From Smart Data LifeCycle to Smart Simulation Project LifeCycle: The Case of the Voluntary Departure Program of Civil Servants in Morocco

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Abstract: This paper investigates the potential of discrete event simulation for the analysis and evaluation of public strategies and policies and discusses the opportunities offered by the use of a simulation project lifecycle. Following this cycle, we evaluate a public policy use case, the voluntary departure operation initiated in Morocco in 2005, and analyses the success rate of this operation, as well as its impact on the Moroccan pension fund, and this for the period from 2005 to 2025. The results of this simulation highlighted, as already indicated in the Court of Auditors' reports, the irrelevance of this operation, particularly from a financial point of view.

Key words: Discrete event simulation, lifecycle, voluntary departure, simulation, smart DLC, simulation project lifecycle, smart data lifecycle, strategy and public policy.

1. Introduction

Simulation has an important role in systems modelling when the direct or analytic solution is too complex [1]–[4]. Simulations use can be useful for studying engineering and operational issues without directly involving the real system [5] or in the case where the cost of the operation to be simulated is very high. Among the application areas of discrete event simulation, we can cite: air traffic, rail, road, production systems, supply chain, patient journey and hospital care flow, inventory management, telecommunication, and waiting systems. [3], [4], [6]–[10]. Its application has been also investigated for business process modelling [11].

Simulation is a modelling technique that makes it possible to build an abstraction or a model of a real system, then to experiment on this model, and to evolve it [2], often in time. It is a technical tool to assist decision- making that can be used for two purposes:

- Study an existing system to better understand it, predict certain aspects of its behaviour, and compare different operation policies, modification or improvement of the system.
- Build a new system, study and compare the chances of success and the risks of failure of various possible construction or operational processes, possibly drawing on existing similar systems.

In this article, we will focus on discrete event simulation for systems whose states change at separate instants in time [12]. The models generally used in the simulation can be logical and/or mathematical [12].

They can also be deterministic or mostly stochastic [6]. The model used is deterministic when it does not involve hazard, and all data in the simulation have values, in this case, it is a scenario [10]. It is stochastic when the problem has a random character and uses probability distributions [8] according to statistical distributions, in which case some simulation data are calculated according to random numbers that come from adapted generators.

Morocco launched a voluntary early retirement program for civil service in 2005 [13] in return for a financial incentive and a pension based on service years.

The objectives of the voluntary departure operation are as following:

- Encourage departing public employees to create businesses;
- Keep the payroll at a manageable level.

At that time, Public Sectors Modernization Ministry made available to employees in the public administration a dedicated website for this operation allowing the calculation of voluntary severance pay and pension's payment. But, in this paper, we propose to use discrete event simulation to study the relevance and effectiveness of this operation over time.

Indeed, the Moroccan court of auditors showed in [14] that if the voluntary departure operation had initially allowed the reduction in the number and weight of the wage bill, its results have not been consolidated. It was limited to a one-off measure of lightening of the workforce, thus losing its ambition to be part of the long term through the establishment of the bases of human resources management. In addition, this operation helped to precipitate the collapse of the pension system, which has given rise, in recent years, to further reforms, sometimes painful for the members of the system.

We try, in the following of this paper to prove this financially through a simulation study showing the impact of this operation on the pension fund, this being inspired by the proposed simulation project lifecycle. Data used in this study are inspired by the Moroccan civil service system.

Given the risk that a poorly conducted simulation may generate, a simulation methodology is essential to carry out all the steps of such a project. These stages constitute the Simulation Project LifeCycle called SPLC. To make this cycle more efficient and effective, we propose to use an existing lifecycle called Smart DLC [15] to adapt it to the simulation context. The lifecycle followed in this article is Smart SPLC.

This article is organized into seven sections. Section 2 presents the Simulation Project LifeCycle (SPLC). Section 3 introduces the Smart Data LifeCycle (Smart DLC) as a process cartography. Section 4 presents our proposal cycle named Simulation Project Lifecycle as a process cartography. Section 5 conducts a case study in order to analyze the relevance of the voluntary departure program of the Moroccan civil service. Section 6 discusses the case study results. Section 7 concludes and gives some perspectives.

2. Simulation Project Lifecycle

In this section, we propose the simulation project lifecycle (SPLC) representation.

System Engineering approach is generally based on a stages chronology, called a cycle development or lifecycle [16].

