FROM ASSESSMENT EX POST TO EX ANTE ESTIMATES: RISKS ANALYSIS OF AGRICULTURAL DEVELOPMENT PROJECTS IN ALGERIA

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Received: 02/06/2019 / **Accepted**: 09/01/2020 / **Published**: 07/05/2020
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ABSTRACT

Today, investors want a larger visible on the validity of time limits and potential financial losses. The study concerns the risk analysis of agricultural projects. On a sample of project achieving enterprises working in area, belonging to three zones: mountain, steppe, and desert, a qualitative analysis made to assess the severity of the causes of risks and a quantitative analysis made on several simulations during the achievement of the project by random edition (type Monte Carlo simulation leading to cumulated probability distributions, it will result in a classification of potential risks and an assessment of contingency reserves for risks (time limits, cost) for parts of **works** of the project. This article concludes that the formalization and use of the risk practice the development project increase the predictability of results and enrich the knowledge of participants.

KEY WORDS: Agricultural project risk, Monte Carlo, classification of risks, contingency reserves

JEL CLASSIFICATION: Q13 R15

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DE L'ÉVALUATION EX POST AUX ESTIMATIONS EX-ANTE : ANALYSE DES RISQUES DES PROJETS DE MISE EN VALEUR AGRICOLE EN ALGÉRIE

RÉSUMÉ

Aujourd'hui, les investisseurs veulent une plus grande visibilité sur la validité des délais et sur les pertes financières potentielles. L'étude porte sur l'analyse des risques des projets agricoles. Sur un échantillon de projet agricoles de mise en valeur, appartenant à trois zones : montagne, steppe et désert, une analyse qualitative était effectuée pour évaluer la gravité des causes des risques et une analyse quantitative effectuée sur plusieurs simulations de Monte Carlo conduisant à des distributions de probabilités cumulées, il en résultera une classification des risques potentiels et une évaluation des réserves (délais, coûts) pour des parties des travaux du projet. Cet article conclut que la formalisation et l'utilisation de la pratique du risque du projet de développement augmentent la prévisibilité des résultats et enrichissent les connaissances des participants.

MOTS CLÉS : Risque de projet Agricole, Monte Carlo, classification des risques, provision

JEL CLASSIFIATION: Q13 R15

من التقييم إلى التقديرات السابقة:
تحليل مخاطر مشروعات التنمية الزراعية في الجزائر

ملخص

اليوم، يريد المستثمرون رؤية أكبر على صحة الحدود الزمنية والخسائر المالية المحتملة. تتعلق الدراسة بتحليل مخاطر المشروعات الزراعية. فيما يلي عينة من المشاريع في منطقة الجبال والسهوب والصحراء، وهو تحليل نوعي أجري لتقييم شدة أسباب المخاطر والتحليل الكمي الذي أجري على العديد من عمليات المحاكاة أثناء إنجاز المشروع من قبل إصدار عشوائي (نوع محاكاة مونت كارلو). والنتيجة هي تصنيف المخاطر المحتملة وتقييم احتياطيات الطوارئ للمخاطر (الحدود الزمنية، التكلفة) لأجزاء من المشروع. ممارسة المخاطر للمشروعات والتوصيات المتعلقة بالإجراءات وأفضل الممارسات لحل المشاكل البيئية والتقنية وعدم اليقين ، واستخدام احتياطي الطوارئ (التأخير، التكلفة) كوسيلة للتواصل بين صناع القرار وأصحاب المصلحة. تخلص المقالة إلى أن إضفاء الطابع الرسمي واستخدام ممارسة المخاطر لمشروع التنمية يزيد من إمكانية التنبؤ بالنتائج وإثراء معرفة المشاركين.

كلمات مفتاحية :مخاطرالمشروع الزراعي، مونتكارلو، تصنيف المخاطر،احتياطيات الطوارئ.

صنيف جال: Q13 R15

INTRODUCTION

A study of the projects financed by the World Bank (1974-1988) showed that 63% of the projects out of 1778 had experienced a significant increase in costs (Baloi D., Price A.D.F., 2003). For the same period out of 1,627 completed projects, delays were sometimes 50 to 809% (Lam P.T.I., A., 1999) if a completed project could be abandoned. These figures alone justify a growing need for project risk management.

In recent years, the subjects of risk and uncertainty have attracted the attention of many researchers and practitioners. Some researchers have concluded that even a reasonable or moderate amount of risk management can minimize project risks and increase the level of project success:: (Baloi D., Price ADF, 2003, Zou, PX, Zhang, G., & Wang, J. 2007, Zwikael, & Ahn, M. 2011).

Today the costs of investment plans are heavy and the estimated losses of the agricultural sector are heavier; for this, the public authorities are interested in agricultural risk management as an integral part of agricultural policies (CIRAD 2018); This is why investors and public authorities are questioning the visibility and validity of deadlines and on potential financial losses. They wonder; if shortcomings (shortage of materials, poor estimate, the performance of companies, etc.) are not likely to cause drifts and slippages concerning project objectives, and how can the objectives of the project be permanently ensured about the drifts likely to affect its course?

