

Contributions for increasing building sites performance

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Abstract

The following paper describes the benefits and costs brought by the usage of modern technologies in the construction areas, essential as far as the aspects of global economy, natural resources protection and enhancement of labor quality are concerned. The productivity, quality and safety of the investment process are the targeted characteristics. This construction sites' performances growth process, which replaces classic timing and traveling methods, which also records the necessary time for the construction process with modern methods, is analyzed through the performances and investment costs, which are the decisive factors for describing the efficiency of the process, protecting the environment and rising the safety. This paper also describes useful and elementary methods which, put into practice quite easily, will function as a support for the investmental process.

Keywords: methodology, benefits, modern technologies, performance.

Rezumat

Prezenta lucrare descrie beneficiile si costurile pe care le aduc utilizarea tehnologiilor moderne in realizarea constructiilor, esentiale sub aspectele economiei globale, protejarea resurselor naturale și îmbunătățirea calității muncii. Productivitatea, calitatea și siguranța procesului investițional sunt caracteristicile care sunt vizate. Acest proces de crestere a performantei santierelor de constructii, care înlocuie metodele clasice de pontaj și de călătorie, de înregistrare a timpului necesar pentru procesul de constructie cu metode moderne este analizată prin performanțele și costurile investitiei, factorii decisivi care descriu eficiența procesului, protejand mediul inconjurator și sporind siguranța. În această lucrare sunt descrise metode utile si elementare , puse in practica relative usor, care vor functiona ca o baza de sustinere pentru procesul investitional.

Keywords: metodologie, beneficii, tehnologii moderne, performanta.

1. Introduction

The following paper will analyse the costs and benefits on short term and long term which resulted from using new technologies in comparison with the conventional methods of supervision of the

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construction site. The implementation and development of modern supervising systems is a present adaptation of scientific management, which comes with a transformation of the human being in the pawn controlled by him and with a completion regarding human errors for correcting the defficiencies which refer to the control and supervision of production processes. In the case of pure scientific management theory, these processes make the manager much more vulnerable. In the works of authors who put the basis to scientific management are presented growth methods for payment and individual efficiency according to norms established by the best workers. The theoretical part, however, can be implemented only through supervision and continuous control for maintaining the stability of this method throughout the entire investitional process. For enhancing the performance, a repeated process of supervision, coordination and control on short term periods will be used, in order to determine the advantages and disadvatages of the studied objective. Therefore, information necessary for efficient coordination and control of the project will be delivered. The contractual basis can be found in the works of International Federation of Consultant Engineers, as well as references to the management and bureaucracy which will endure a normal development of investitions, according to Gantt graphics [1].

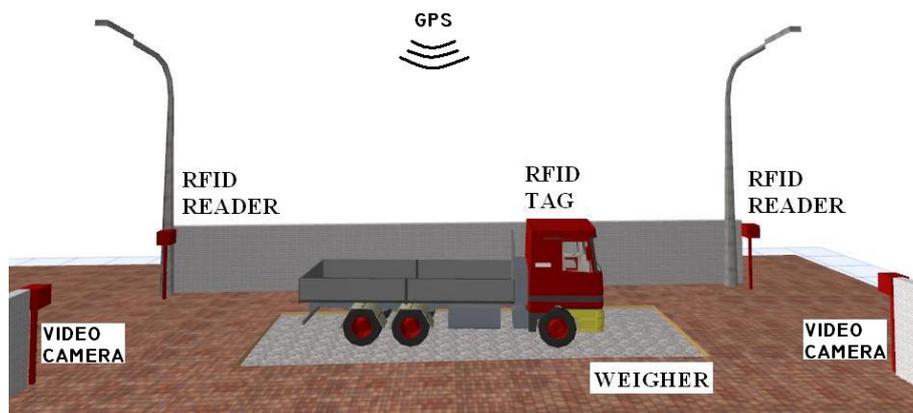


Figure 1. Supervising with modern technologies [8].