According to the literature review, there are many proposals for the simulation project lifecycle. We used the most cited steps in the majority of these proposals to provide the cycle described in Figure 1.

The simulation methodology followed during this lifecycle is:

1) Problem **analysis and formulation** [1]–[3], [6], [8], [9], [16]–[19]

- Define study limits;
- Define the objectives which must be answered;
- Define the measured indicators.

2) System **definition** [6], [16]

- Define the entities or system elements, and their attributes or characteristics ;
- Define system elements or activities interactions.

3) Data Collection [1], [3], [4], [8], [9], [16], [18]

- Collect simulation data, and determine their statistical distributions when they are stochastic;
- Specify the simulation hypotheses and parameters for different scenarios and policies to be studied.

4) Modelling [1]–[4], [6], [8]–[10], [10], [16], [18]

- Construct a reality abstraction;
- Construct a mathematical, logical and/or verbal representation of the studied real system.

5) Model programming or implementation [2]–[4], [6], [16], [18]

- Either use a standard programming language: Fortran, C, Pascal, Java, VB, Python, etc.
- Or use a specialized language: Simula, GPSS, SimScript, SLAM II, ARENA [20], R, etc.

6) Program validation [2], [3], [16]

After the program has been finalized, if the program does not meet the objectives set, go back to step 5.

7) Model validation [1]–[3], [6], [8], [16]

In the case where the simulation results are not satisfactory, the model can be questioned, and return in this case to step 4.

8) Experimentation [1]–[3], [6], [8], [16], [18]

- Specify the number of experiments to perform to obtain reliable results;
- Specify for each new scenario or policy to experiment with data, the study rules, and parameters. For this, it will be necessary to return to step 3.

9) Results Analysis and **decision making** [1], [2], [2], [3], [6], [8], [9], [16]

- Results Reporting ;
- Analyse and interpret the results obtained for the assumptions and simulation context;
- List proposals and potential decisions.

10) Documentation [3], [6]

- Simulation project documentation ;
- Conclusions capitalization, analysis, and recommendations ;
- Model documentation and simulation program for possible reuse.

3. Data LifeCycle: Smart DLC as a Process Cartography

In this section, we present an existing data lifecycle named Smart DLC [15], [21], [22]. We justify the choice of this lifecycle to be the model adapted to the simulation project lifecycle.

A Data LifeCycle (DLC) has been defined in [23]–[26] by all the implemented phases to manage data from its creation to its destruction.

Several DLC models have been proposed in the literature. We choose the Smart DLC [15] which is interested not only in the technical aspect of data lifecycle but also in the management part which is a key factor of the success of the technique. Smart DLC is modeled in process cartography, according to ISO 9001: 2015 standard [27] and the CIGREF directives [28]. The process approach allows stakeholders and processes not to operate in isolation. **Smart DLC** begins with the company requirements definition related to data management. It is a strategic view of the business from which it defines the goals to be achieved in terms of data managing in order to improve its business processes. The company is constantly changing its data management policy and considering the data lifecycle as a urbanized process cartography that helps it better manage these changes and thus improve the interdependence of its processes. This urbanization approach in process cartography of the DLC aims to support data management at a better cost/quality and time.

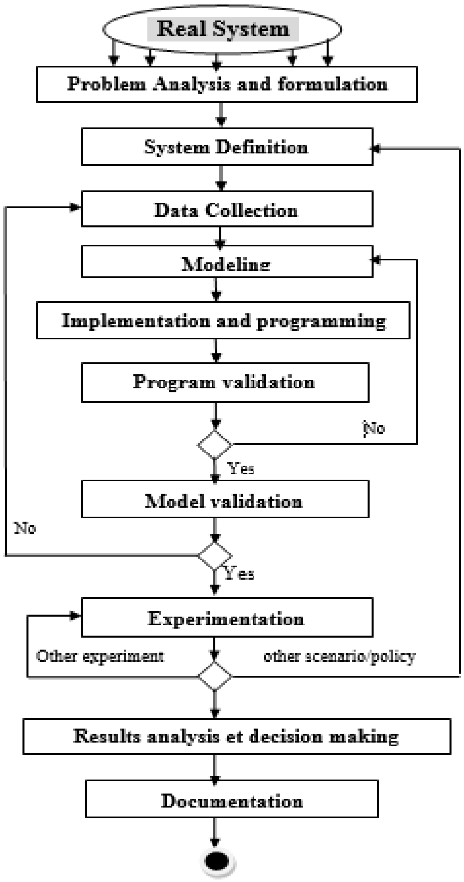

Fig. 1. Simulation Project LifeCycle (SPLC).