In this perspective; focusing on the agricultural development policy through the national agricultural and rural development program (PNDAR, 2000) in Algeria, which aims to revitalize the rural environment and agriculture in general. And operationally, increasing productive potential by increasing the area of tree plantations and creating permanent jobs. For that, the program benefited from considerable budgetary resources within the framework of setting up of the national fund of regulation and agricultural development (FNRDA) of the order of nearly 40 billion DA in 2000. (Bessaoud, O.2006). it financed operations such as the construction of water storage basins, the installation of irrigation equipment (drip for example), the digging and rehabilitation of wells, the installation of windbreaks. ..

However, the development has not yielded sufficient results; a high rate of abandoned projects and a considerable number of incomplete projects; and project implementation delays; all this pushes us to study closely the risks inherent in the development of development projects; to avoid drifts that could affect projects.

Therefore, this study aims to eliminate past errors and detect risky situations, allowing better control of development projects. So far, the use of risk management in farmland development projects based on feedback has not been widespread and the majority of risk management practices are limited to the use of tools risk classification (risk matrix; Only simple techniques are used to assess risks).

For it; this research aims to put risk management into practice based on an analysis of 224 development projects; in three agro-ecological zones, mountain, steppe and Sahara. The objectives of this article are as follows; identified; examine and assess the effects of the probable causes of project failure by providing response plans for risk situations, and to quantify the share of risks in reserves on time and costs for better decision-making.

1. REVIEW OF LITERATURE

1.1. Project Risk Management

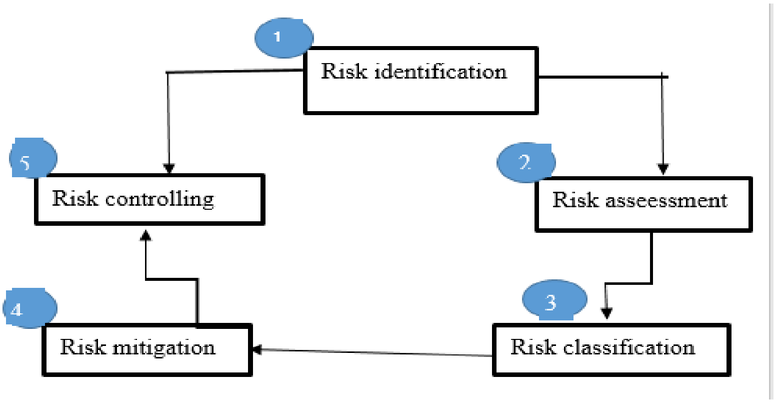
According to the Project Management Institute (PMI) (**PMI. 2013).**, project risk management is an important area and one of the 10 knowledge areas of project management. However, the Association for Project Management (APM) and PMI define project risk management as «a process that allows individual risk events and overall risk to be understood and managed proactively, optimizing success by minimizing threats and maximizing opportunities. » (APM. 2004).

However, the literature shows that there is no standard for defining risk management. (Gray, C. F. et Larson, E. W. 2014) defines risk management as a « specific process deployed to address the many uncertainties of a project ». This preventive process aims to:

- Eliminate threats (adverse events) or minimize their negative impact on the project's ability to meet objectives and obligations.
- Promote opportunities (desirable events) or maximize their positive consequences.

According to (Besner and Hobbs 2012), risk management is an organized practice to effectively manage project risks. Academics and professional organizations generally agree that the project risk management process involves five steps: risk identification, risk assessment, risk classification, risk mitigation, and risk control. Figure 1 (below) illustrates these steps.

Figure 01 : **Project risk management process**



Source :(Firmenich, J., & Firmenich, J. (2017)

The risk management process can be summarized as follows: a first phase that identifies the risks as well as their causes, their effects, a second phase that assesses their probabilities and impact and prioritizes them, a phase of quantification of risk contingencies in terms of cost reserves and delays and a final phase is devoted to the realization of the responses identified to risks, monitoring, and improvement.

1 .2. Different tool and techniques in the project risk management process

Several researchers believe that, despite the many tools available for project risk assessment, the majority of project risk management practices are limited to the use of risk ranking tools. (risk matrix) (Cagliano et al., 2015; Mojtahedi et al., 2010; Osabutey et al.,2013; Whitfield, 2015). Other techniques are less used, such as Monte Carlo Simulations.

Aligned with these results, according to (Hendricks 1996. ; McKay, C. P. 1997,. ; Pertmaster-Risk tutorial 2007). showed that the choice between the methods is dependent on several elements. They found that to estimate a linear wallet and a horizon of time short, the method of the matrix of variance-covariance applies best, seen that it is easy to use. On the other hand, if the wallet to be optimized is not linear and if the horizon of time is relatively big, the methods of simulations would be more appropriate, particularly the method of simulation of Monte Carlo.

1.2.1. Simulation of Monte Carlo

The simulation of Monte Carlo comes lastly stage of deepening of the quantitative analysis of the risk in a project. Whereas the methods which precede subject her to examination a number restricted of possibilities, the simulation Monte Carlo consider, as for her, all the possible results in "continuous specter", as well as their probability of case (Kaloset M.H, Whitlock P.A,1986) The result is presented as a continuous distribution of several likely values. It is in a way a representation of all the parallel worlds of the studied project.