2. Strategical actions for the implementation of supervision systems

2.1 Basis of the project's shaping

For establishing the basis of the CSM (Construction Site Monitoring) supervising system's shaping, first it will be necessary to analyse the present situation and the future situation, regarding the organization of the site and the interest points. Each interest point will be supervised through a video equipment which contains a DVR with four cameras and a storage media. A RFID reader will be installed for entries and exits connected to a module for processing and stocking, sustained by an UPS which will transmit the data through the GSM module. Trucks and equipments will also have an active RFID label installed, for automatic clocking, and a GPS device connected for transmitting data such as position and consume. We can consider as interest points those areas where natural resources are taken or downloaded, limited areas where the so-called execution is being made or simply clocking points installed in the most circulated areas.

2.2 Lasting project models

Performant management is a present adaptation of the scientific management, which comes as a completion for the correction of defficiencies in terms of control and supervision of the production processes which make the manager vulnerable in front of the pure scientific management.

Therefore, through those supervision systems, the project manager will be protected and will assure a higher efficiency. Theoretically, the rising of the investment's performance will be done only throughout technical implementation of the system without the implementation of the methodology through which it is recommended the operation and registration by a supervisor, for each of 3 interest point with 100 trucks and equipments [2].

2.3 Impacts over the construction industry

The construction industry will have major benefits from the implementation of these complex systems, because the implementation costs will be small in comparison with the benefits they will bring. More important, the length of execution will drop with 16,7% over the next 5 years. Smaller investment costs will make more accesible the participation of more enterprises to the public auctions and lower starting bids. In this context of a higher quality of the execution, of the protection of the environment through higher efficiency and smaller costs, this supervision system will define a fast and strict execution process [3].

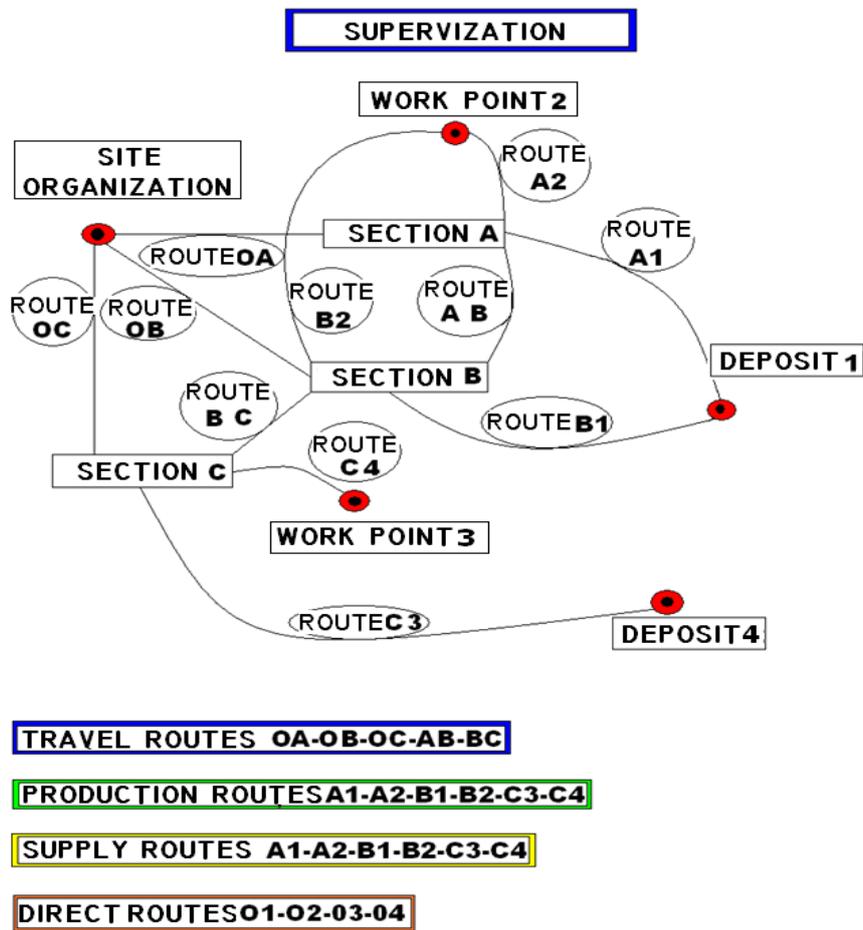


Figure 2. Supervization plan

3. Case study

The beneficiary of the project is a enterprise who, through her projected theme, wants the finalisation of the construction of a hydro-electric plant. The construction work solicited by the beneficiary of the work will be realised on the actual placement of the Olt river near Racovita town. The execution length of the last investition is of about 72 months in a normal situation, 60 months to which are added 6 months for winter economical-financial analysis and another 6 months for