Smart DLC is modelled in Figure 2 as process cartography with three types of processes:

- **Management processes:** They participate in the overall organization, the policy and strategies development, the objectives deployment and all the necessary checks. These are the Planning and Management processes [19].
- **Realization processes:** They group together all processes that are directly related to data. They transform input data into output data by adding value. These are the processes of: collection, integration, filtering, enrichment, access, analysis, visualization, archiving, and destruction.
- **Support processes:** They provide the resources necessary for the proper functioning of the management and implementation processes. These are storage, quality, and security processes.

4. Simulation Project Lifecycle as a Process Cartography

In this section, we illustrate the convergence points between the Smart DLC and the SPLC. To do this, we develop a functional correspondence matrix between the phases or processes of the two lifecycles in order to show the motivation behind the adaptation of SPLC by Smart DLC.

4.1. Motivation

The advantage of considering the simulation project lifecycle as process cartography like Smart DLC, is to take advantage of its urbanization by defining, from the beginning, the missions of each party [29], [30]. Also, this way of doing things, inspired by Smart DLC, will allow this cycle to evolve so that it supports efficiently simulation missions for complex phenomena, especially those whose transformation takes place over time. This cartography takes into account the existing situation and makes it possible to better anticipate the internal or external evolutions or constraints impacting the simulation project lifecycle. Representing simulation project lifecycle in urbanized process cartography facilitates its transformation and change. This change may affect the input parameters or the simulation scenario. Functional correspondence matrix between SPLC and Smart DLC.

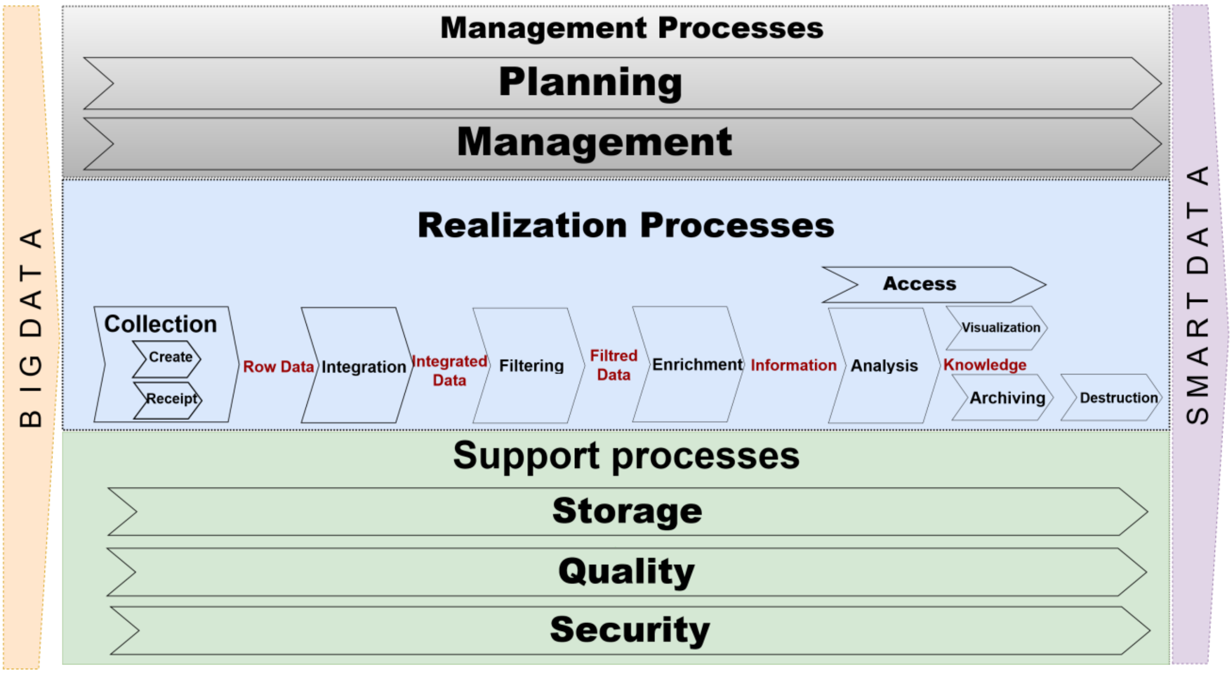

Fig. 1. Smart DLC [15]