The method of Monte Carlo defines simply the average or the likely value and the standard deviation for décrir the variation around the average (Hammersley et J.M.C. Handscomb D., 1964). The intermediate values close to the average are the most likely (Ventsel.. H., 1973). This distribution describes numerous phenomena, such as the cost and deadline the project,

The simulation Monte Carlo proceeds to the analysis of the risk by the elaboration of models of possible results, by substituting a valuable beach- a probability distribution - for any expanding factor of uncertainty.

2. MATERIALS AND METHODS

2.1. Risk analysis selected methods:

The objective of this work is to analyze the risk of construction projects, in particular, the agricultural projects, to give more clear clairvoyance to the decision-makers and the investors. Thus it is a question of calculating reserves deadlines and costs to mitigate the risks incurred in the projects. This work Require beforehand the progress of the process of managing risk, i.e.:

Stage 1: Identification of the risks

This work ended in a first inventory of the problems met through the taken place projects (evaluation ex-post), through interviews of companies directors activating in the department. These problems have bound the studies, the procurement, the revaluation and the adjustment of the authorization of the program.

Stage 2: a qualitative analysis of the risks:

This phase aims at converting the information and the data on the risks collected in the phase identification, by attributing to every risk its probability to show itself or its possible degree of appearance, and its impact which aims to be to be the consequence if he arose. The tool used on this phase, is the questionnaire, to estimate the probability and the impact of the risk we let us use the values predefined by the guide PMBOK. Once the collected questionnaires, the average probability, the impact and the criticality (C=P*I) are calculated. This work is made for 15 in charge of the follow-up, is resumed for 15 companies. This approach allows classifying the risks according to the strongest criticality, by listing a notation of the criticality

MAR: arithmetical mean $= \sum_{i=1}^{i=n}(Pi * Xi)/n$ For the probability

Avec :**Pi** : Possible probability (*0.1- 0.3- 0.5- 0.7* ou *0.9*)

Xi : occurrence probability

MAR : arithmetical mean = $\sum_{i=1}^{i=n}(Li * Yi)/n$ For the impacts

Li: impact possible (*0.5- 0.1- 0.2- 0.4- 0.8*)

Yi: occurrence probability for the impacts

Criticalities calculated in the previous paintings are taken and classified in order of priority, going off the strongest criticality to the lowest criticality, to draw up afterward the plan of the answer;

Stage 3: quantitative analysis of the risks

The values of entry for the simulation of the deadline containing the minimal and maximal durations lent by the estimations of the tenderers to the project quote below

The values of entry for the simulation of the cost containing the minimal and maximal durations lent by the estimations of the tenderers to the project quote below.

The quantitative analysis of the risks aims at reaching the following goals:

- Define the curves of probability accumulated by the costs and the times;
- Establish the reserves of cost and the schedule required for the project;
- Find a date of completion of the more realistic project;
- Find a more realistic cost;
- Establish the bases of the plan of mitigation of the risks.

The quantitative analysis was realized by the software PERTMASTER v8, based on the estimations of the tenderers in the works of realization.

2.2. Data

The ex-post evaluation carried out for the evaluation of the development projects was based on two sources of information, the first source is the existing information of the project owner, the design office and the second source., field survey of beneficiaries (established the logical framework of the program see annex 1).

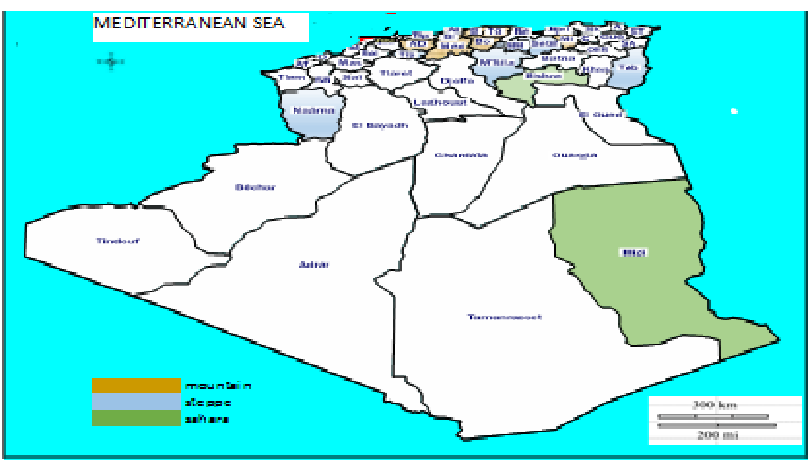
2.2.1. Information gathering

The collection was made with the owner (GCA, general agricultural concessions), the national office of study of rural agricultural development (BENDER), directors of the agricultural services (DSA) and ONTA (national office of the agricultural lands).
The information held for the evaluation is the database of the client (perimeter, area, amounts committed ......) and the documents of the local authorities concerning the lists of beneficiaries, and contracts awarded after five years of implementation. in place of the agricultural concession.