unpredicted situations. Financing sources of the investments are done according to the actual legislation and consist of private funding, thus ensuring the continuity necessary for relevant experimental proofs.

Since it's a hydro-electric plant, the income will be realized through the production of electric energy, which will be available for an amount of money. For this, there have been made approximate financial predictions for the entire production, available for both scenarios.

As a consequence to the finish of the investments, the identification of costs and the quantifiable benefits and extra monetary factors has been searched for. The prediction has been made by taking into consideration both the positive and negative effects of the investment. The extra costs which are due to the implementation of the supervision system have been added to the investment costs, and they have been estimated for a length of 5 years.

The benefits of works will be materialised, thanks to supervision systems which will grow the productivity of the site, its safety being estimated to an annual value which will be doubled in the last year because the operation costs from year 6 have been cancelled. The sixth year will be the year which will disappear from the Gantt graphic due to the usage of latest supervision technologies, and the site's efficiency will grow.

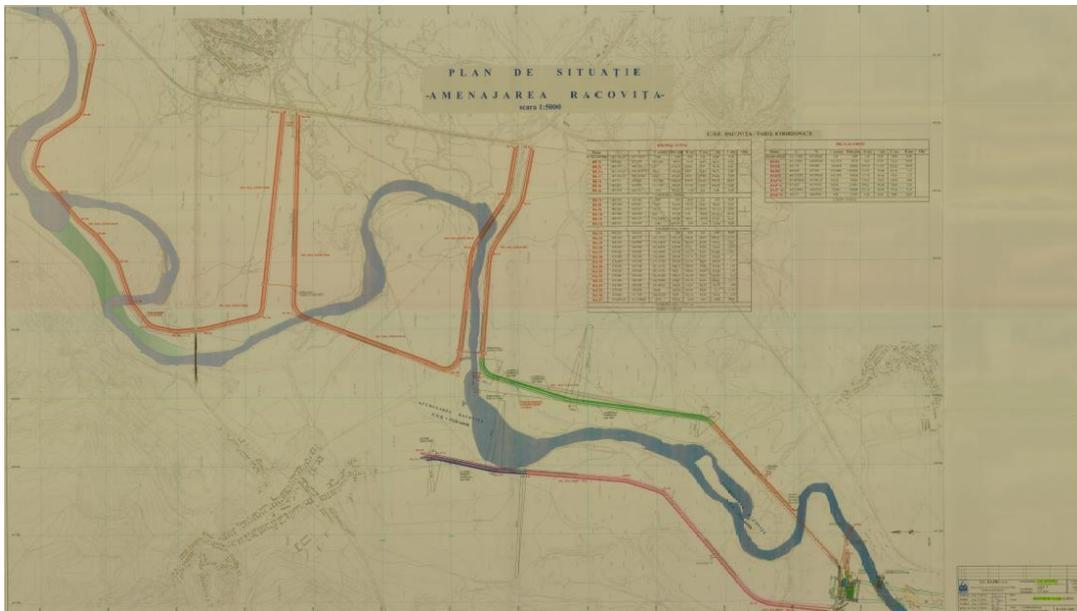


Figure 3. Site plan

Moreover, two scenarios will be presented and the accent will be put on the benefits obtained from the usage of performant supervising systems for a length of 72 months which are necessary for the construction's development. The scenario which will follow the first variant uses conventional supervision methods for the construction of CHE Romania. The construction used human clocking methods and the research was done on 3 patterns of 10 trucks and equipments. These work approximately 20 days, 10 hours a day, and realise approximately 25 rides a day. The average distance between the interest point and the warehouse or the storage are is of approximately 5 km. When calculating the analysis years, we will take into consideration a rise in the number of vehicles of 5%/year, a traffic of 100 trucks a day which will perform 25 daily rides, each of 5 km, therefore, in the first year, 600000 rides will be clocked.