Table 1. Functional Correspondence Matrix between SPLC and Smart DLC

SPLC Steps / Smart DLC processes	Problem analysis and formulation	System definition	Data Collection	Modelling	Model implementation	Program validation	Model validation	Experimentation	Results analysis and decision making	Documentation
Planning	✓	✓								
Management				✓		✓	✓		✓	✓
Collection			✓							
Integration				✓						
Filtering				✓						
Enrichment				✓						
Analysis					✓					
Access								✓		
Visualization									✓	
Archiving										
Destruction										
Storage										
Quality										
Security										

The complexity of a simulation project has consequences on the costs, duration, and risks for model generation, implementation and validation. It also impacts decision-making at the strategic level. To gradually master the evolution of a simulation project, and to reduce costs, a response is provided by the process urbanization that Smart DLC has brought.

4.2. Functional Correspondence between Smart DLC and SPLC

In order to identify the convergence points between SPLC and Smart DLC, a functional correspondence matrix between the two cycles has been developed. The checked boxes represent the correspondence between the Smart DLC processes and the SPLC steps from a functional point of view. For example, the Smart DLC planning process corresponds to the Problem analysis and formulation and the system definition SPLC processes. Some Smart DLC processes correspond to several SPLC processes such as the management process that corresponds to the modelling, model and program validation, results analysis and decision making processes, as well as SPLC Cycle Documentation. Table 1 shows the functional correspondence matrix between SPLC and Smart DLC. We were able to build this matrix from the SPLC steps described in section 2 and those from Smart DLC described in section 3.

5. Case Study

In this section, we use the proposed simulation project lifecycle (Smart SPLC) in a practical implementation about a simulation project of "the voluntary departure program for the Moroccan civil service".

To do this, we will run this simulation following the proposed cycle by looking at each process of the model.

We are trying to conduct the project simulation related to the of voluntary departure program for the Moroccan civil service following the proposed Smart SPLC cycle by describing what has been done in each process of this cycle. The objective of this project being, as already mentioned, to study the relevance of the voluntary departure operation, with a little more than 10 years of decline after its adoption.

5.1. Management Processes

5.1.1. Planning

In this process, the planning team defines the boundaries of the study. In this case, it assumes that the start year of the study, the year of voluntary departure, is 2005 and that the system to be simulated, a sample inspired by the real Moroccan system, namely the Moroccan civil service, is a pension fund consisting of 10,000 employees. Retirement is still 60 years, in this period, and the number of pensioners in this year (2005) is 1000 and the current reserve of the fund is 250 Mdhs (Million dirhams that is the official monetary currency of Morocco). The normal retirement pension at age 60 (PR) is calculated as follows:

$$PR = \frac{NYW * 2.5 * LSBR}{100}$$

With:

- **NYW** : Number of years worked
- **LSBR** : Last Salary Before Retirement

It is in this process that the indicators to be measured for a given year are also defined. In our case, and annually:

- The total number of employee members;
- The total number of retirees;
- The total amount of employee contributions (TAEC);
- The total amount of retirees' pensions (TARP);

- The total amount of the fund's reserve ;
- The number of new retirees for this year, which will be counted in the total number of retirees from the following year;
- The number of recruits for this year, which will be counted in the total number of employees in the following year.

The study will cover the period from 2005 to 2025.

It is also in this process that the plans of all realization processes are defined (collection plan, integration plan, filtering plan, enrichment plan, analysis plan, access plan, visualization plan, archiving plan, and destruction plan). For example, the collection plan for this study consists of: data sources definition, update frequency, data cross-referencing, data reliability, and data restriction.

Management

The system definition, namely, its entities (employees, retirees, recruits...) and their attributes (current age, current salary, age at hiring ...), as well as the assumptions and parameters of the simulation for the different scenarios and policies to be studied are specified in this process. In this case, and in order to study the relevance of this voluntary departure operation, we propose to consider the following two policies:

- **Policy 1**: Apply the voluntary departure from December 2005 for employees aged between 40 and 55 with a minimum age of 18 years, and wishing to benefit from early retirement. Up to 1 employee out of 5 interested and selected for voluntary departure. An employee, wishing to leave and to whom the departure has been granted, will benefit from:
- A departure incentive, of an amount equal to:

LSBR *2 * NYW (capped at 18 years)

- A **retirement** pension calculated as follows:

$$PR = \frac{NYW * 2 * LSBR}{100}$$

- **Policy 2**: Do not apply voluntary departure. And in this case, inject a grant, equivalent to the severance pay of **employees** who might have been interested and retained for this operation, in the pension fund's reserve, and this in December 2005.