2.2.2. Field investigation

Our survey took place from January to June 2015 (see fig.01),

Fig 01: **Map of Algeria of sample ecosystems**



Source: authors

It affected three agro-ecological with a stratified random sample of 224 perimeters spread over fifteen departments (Blida, Boumerdes, Bouira Biskra, Mila, Ain Defla, Medea, Tizi Ouzou, Bordj Bourreridj, Tebessa, Tisimsilt, Naama, Setif, M'sila, Illizi).

Including 75 perimeters in the mountainous area, 98 in the steppe zone and 51 in the Saharan zone.

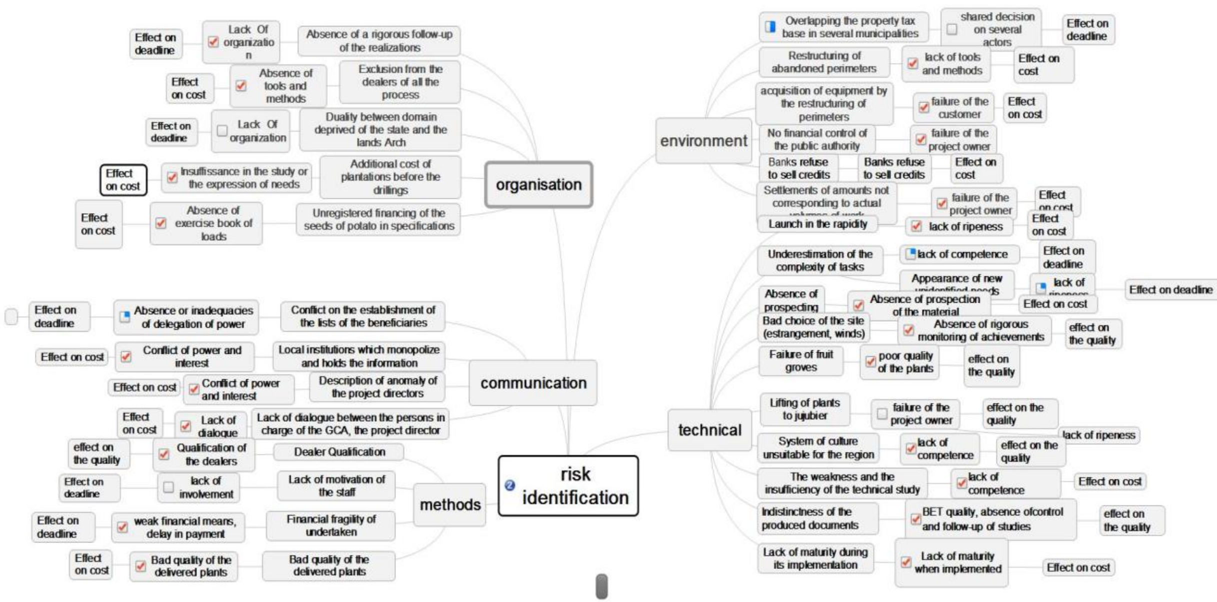
The application of the Monto Carlo simulation is realized by the software PERTMASTER V8 Primavera Pertmaster. The data are based on the exploitation of the report biding which has allowed us to see that the assessment, of the, bides for costs vary more or less between 20% and 30% to those of the designed enterprise; for the time limits they between 10% and 40%, so an average of cost of 30% for time limits.

3. RESULTS AND DISCUSSION

3.1. Identification of problems

The identification of problems is a very important stage in such a way that it defines the efficiency of all the others. This work has resulted in the first registration of problems encountered during the past projects through their different stages.fig.01

Figure 02: Risk Mapping of Development Projects



These problems encountered in past projects and which may constitute potential risks for future projects are sorted and classified by risk categories (technical, environment, methods, organization). This categorization aligns with research by (Kasimu, MA, 2012, Mohamad, MRB 2010) which identifies five categories, including financial factors, factors related to parts of the construction, factors related to construction elements, environmental and political factors. Subsequently, a decline in these causes and effects will be determined immediately. For example, the problem of "Emerging new needs not identified in the first place" affects the cost of the project. This mapping serves as a reference to guide the risk management policy.

3.2. Qualitative risks analysis

After the calculation of the medium probability (pi) the average impact (li) for each, we obtain the severity a comparison of results of those in charge of the follow-up of works and the enterprises to have a better subjectivity of interviewed, the strongest severity is considered and the results are shown in next.

Table 01: **Severity of the causes of the risks**

Risk	Summary 15 Companies and 15 Monitoring Charges	Average ∑pi*xi/n	Average ∑li*yi/n	severity
Quality Risk	Launch of the specifications without prior studies.	0,55	0,31	0,17
	Lack of qualification of staff.	0,71	0,22	0,16
	Lack of competence.	0,55	0,28	0,15
	Poor quality of the plants.	0,46	0,27	0,12
Cost risk	Lack of maturity of the project.	0,63	0,33	0,21
	Under evaluation of the volume of the stain.	0,54	0,36	0,20
	Absence of soil study.	0,50	0,21	0,11
	Failure of the Client.	0,43	0,19	0,08
Risk delay	absence or insufficiency of delegation of powers	0,73	0,35	0,25
	weak financial means, delay in payment	0,74	0,33	0,24
	Absence of prospection of the material.	0,73	0,32	0,23
	Establishment of planning without methodology.	0,73	0,30	0,22

