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Cost-Benefit Analysis for Investments Supervised by Modern Technologies

KEYWORDS: investment analysis, modern tehnologies, benefits, costs.

Mihai Iliescu
Technical University of Cluj-Napoca, Faculty of Civil Engineering. 72-74 Observatorului Street, Cluj-Napoca, Romania

Remus Ciocan
Technical University of Cluj-Napoca, Faculty of Civil Engineering. 72-74 Observatorului Street, Cluj-Napoca, Romania

ABSTRACT *The project implementation under supervising system through modern technologies is required by the global economy aspects, protecting natural resources and improving the quality of work. Productivity, economy and safety of the investment process are the features which should be targeted. This system which replace the classical clocking methods and travel time registration for building process with modern methodology is analysed through performance and costs, the decisive factors which is described by process efficiency, environment friendly and safety. In this paper are described the usefull systems like GPS supervising, video monitoring and RFID clocking.*

2. INTRODUCTION

The following paper intends to analyse the long-term benefits and results of using new technologies in report with the costs of the system's implementation.

The implementation and development of modern supervising systems are a present adaptation of the scientific management, which comes as a completion, regarding human errors. It is intended to correct the defficiencies which occur in the control and supervision of production processes which make the manager vulnerable as far as pure scientific management theory is concerned. In papers belonging to the founders of scientific management it is presented growth and payment methods for individual efficiency according to terms established by the best workers, but the theoretical part can be implemented only by continuous supervising and control for maintaining these methods stable during the entire investition.

Through supervising we understand a repeated, short-time process of supervising, coordination and control, with the intention of identifying the advantages and disadvantages of the studied objective, in order to obtain information necessary for the project's efficient coordination and control [1].

The investition on which the research was made, being evaluated at 50,04 mil Euro, will

need a fund suppliment due to the purchase and install of the modern supervising system which was estimated at approx. 0,11 mil. Euro. Three important access points were taken into consideration, with video monitorizing and it were also given RFID readers, and 100 trucks and equipments were provided with GPS transmitters and RFID labels.

The production areas have workers and engineers which have the duties of clocking, checking and supervising. The persons who benefit from these atributions have a low surveillance rate in comparison with a modern automatic system.

3. CASE STUDY - OPTION ANALISYS

2.1. The scenario without modern supervising systems

The investition began by using human clocking assistants which used a writter check sheet based on the trucks and equipments' observations and recordings. The equipment park is the main instrument of the investition, being the primary key in terms of execution time and quality. The project would have a continuous and safe course if the park would function at full efficiency, without route deviations or even the lack of deviation from the work field [5].

In order for the construction to be done, 72 months of conventional clocking methods are needed. The research was made on 3 samples of 10 trucks and equipments each. These function on average 20 days of 10 hours each, and they make approximately 25 daily courses of an approximately 5 km distance between the interest point and the warehouse.

2.2. The scenario with modern supervising systems

The construction site's performance could be better controled through a calculus methodology sustained through a real time clocking system, using RFID reader and labers, video surveillance as well as GPS monitorising, the system being called Construction Site Monitoring (CSM).

The construction's realisation could be reality in 60 monts by using clocking and supervising methods with modern technologies. The research was made on 3 samples of 10 trucks and equipments each. These function on average 20 days of 10 hours each, and they make approximately 30 daily courses of an approximately 5 km distance between the interest point and the warehouse, after the following model:

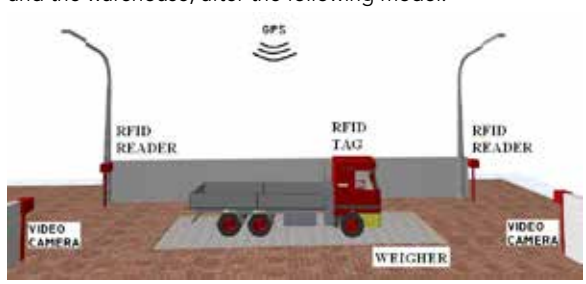

Figure 1. Supervising with modern technologies

4. FINANCIAL ANALYSIS

Performance evaluation

The construction site's performance is the decisive factor which offers us a clear description of the site's evolution, seen through the aspects of individual efficiency of trucks and equipments which are trained in the process. The main objective of this financial analysis (financial analysis cost-benefit) is to calculate the indicators of the project's financial performance (its profitability) This analysis is usually developed from the infrastructure's owner's (or legal administrator's) point of view [4].

The analysis length recommended for this project is of approximately 20 years, and the recommended actualisation rate for financial analysis is of 5%. The investition and self

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contribution's financial profitability is determined by using NPVF/C (current net income in report with the investition's total value) and IRRF/C (intern rate of rentability in report with the investition's total value.

Net Present Value (NPV) is the difference between the present financial entries and exits, which offers us information about the profitability of an investition during a certain amount [7].

The Internal Rate of Return (IRR) of an investment is the discount rate at which the net present value of costs (negative cash flows) of the investment equals the net present value of the benefits (positive cash flows) of the investment [6].

The B/C Ratio is the share between the total of benefits and costs determined on a certain amount of calculus.