5.2. Realization Processes

5.2.1. Collection

In this process, we have identified all data we have found useful in this project. To do this, we drew on the data distribution relating to public service employees, including data from the Budget Department, the General Directorate of Local Government and the Public Enterprises and Privatization Department.

5.2.2. Integration

In the previous process, we received data in a raw state. The purpose of the integration process is to provide a consistent data model from multiple independent, distributed and heterogeneous information sources to facilitate data access and querying. These data are of the stochastic (random) type, such as age at recruitment. Hence, the need to use, in this process, a pseudorandom number generator.

5.2.3. Filtering

In this process, only data that will be used later by the simulation project are maintained, in particular, those relating to:

- The employees' current age;

- The employees' Current salary;
- age at hiring;
- Salary for hiring;
- Contribution of members to the pension fund, according to the salary;

5.2.4. Enrichment

System modelling starts from this process, to construct a real abstraction, and to design the mathematical model. In our use case, this process is responsible for defining the different input models. These parameters have been modelled, for the most part, as tabulated distributions and in each interval the function is uniform.

Here is the mathematical model of each parameter:

- **Current net salary**: Salary **distribution** for the 10,000 employees considered in the study.

Table 2. Distribution of the Current Net Salary

Actual salary(dh)	[30.000 40.000]	[20.000 30.000]	[15.000 20.000]	[10.000 15.000]	[7.500 10.000]	[5.000 7.500]	[3.000 5.000]
Frequency (%)	5	10	10	15	20	20	20

- **Employees actual age:** Employees current age distribution

Table 3. Actual Age Distribution

Actual age (years)	[51-60]	[41-50]	[31-40]	[20-30]
Frequency (%)	40	30	15	15

- **Recruitments:** In this study, while considering an initial sample of 10,000 employees, it is assumed that between 250 and 400 **new** employees are recruited each year according to a uniform law.
- **Age at hiring:** Age **distribution** for new hires.

Table 4. Age at Hiring DISTRIBUTION

Age at hiring (years)	[20-22]	[23 - 24]	[25 - 28]	[29 - 32]	[33 - 35]	[36 - 40]
Frequency (%)	5	20	25	25	20	5

- **Net salary at hiring**: The salary of employees is distributed according to the table below:

Table 5. Salary at Hiring Distribution

Salary at hiring (dh)	[24.000-32.000]	[16.000-24.000]	[12.000-16.000]	[8.000-12.000]	[6.000-8.000]	[4.000-6.000]	[2.400-4.000]
Frequency (%)	5	5	10	20	20	20	20

- **Progress:** In **this** simulation, we assume that for the employees' advancement, salaries are increased by 5% every 5 years.
- **Contribution to salary:** the contribution rate distribution to the pension fund by salary bracket.

Table 6. Contribution Distribution

Salary bracket (dh)	<= 5.000	5.000 to 7.000	7.000 to 10.000	10.000 to 40.000
Contribution rate (%)	5	6	7	10

5.2.5. Analysis

The model development and implementation are carried out in this process. First, the model is built, in our case, it is the modelling of the Moroccan pension fund. We used UML [31] to design the program that will be run to simulate the pension fund.

After modelling, an implementation is performed using a programming language. To do this, we opted for an object-oriented programming language that is Java to implement our model. This choice was made to master all parts of the code and also to take advantage of the object-oriented approach including the principle of maintenance and scalability, such as adding other features without redoing all programming.

The program that we developed starts each simulation with an initialization, this one is done with respect to the policy to be executed. This initialization consists of generating 10,000 employees stored in memory, it also generates the 1000 retirees, as well as the employees whose request of voluntary departure was accepted (about one out of five employees of those aged between 40 and 55 years old and having seniority 18 years), in the policy 1 case for example. After this simulation initialization, the simulation program updates all the pension fund data and calculates the different measured indicators values, with a one-year frequency (December of each year), this on a period of 20 years, from 2005 to 2025.