Source: authors

This table shows that the measure of the criticality of the causes of the risks reached a high index of 0.25 having the effect of exceeding the deadline, represented in large part by "absence or insufficiency of delegation of powers; weak financial means, delay in payment; Absence of prospecting of the material; Establishment of planning without methodology "; The interview with the beneficiaries and the project managers revealed that exceeding the deadlines amounts to repeating of the plants following fires in the mountains; and resumption of soil studies after discovering limestone rocks and salinity of soils in steppe the Sahara. All this delayed the closing of projects on schedule

This classification joins the results of (Ade-Ojo, CO and Babalola, AA 2013) affirms that there are 6 main causes which would lead to schedule overruns, the identified causes have been classified as follows: design error, poor condition of the site, late payment, financial incapacity of the client, financial incapacity of the entrepreneur and the unavailability of the subcontractor and the supplier

The criticality calculation also displayed an index of 0.21 for cost risk; represented by the main causes “Lack of maturity of the Project; Under evaluation of the volume of the stain; Absence of soil study; Failure of the Client ". This classification is similar to the results found by (Al-Najjar, J.M., 2002) identified five main causes of cost overrun as follows: technical incompetence, poor organizational structure and business failures, lack of cost reports during the construction phase, insufficient preparation, planning, and implementation of the project were classified among the top five causes of cost overruns.

Interviews with beneficiaries revealed that the cost overrun is largely due to the resumption of plants not generated following a lack of supplier selection procedure; and also the non-respect of the order of execution of the project such as; the forcing of the wells comes before planting because the unavailability of water and salinity of water observed in the steppe and the Sahara have caused additional expenditure which is not justified.

For the quality; the criticality index of 0.17 is more or less low but which has caused significant delays and cost overruns; we quote “Launch of the specifications without prior studies; Lack of qualification of staff; Lack of competence; Poor quality of the plants ”.

The cornerstone of the quality of project execution is the qualification and competence of the team. Many such authors (Fusco 1997; Dainty and More 2007; Askarany 2006; Soderlund and Berdin 2006) for whom; the human factor is one of the main causes of success or failure of large-scale projects. and also these results are confirmed by the idea of (Courtol1997; Geddes and Hastings1993; Saladis 2013) for whom; leadership is a key factor in the performance of complex projects.

3.3. Quantitative risks analysis:

The results of the Monte Carlo simulation show that the date in which the tasks are finished with the most probable duration (the ending date CPM/ generally shows with a yellow arrow which gives the percentage of probability.

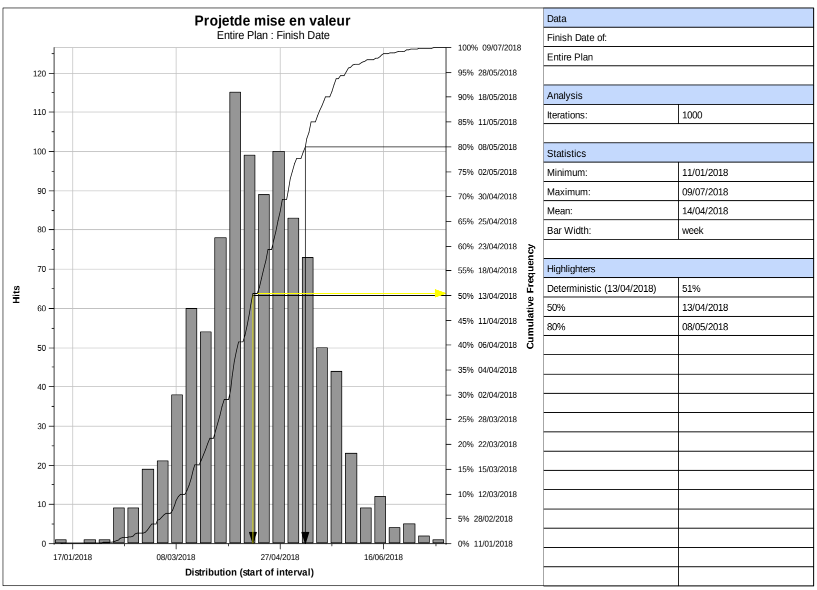
Table 02: **Summary of Provisions**

Probability	dates	Provisions in days
Deterministic:P-51%	13/04/20018	
P-80	08/05/2018	26 jours
P-90	18/05/2018	36 jours

Source : Authors

The results of the simulation can help us explain the risk we have in the total project time. The most popular statistics are the average (average time), the most likely time, and the 50th and 80th percentiles.