In variant number I, incomes from self production will be realised, which will be available for an amount of money and for this matter there have been made approximate financial predictions which will be considered the same in both scenatios. The process will take 72 months for unlocking the objective and the following financial indicators were given:

a	5,00%				K	50.040.125
NPVF/C	944.097				NPVF/K	944.097
					IRRF/K	5,6824%
IRRF/C=	5,6824%					
RATIO B/C	2,10					

Table 1. Financiar indicators for variant I

In variant number II, incomes from self production will be realised, available for an amount of money, and for this matter the same financial predicitions have been made. However, the process will take only 60 months and the following financial indicators were given:

a	5,00%				K	50.040.125
NPVF/C	3.351.921				NPVF/K	3.351.921
					IRRF/K	6,1635%
IRRF/C=	6,1635%					
RATIO B/C	2,13					

Table 2. Financiar Indicators for variant II

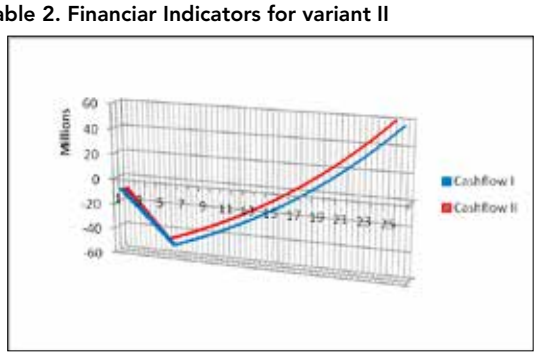

Figure 2. Cashflow variation for financial analysis (EURO)

5. ECONOMICAL ANALYSIS

Through realisation and maintenance of a high performance, through continuous surveillance in real time, coordination and efficient usage of execution costs, a high quality of the desired objective is ensured.The rational support economical evaluation is that the project's entries should be evaluated at its opportunity costs and the project's exits at the consumers' willness to pay [3].

The economical analysis is realised from the beneficiary's point of view. The cashflow from the financial analysis is taken as a starting point for the economical analysis. For determining the economical performance indicators, some adjustments should be made. These adjustments refer to benefits from works and benefits from road expenses during the investition, and small benefits from the investition's lifetime length.

Variant II presents superior economical indicators in comparison with Variant I:

a	5,50%		a	5,50%
NPVE/C	4.112.043		NPVE/C	1.652.050
IRRE/C=	6,3108%		IRRE/C=	5,8179%
RATIO B/C	2,16		RATIO B/C	2,14
K	50.040.125		K	50.040.125
NPVE/K	4.112.043		NPVE/K	1.652.050
IRRE/K	6,3108%		IRRE/K	5,8179%

Table 3. Economical indicators for each variants

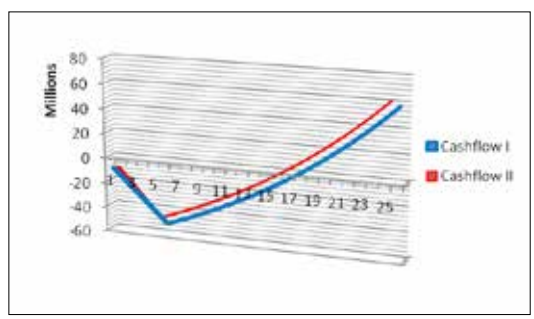

Figure 3. Cashflow variation for economical analysis (EURO)

In the following graphic it has been taken into consideration the execution of works through the classic clocking method evaluated at a length of 6 years and through the modern supervising method using new technologies, evaluated at a time length of 5 years.

Taking into consideration the evolution system maintained at a medium performance of 80%, by using a methodological calculus, it can be observed a decrease in the execution time of 12,5% (6 months) in connexion with the work's progress of 50%, and a decrease in the execution time of 16,7 % (12 months) in connection with the work's 100% progress.

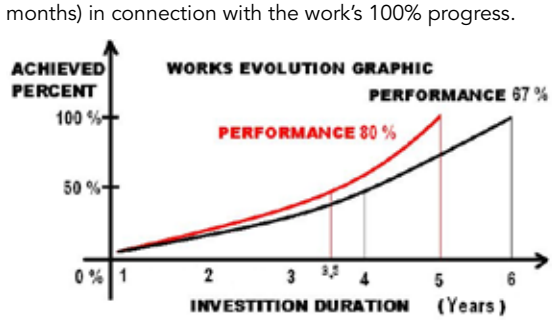

Figure 4. Variation of the investition's evolution by using the two methods

6. SENSITIVITY ANALYSIS:

During the sensitivity analysis, it has been appreciated as a critical value the size of annual and periodic maintenance costs, and it has been studied the infuence of their variation

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with +/- 1% over the results. The variation of NPVE/C and IRRE/C is insignificant when modifying these costs.

As a following of the sensitivity analysis we can conclude that the project is stable, even when important modifications of operating and maintaining costs occur, in comparison with variant I. The individual project is strongly tied to the strategic objectives and the investor's strategic development priorities.

	C	50.040.125
pt -1%	NPVE/C	4.119.207
	IRRE/C	6,3122%
pt.+1%	NPVE/C	4.104.878
	IRRE/C	6,3094%

Table 4. Economical indicators for sensitivity

7. FINANCING SOURCES AND NEW WORK PLACES CREATED:

The financing sources of the investitions are in accordance with the current legislation and they will be stablished by the beneficiary after he has been presented the report of the second variant.

The specific character of the execution works involves the creation of new work places both in the implementation phase and in the operation phase for realising the investition. In the operation phase, new workplaces are created directly through the posts of system operators. The workforce needed during the investition depends on the beneficiary's decision to keep the system active.

8. CONCLUSIONS

The conclusions show us that the study of feasability, performance and costs reglation through the implementation and operation of the modern system is strongly tied to the supervising activity, which leads to economy, coordination and full safety during an exploatation. The accent shoud be put on the execution of the work program, on the steps which must be respected, as well on the quality control program, which is related to the work with dated images of finite parts. The usage of the modern system CSM will have a major impact over the future of constructions, throughout the world, by growing the pace of execution works, their quality and by minimalising any loss which can be reflected from entrepreneur to the beneficiary. The implementation of this system, named Construction Site Monitoring (CSM) will be easy, taking into consideration the price, which is relatively small in comparison with the major benefits it brings.

9. AKNOWLEDGEMENT

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