5.2.6. Access

This process provides users with access to simulation results for possible use.

5.2.7. Visualization

Simulation results presentation is done in this process. This is where the simulation results are analyzed and decisions are made. In this study, the system will be explored and the results periodically visualized from one end of the year to the next. For both policies, we initially have:

- 10.000 employees ;
- 1000 retirees;
- Fund reserve is 250 Mdhs (equivalent to 25 Million $).

In addition, our simulation generated according to the policy followed other values for each year, notably:

- 720 voluntary departures in 2005 for the policy 1
- A subsidy of an amount equivalent to that of the voluntary departure bonus if political 1, of 318 Mdhs (equivalent to 31, 8 Million $) which will be injected in 2005 to the pension reserve fund for policy 2.

Since we are interested in the pension fund reserve, we have seen fit to follow its evolution over the years. Fig. 3 illustrates the evolution of the reserve fund for both policies.

The voluntary departure program has, admittedly, allowed a reduction of public employees, at least initially, as shown in tables 1 and 2, but the pension reserve fund will be in deficit in 2025 by 10,301 Mdhs instead of 9.560 Mdhs when the voluntary departure is not applied, thus almost 740 Millions of Dirhams of deficit in more. This is simply due to the increase in the number of residents at the departure time, while in the second case it was assumed that we did not have all these new retirees in 2005 and that in addition, we have injected the amounts of voluntary departure incentive payments into the reserve fund.

Thus, the voluntary departure program for the civil service did not have an interest in the financial aspect, on the contrary, it contributed to an aggravation of the Moroccan pension fund expenses.

The pension fund crisis gave, from 2014, another reform which consisted, among other things, in increasing the retirement age to 63 and thus retaining new and more employees. This is in contradiction with the thesis defended in 2005 to justify the launch of the voluntary departures operation, and which aimed to reduce the employees' number and subsequently the wage bill.

5.2.8. Archiving

This process allows the long-term data storage from different simulations for possible use. The effective lifecycle management proposed for a simulation project (Smart SPLC) includes intelligence not only at the level of data collected on the model and scenarios, but also the archiving policy based on specific parameters or business rules such as the data age or the last date of use. It can also help the planning team to develop an automated hierarchical storage strategy to archive dormant data in a data warehouse, improving its overall performance.

In our case, we can archive for possible use in new studies dealing with this recurring and permanent retirement problem.

5.2.9. Destruction

This process consists of deleting data related to a simulation project when it becomes useless or without added value. Although, at first glance, the advantage of this process does not appear, it becomes essential when there is a lot of data and a lot of results relating to different simulation scenarios, which are not necessarily all to be kept, because storage has a cost. This operation can be used also for:

- Remove too many experiments during the experimental phase to keep only the synthesis or the most relevant experiences.
- Remove too many policies that have been studied, whose interest has not been confirmed, or at least some details about these policies, to keep only syntheses.