Graph 01: **results of Monte Carlo simulations on the project deadline**



Source: authors

We can observe that the 80th percentile that corresponds to date of 08 May (right-hand delimiter). We can say that there is only a 20% chance that we will exceed this date. In the same graph, we can also see that the 90th percentile of the total project delay is May 18th. So we can say that to increase our level of confidence from 80% to 90%, we will have to add a 10-day delay provision. However, we find that the supply of delay increases inversely with the level of confidence

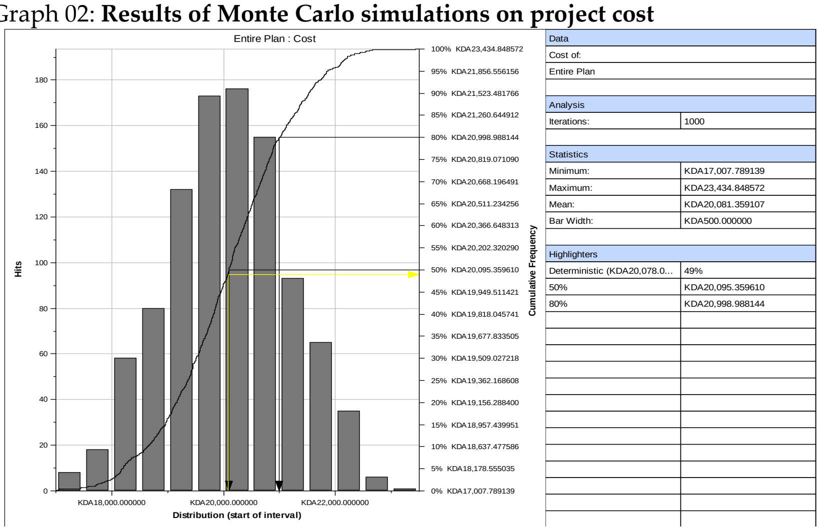
Table 03: **Simulation results (cost)**

probability	Amount	reserve
deterministic : P-49%	20.095.35 KDA	
P-80	20.998.98 KDA	90.363 KDA
P-90	21.523.48 KDA	52.450 KDA

Source: authors

The results of the simulation can help us explain the risk we have in the total project time. The most popular statistics are the average (average time), the most likely time, and the 50th and 80th percentiles.

Graph 02: **Results of Monte Carlo simulations on project cost**



Source: authors

We can observe that the 80th percentile that corresponds to a total cost of 20.998.98KDA (right delimiter). We can say that there is only a 20% chance that we exceed 20.998,98KDA. Otherwise, we have an 80% chance that the total cost will be less than or equal to 20,998.98KDA. In the same graph, we can also see that the 90th percentile of the total project cost is 21,523KDA. So we can say that to increase our level of confidence from 80% to 90%, we will have to add a reserve of 52,450 KDA to the total cost.

3.4. Response plan:

Once the risks are classified in order of priority going from the strongest severity to the weakest one in the qualitative risk analysis (risk demanding a short term response and meeting a supplementary analysis, registered the watch list). These responses are inspired by the combination of the responses received by the interviewees and are summarized in the following tables:

Table 04: **Answers to risks demanding a short term answer**

ID	Risks/ answers	severity
RM13	**Late intervention of controls** Review of the clauses of the control agreements. And diversify the control partners.	0,23
RT17	**Underestimation of the complexity of the tasks** Improve the quality of the studies and the implementation of a device of contradiction in the study	0,20
RM09	**Financial fragility of the company** Handle the causes of the delays in the payment	0,19

Source: authors

Risk mitigation implies a reduction in the probability and/or impact of an adverse risk to be within acceptable threshold limits

A major improvement must be sought for the exploitation and sharing of experience feedback, especially related to risks that present significant criticisms. In Table 04, we propose concrete measures to improve the risks identified in development projects.

Table 05: **answers to the risks requiring an additional analysis**

ID	Risks/ **answer**s	severity
RT13	**unforeseen ground conditions** Improve the quality of the identification of needs and avoid as possible launching works without preliminary prospecting of equipment bids.	0,16
RT4	**Absence of prospecting of plants and equipment** Improve the quality of the identification of needs and avoid as possible launching works without preliminary prospecting of equipment	0,15
RT02	**Absence of soil studies** To improve the quality of the identification of needs and to avoid, as far as possible, starting work without prior soil studies	0,11

Source: authors

This strategy can be either passive or active. Passive acceptance requires no action except to document the strategy, The most common active acceptance strategy is to establish a contingency reserve, including amounts of time, money, or resources to handle the risks.

Table 06: **Low priority risks on a Watch list**

ID	Risks/ answers	severity
RT11	Appearance of new needs not identified at first to Improve the quality of the identification of needs.	0,07
RT06	Under evaluation of the volume of the task improve the quality of specifications	0,06
RT9	Change of the initial design improve the quality of identification of needs, feasibility and technical solutions	0,05

Source: authors

It is difficult to associate for each risk answer strategy (avoid, reduce, transfer, accept) a monetary value as it appears on another risk. Also, it is very difficult to experiment with it for the first time, nevertheless, it is possible to proceed to analogies with realized projects experiments and so to determinate from one project to another one the monetary value affected the risk and the answer strategy for this risk. Lastly, when this is possible, it is easier to not make allocation and to keep the global amount. This amount is spent during the going on of the project, during the occurrences of the risks as identified by the analysis and the occurrences of unforeseen risks that were not identified by the analysis.

