Name and first name	Matricul	Date of birth	Seniority	School
1		352636 F	1955-04-21	16	
2		598936 G	1969-07-08	16	Lycée de Kokodo
3		561122 J	1963-01-15	16	Lycée Ebebda
4		673385 K	1977-07-04	16	Administration
5		655163 I	1978-04-18	16	Lycée Elig-Mfomo
6		584403 D	1972-08-31	16	Lycée Elig-Mfomo
7		362612 C	1962-10-26	16	CES de Nkom

Figure 3 : List of teachers at least 10 years in the current position

Total : 148 teachers			
Name and first name	Matricule	Date of birth	Age
	352636 F	1955-04-21	61
	127381-M	1955-09-07	61
	082283-M	1955-10-14	61
	143798 K	1955-05-18	61
	116934 A	1955-09-14	61

Figure 4 : Teachers who have reached the retirement age but still work in a specific region

The crossing of these previous tables and graphs allowed the minister in charge of secondary education to redeploy the staff of his ministerial department in compliance with the application of the texts in force. Indeed, the texts provide that a teacher with at least three (3) continuous years in the same institution is likely to be transferred for efficiency purposes. These figures present a real and contradictory situation on the ground. Teachers who accumulate ten or more years at the same post. The risk for this kind of staff is the installation of the routine resulting in the reduction of the efficiency curve. For performance reasons, staff turnover must be permanent and steady. It should not be too fast or too late.

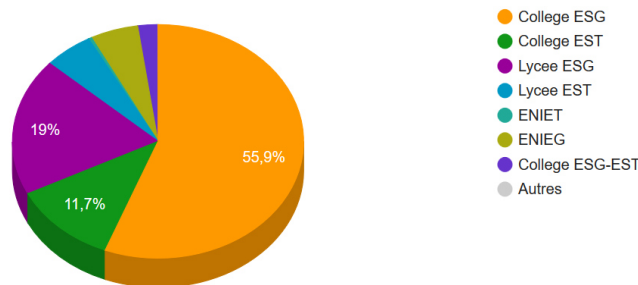


Figure 5 : Distribution of types of establishments in the Central Region

While the GESP emphasizes the professionalization of teaching, the following figure (Figure 5) indicates that in the reference region of the Center, general secondary schools (ESG secondary schools and colleges) are the most numerous.

However, in order to achieve the objective of professionalization, emphasis must be placed on the pathways leading to a profession, such as the definition of the word "professionalization" in its general use: "the action which makes it possible to claim the mastery of" A profession or a professional activity "(Rey, 2000: 2958). Similarly, a few years ago, as cited by Henry & Bournel (2014, p.35), the French commission explained that the "Professionalization of teaching" aims to give "a broad definition of professionalization" "A training which makes it suitable to carry out a determined economic activity" (Vincens & Chirache, 1992, p.2). It is with this objective that the Minister of Secondary Education launched the school year 2016/2017 under the theme:

"Intensification of the professionalization of the teachings for a training more compatible with the socio-economic demand" (EyebeEyebe, 2016, P.3).

Discussions

Observe: Why? How?

Guichard (1998, p.46) states that "Developing observation means developing intelligence". In the same sense, Rouet (2016, pp. 5-10) describes the characteristics of observation:

- Observation is not a mere look at what surrounds us. It is a question of describing what one sees and what one thinks one sees. "It is by observing that one learns to observe";
- Observation is always based on a reference model which for us is the roadmap which is the Strategy Document for Growth and Employment (GESP), which describes the objectives to be achieved as well as the indicators to be taken as references during observation;
- Visual sense and substitute documents (slides, charts, charts, maps ...) are essential in observation when direct observation on the ground is difficult or impossible. Here, the observatory and its dashboards act as an interface between the field and the decision-maker. The latter can observe the actual situation prevailing in the field.

Observe to evaluate

"The analysis of the elements of the objectives to be attained leads the decision-maker to come up with an objective approach" (AE-EPS, 2015, p.15) This approach is accompanied by justifications based on indicators defined in the roadmap and explained in Developer of the information system "to encourage objective evaluations of the results" (Evain, Lebrun, &Raybaud, 2013, p.6). Chalaye (2011, pp. 95-107), however, pointed out some of the difficulties presented by the observation. Author explains that in order to respond to the information needs of decision-makers, quantitative approaches based on databases are generally used, and in this context, dashboards are developed such as the dynamic observatory applied to the education system , these dashboards usually present only a few indicators that do not allow to fully appreciate the characteristics and performances of a system like that of the vast domain that is education but at least, They provide a clear idea of the indicators chosen and presented. To optimize the results, author recommends that it is essential to ensure the cooperation, the sincerity of those who collect the data.