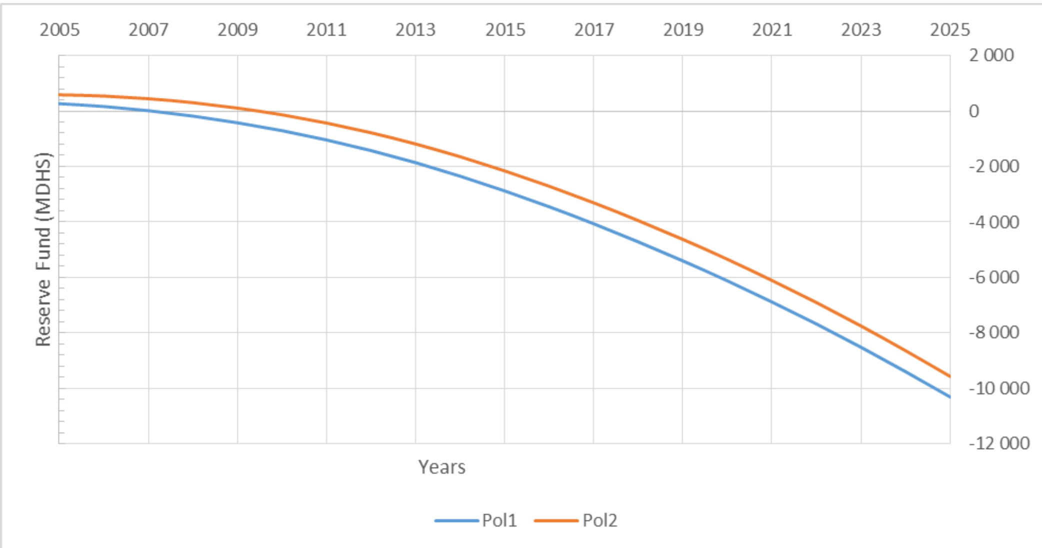

Fig. 3. Evolution of the reserve fund for both policies from 2005 to 2025

5.3. Support Processes

Processes belonging to this type are transversal, that is to say, that they concern all the other processes in the simulation project lifecycle and in order to provide storage means, quality, and security means.

5.3.1. Storage

Storage is about all the other processes of the simulation project lifecycle, and it allows data to be stored throughout the cycle for continuous data traceability in each process and to know its status.

5.3.2. Quality

Quality control is done in this process. This involves simulation program validation as well as the proposed model, by the data quality generated via the use of a suitable pseudo-random number generator, as well as by the simulation parameters validation used at the experimentation phase.

5.3.3. Security

This simulation project lifecycle process describes the implementation of data simulation security and the means deployed for it, as well as the profiles in the management and confidentiality of the data.

This process concerns three essential security parameters that we explained in [24]: data integrity, access control, and privacy.

In some cases where the simulation data are of a secret nature, these could be collected along a secure transmission channel (encryption) to verify the reliability of these data, which contributes, on the one hand, to the reliability data verification since they are received from a secure source and on the other hand allows only authorized entities to provide the simulation data.

The authentication of the simulation actors of the project will also strengthen the aspect of security.

The simulation data collected may contain personal data which constitutes a threat to privacy. To remain anonymous privacy, masking of personal data could be done in this process. This is, moreover, what we did in this study because the data needed for the calculations did not disclose any personal data on the identity of employees and retirees.

6. Synthesis and Discussion

The pension fund simulation, following the voluntary departure program of the Moroccan civil service, carried out in this section was conducted resulting in the proposed Smart SPLC cycle, inspired by Smart DLC data lifecycle, which proposed a new simulation project development cycle vision in the form of process cartography. This allowed, on the one hand, an extension of the Smart DLC data cycle to the SPLC simulation cycle, which gave the Smart SPLC, and on the other hand, an application of a simulation case study with discrete events.

Indeed, SPLC is a series of stages articulated on the activities to be performed at the operational level and from a technical point of view without highlighting the organization of the simulation project in terms of process management. In the Smart SPLC cycle for the simulation of complex systems, the strategic and managerial aspects are of paramount importance. Smart SPLC modelled in process cartography begins with a simulation project requirements definition as well as the parameters of the scenarios to be simulated. It is a strategic vision from which the objectives to be achieved by the simulation project are determined by the top management. Following this vision, the planning team defines all the plans for the other processes, the project boundaries and the indicators to be measured. In addition, Smart SPLC is interested in simulation data security and privacy. Similarly, it provides for pre-processing simulation data before modelling, and also considers the destruction of archived simulation project data that becomes obsolete and without added value.

Smart SPLC inspired by Smart DLC thus enriches the SPLC to make its organization into three types of processes: management, realization, and support according to ISO 9001: 2015 [27] and CIGREF [28] where a standardized framework that normalizes the simulation project running. Next, Smart SPLC places importance not only on the technical processes that have a direct impact on the simulation data but also on the managerial ones that determine how the realization processes should work. This importance is also given to the support processes that accompany the realization processes in the accomplishment of their missions.

The pension fund simulation, following the voluntary departure program of the Moroccan civil service of 2005, finally confirmed, and this by projecting on the future years, which was also reported in the report of the court of accounts Moroccan [14]. This report considers that the voluntary departure operation had certainly reduced, even at the beginning, the number of employees and the weight of the payroll, but the number of pensioners increased by one suddenly precipitated the crisis of the pension fund.