From this study, the following findings emerged:

-the potential for improvement exists to improve the ex-ante evaluation of future development projects;

The reserve calculated in expost of projects represents an error of 2% for delays and 4% in cost about the real value recorded (time) and adds (cost) to the completion of projects

This study first gave an empirical look at an object of study, the risk analysis of projects. It revealed a practice of estimating the reserve allocated to projects to mitigate the inherent risks.

This study also differs from previous studies by consulting two groups of actors from the participating projects, ie the project owner and project manager, to improve the relevance of the decision-making system following the evaluation, as well as the resulting system of action.

The research strategy used is another valuable contribution to the study. Its originality is based on the use of Monte Carlo simulation, a technique that allows for taking into account risk in quantitative analysis and decision making.

CONCLUSION

The purpose of this article was to analyze and formalize the risk practice of a development project, to help decision-makers to anticipate and capitalize on the experience of previous projects,

This document has identified the categories of factors acting on enhancement projects incurred in enhancement projects, (environmental, technical, organizational), giving risk mitigation responses through procedures and good practices. , and measured the prevention of the risks associated with time overruns and/or the money allocated to deal with the identified risks translated by the contingency reserve, which represents a means of communication between decision-makers and stakeholders.

Also, using the Monte Carlo simulation to calculate the contingency reserve is a solid way to increase the predictability of project results.

All this; has the effect of estimating the costs of poorly managed and underestimated risks by allowing the government to be more proactive in reducing the economic impact of agricultural development projects

These risks can be barriers to growth and the economies of developing countries. However, taking risks into account in an agricultural development policy requires a risk integration strategy which is mainly based on the availability of a solid information system.

Also, the use of the Carlo Elevation Simulation to calculate the reserve for unforeseen constitutes a solid means to increase the predictability of the results of the project.

REFERENCES

Ade-Ojo, C. O. et Babalola, A. A. (2013). "Cost and Time performance of construction projects under the due process reform in Nigeria. Research Inventy» International Journal Of Engineering And Science: Vol.3, Issue 6 (Aug 2013), PP 01-06: Issn(e): 2278-4721, Issn(p):2319-6483, Www.Researchinventy.Com.

Al-Najjar, J.M., (2002). "Factors Influencing Time and Cost Overruns on Construction Projects in the Gaza Strip», Master's Thesis: The Islamic University of Gaza.

APM. (2004). «PRAM - Project Risk Analysis and Management guide. Buckinghamshire», APM Publishing.

Baloi D., Price A.D.F., (2003), «Modelling global risk factors affecting construction cost performance», Int. J. of Project Management, 21, 261-269, 2003;

Bessaoud, O. (2006). « stratégie de développement rural en Algérie » cahiers options méditerranéennes. Serie A/n° 71, pp 81.82. in heurs et malheurs du secteur agricole en Algérie, L'Harmattan.

Besner, C., & Hobbs, B. (2012). «The paradox of risk management; a project management practice perspective». International Journal of Managing Projects in Business, 5(2), 230–247. DOI:10.1108/17538371211214923]

Cagliano, A. C., Grimaldi, S., & Rafele, C. (2015). «Choosing project risk management techniques. A theoretical framework. » Journal of Risk Research, 18(2), 232–248

CIRAD, (2018). «Platform for Agricultural Risk Management» ; Centre de Coopération International en Recherches Agronomiques pour le Développement

Courtot H., (1997). « Les risques liés à la gestion des acteurs d'un projet », Document inédit, GREGOR, l'Institut d'administration des entreprises de Paris,.

Dainty A., More, J (2007). «Integrating disaster risk management into construction: a UK perspective», Building Research & Information, 35:2, 163-177, DOI: 10.1080/09613210600979848

Firmenich, J., & Firmenich, J. (2017). «Customisable framework for project risk management». Construction Innovation, 17(1), 68–89.

Geddes, M. & Hastings, C, (1993). «*Le manager de projet : un leader*», Édition Afnor Gestion, , 177 p.

Gray, C. F. et Larson, E. W. (2014). «Project management: the managerial process». McGraw Hill, 6 édition.

Hammersleyet J.M.C. Handscomb. D, (1964). «Monte Carlo methods». London: Chapman and Hall

Hendricks (1996) D. «Evaluation of value at risk using historical data». Economy Policy Review, April, pp. 39-69.

Kaloset M.H, Whitlock P.A, (1986). «Monte Carlo Methods, Basics». Wiley-Interscience

Kasimu, M. A., (2012). «Significant factors that causes cost overruns in building construction project in Nigeria». Interdisciplinary journal of contemporary research in business: March 2012, VOL 3, NO 11.

Lam P.T.I., A., 1999. «A sectoral review of risks associated with major infrastructure projects». Int. J. Project Management, 17, 2, 77-87, 1999**.**

Mohamad, M.R.B. 2010, «The factors and effect of delay in government Construction project, Case study in Kuantan». University Malaysia Pahang

Mojtahedi, S. M. H., Mousavi, S. M., & Makui, A. (2010). «Project risk identification and assessment simultaneously using a multi-attribute group decision-making technique». Safety Science, 48(4), 499–507.