Observe for better planning

Being able to observe not only allows you to better know your surroundings but also to better plan the actions to be carried out. Malina&Selto (2001, pp. 47-90) recommend that observation should influence the action of the decision-maker who plans his actions on the basis of a concrete observation of the variations in the indicators. Its actions are inspired by real needs on the ground because the observation initiates the implementation of an intervention process advocated by the roadmap and the objectives to be achieved as shown in the diagram below.

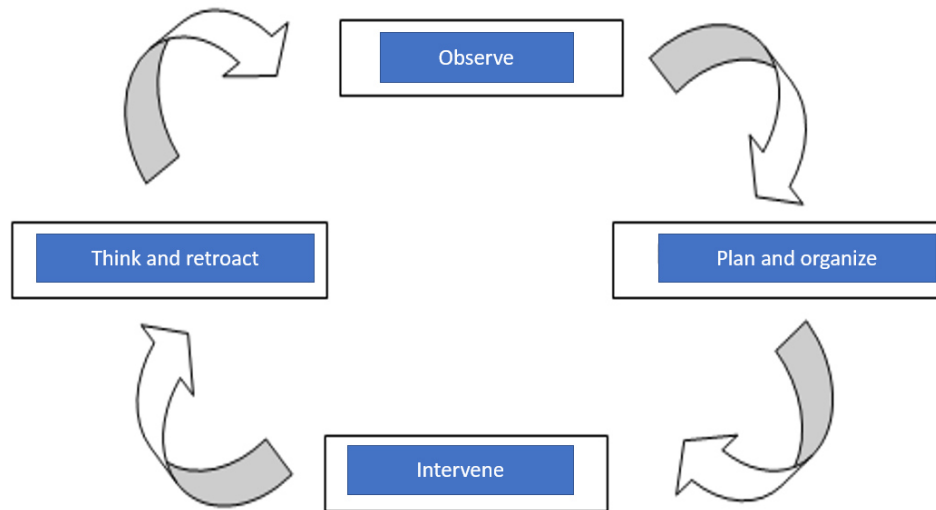


Figure 6 : Planning from observation

Conclusion and perspectives

Observation is a spontaneous and natural activity in humans. It is generally used to better understand its environment or to understand phenomena that make us perplexed. Tools such as grids and dashboards, maps or graphs allow to report objective facts and limit interpretations. They help guide the observer's interventions in order to better guide his decisions. To observe is to seek to answer a question by a search based on a hypothesis. Once the diagnosis is made by the decision-maker, he knows which indicators should be observed. This allows it to organize itself with method and rigor by defining the criteria and orienting its analysis towards the objectives to be achieved. However, in order for observation to be effective, it is essential to accompany it and develop the scientific attitude which consists of objectivity and lack of judgment.

Observation requires investment time. Observer must indeed take the time to observe the phenomena, their evolutions, their variations, their limits, their assets, and so on. These observations will make it possible to know the environment in order to better understand the issues at stake. Data collected are used to plan, structure and organize activities adapted to this environment. Observer discovers that it is much easier to make

decisions when one is mastering one's environment. The planning of his observations with more precise objectives, defined in advance allows him to better see the needs, the faults of the observed group. The subjects of our case study admit that this new approach greatly changes the way in which decisions are made. He is no longer the one who brings, proposes, and even imposes his ideas to meet a need, to solve a problem posed, but now he observes and seeks to understand the interests and needs of his present environment. This change makes it possible to be attentive to each of the indicators, sensitive to the variations of these. In fact, the decision-maker is no longer at the center of the decision-making process but rather the environment. However, in the current state of the ODSE, the decision-maker cannot anticipate decisions on the basis of projections based on predictive analyzes, but these would be indispensable for better anticipation in the evolution of indicators and adaptability Rapidly changing environment. This is a point of reflection which it is desirable to explore.

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