Our simulation dealt with this issue in order to study the impact of this operation on the Moroccan pension fund. And we were surprised by the results, because this program, which temporarily reduced the payroll, worsened, from one year to the next, the state of the pension fund. Admittedly, this operation has led to a reduction in the workforce immediately but not for the long term since the difference in staffing between the two policies, towards the end of the simulated period, is very low because the employees number passes, in 2025, from 8408 employees if we don't apply the departure program to 8355 employees if the voluntary departure is applied, a slight difference of just 53 employees. The reserve fund will be deficit of 10.301 Mdhs when the voluntary departure is applied, instead of being deficit of only 9.560 Mdhs when the voluntary departure is not applied, that is almost 740 Million dirhams of deficit of more. This is mainly due to the pensioners' provision, whose number has greatly increased following the voluntary departure operation. Also, this reserve becomes deficit as of the year 2008 when the voluntary departure is applied instead of being it until the year 2010 in case of non-application of this operation. Thus, the voluntary departure program of the public service did not have the expected interest in the financial aspect. This has been confirmed since 2014 by a new pension reform that has been initiated and whose main directive is to postpone the retirement age, and therefore retain more people and thus do the opposite of what has been done in 2005. Indeed, the goal in 2005 was to reduce the wage bill, but this goal was achieved only momentarily and not over time, as long as the trend of the wage bill is to regain the GDP rate (Gross Domestic Product) which it was in 2005 from 2020, according to the report on the Moroccan civil service [14].

So, we think that the operation of voluntary departure was not very relevant, at least by itself. Other projects had to follow (overhaul of the remuneration system, development of a continuous training strategy, etc.). And even the advantage expected by the Moroccan state with the operation "Intilaka" (Launch) which was intended to boost investment has not been, either, to the height except, perhaps, for investments in real estate, which, with the help of the economic crisis in 2008, contributed to soaring prices in the real estate sector in Morocco.

Conclusion and perspectives

In this article, we used two scientific notions to answer a financial question:

- A data lifecycle from the literature called Smart DLC [15] that tracks the data from their creation to their destruction. It is modelled in the form of cartography of three types of processes, namely, management, realization and support processes, following the standard ISO 9001: 2015 [27] and the CIGREF framework [28].
- A simulation project lifecycle SPLC that we have proposed in this article. This cycle describes all the steps to simulate a complex system from the analysis and formulation of the problem to its documentation.

We presented the motivations for adopting Smart DLC to a simulation project lifecycle through a new cycle called Smart SPLC. We have validated the proposed lifecycle by a case study on the voluntary departure program of the Moroccan civil service.

The results analysis of the simulation, according to Smart SPLC, highlighted a doubt about the merits of this operation or strategy from a financial point of view because the reserve of the pension fund in 2025 would have a deficit of 10,301 Mdhs instead of being in deficit of 9.560 Mdhs when the voluntary departure is not applied, so almost 740 million dirhams of deficit more. Also, this reserve becomes deficit as of the year 2008 when the voluntary departure is applied instead of being it until the year 2010 in case of non-application of this operation. Moreover, the doubt about the benefit of this approach was confirmed in a report of the Moroccan court of accounts [14] and also by the last crisis of the pension fund which gave, in 2014 , new and recent reform of this fund which amounts to doing the reverse of what was done in 2005 to increase the retirement age, but also the contributions rate of members, as well as a decline of pensions calculation at retirement.

Simulation thus makes it possible to analyze and evaluate public strategies and policies, over years, and by projecting themselves in the future, which makes it possible to highlight the impact of these on the financial and social plan.

In the same context, and in relation to the same themes, the simulation and the pension problem, we propose to carry out a new simulation study to analyze the relevance of the parametric reform of the pension fund, initiated in 2014, and which is based on the readjustment of 3 parameters:

- Extension of the retirement age to 63, at the rate of 6 months per year starting in 2018;
- Increase the members' contribution rate, which was 10%, by 1% each year, to reach 14% of salary in January 2019;
- Regression of the retirement pension calculated no longer based on the last salary, but on the average salary of the last 8 years, and with a weighting of 2 points, instead of 2.5, per year worked.

Therefore, we propose to do a simulation study to analyze, in time, the relevance and durability of this new strategy, knowing that in some reports on the public service, we are already talking about the limit of this reform, and that the problem will be again posited by 2021, 2022. Compared to the same subject, we also propose to make other simulation studies considering new variations for the 3 previous parameters.

We end by pointing out that the interest of the simulation could be even more important if the studies are conducted before the application of certain public and social policies, this would make it possible, and in time, to make informed and better thought out strategic choices. Also, and in the case study, the simulation concerns a very simplified image of the real system, namely the Moroccan civil service, but nevertheless that it sheds light on the analyses and studies that simulation allows to carry out on potentially complex systems.

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