McKay, C. P. (1997), «The search for life on Mars, Origins of Life and Evolution of the Biosphere». 27, 263–289.

Osabutey, D., Obro-Adibo, G., Agbodohu, W., & Kumi, P. (2013). «Analysis of risk management practices in the oil and gas industry in Ghana. Case study of Tema Oil Refinery (TOR) ». European journal of business and management, 5(29).

PMI. (2013). «A Guide to the Project Management Body of Knowledge (PMBOK Guide)». Newtown Square, Pennsylvania: Project Management Institute.

Pert master-Risk tutorial, (2007). «Primavera Pert master». https://fr.scribd.com/doc/152214685/Pert-Master

Söderlund J., & **Bredin K.,** (**2006).** «HRM in project-intensive firms : Changes and Challenges», Human Resource Management, vol. 45, n° 2, , p. 249-265.

Whitfield S., (2015). «Managing Nontechnical Risk in Offshore Projects». SPE-1015-0016-OGF.doi:10.2218/1015-0016-OGF.

Zou, P. X., Zhang, G., & Wang, J. (2007). «Understanding the key risks in construction projects in China». International Journal of Project Management, 25(6), 601–614.

Zwikael & **Ahn M., (2011).** «The effectiveness of risk management: an analysis of project risk planning across industries and countries». Risk analysis, 31(1), 25–37.

Ventsel H., (1973). «Théorie des probabilités». Editions Mir, Moscou.

Annex1

Probability and Impact Matrix

Probability	Threats					Opportunities				
0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
	0.05/ Very Low	0.10/ Low	0.20/ Moderate	0.40/ High	0.80/ Very High	0.80/ Very High	0.40/ High	0.20/ Moderate	0.10/ Low	0.05/ Very Low

Impact (numerical scale) on an objective (e.g., cost, time, scope or quality)

Each risk is rated on its probability of occurring and impact on an objective if it does occur. The organization's thresholds for low, moderate or high risks are shown in the matrix and determine whether the risk is scored as high, moderate or low for that objective.

Annexe2

ID	Risk	Summary 15 companies and 15 follow-up charge	probability					MAR	Impact					MAR Σ li*yi/n	criticality
			TF	F	M	E	TE	Σpi* xi/n	TF	F	M	E	TE		
		Description of risks	0,1	0,3	0,5	0,7	0,9		0,05	0,1	0,2	0,4	0,8		
ROG2	risk delay	Poor assessment of task duration during planning	0	1	2	6	6	0,73		2	5	6	2	0,35	0,25
RM02		Shortage of materials.			3	6	6	0,74		3	5	5	2	0,33	0,24
RM13		The late intervention of controls.			3	7	5	0,73	1	3	4	5	2	0,32	0,23
ROG3		Establishment of planning without methodology.			4	5	6	0,73		3	5	6	1	0,30	0,22
RE1		The short delay imposed difficult to control		2	4	7	2	0,62		4	4	5	2	0,32	0,20
RE11		Inadequate time to start work	2	1	1	5	5	0,60	4	2	2	4	3	0,32	0,19
ROG5		Lack of schedule update			4	6	5	0,71	1	3	6	4	1	0,26	0,19
RE3		Slow in approving contracts.	1	2	4	6	2	0,58	2	1	5	5	2	0,32	0,19
RM09		Financial fragility of the company.	1	2	4	5	3	0,59	1	3	4	5	2	0,32	0,19
RT8	qualit y risk	Launch of the specifications without preliminary studies.	3	2	2	4	4	0,55		2	6	6	1	0,31	0,17
RM07		Lack of qualification of personnel.		2	2	4	7	0,71		5	6	4		0,22	0,16
RM11		Antiquated equipment	1	3	5	3	3	0,55	2	3	5	3	2	0,28	0,15
RM01		Lack of qualified companies.	2	3	5	4	1	0,49	2	2	5	4	2	0,30	0,15
RT12		Construction plan not available on site	2	1	5	6	1	0,54	2	3	5	4	1	0,25	0,14
RM04		Bad quality of materials.	3	2	5	5		0,46	2	3	6	2	2	0,27	0,12
RT10	risk cost	Catching up on deficiencies.	0	2	4	6	3	0,63	0	3	5	5	2	0,33	0,21
RT7		Understated by the volume of the spot.	2	2	3	7	1	0,54	1	4	3	3	4	0,36	0,20
RM05		The increased cost of materials. Lack of soil study.	5	1	4	5		0,42		1	5	4	5	0,45	0,19
RT2		Lack of soil study.	1	4	4	6		0,50	2	7	2	3	1	0,21	0,11
RT5		The vagueness of the documents produced.	4	2	4	4	1	0,45	4	4	4	3		0,17	0,08
RE2		The market is not revisable.	4	3	2	6		0,43		6	7	2		0,19	0,08
RT11		Emerging new needs not identified in the first place	4	4	4	2	1	0,39	4	4	4	3		0,17	0,07
RM03		Distant from the materials.	6	5	4			0,27	1	1	8	5		0,25	0,07
RT1		Lack of various facilities.	3	3	4	5		0,45	3	6	5	1		0,14	0,06