The scenario using the second variant presents the construction of CHE Racovita done with modern supervision methods.

Table. 1. Implementation and operation costs

Equipment	Units	Value	Total	Subscription (60 months)
RFID	3	14000	42000	1440
VIDEO	3	1700	5100	1440
GPS	100	135	13500	48000
TOTAL	Euro		60600	50880
TOTAL	Euro			111480
TOTAL	Ron			477669,504

The second variant used clocking and supervision methods with modern technologies and the research was carried on 3 patterns of 100 trucks and equipments each. These work approximately 20 days, 10 hours a day and perform about 30 rides/ day on an average distance of 5 km between the interest point and the warehouse/storage area. When calculating the analysis years, we will consider a rise in the number of vehicles of 5%/year, a traffic of 100 trucks/day which will perform 30 rides of 5 km each; in the first year, 720000 rides. The difference between the costs is represented by the higher value necessary for the investment, but for justifying the fuel economy, only 600000 rides will be taken into consideration. Therefore, a 20% fuel economy will be made, but also a drop of 16,7% in the number of rides, which will decrease the annual price of the execution.

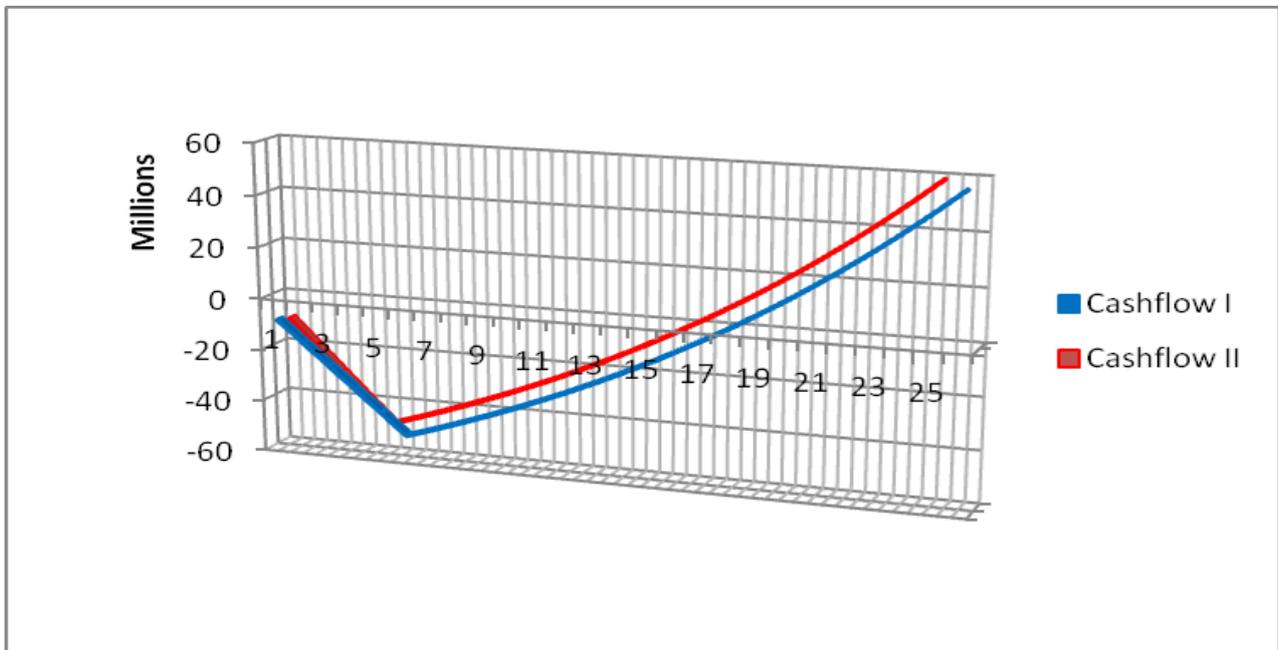


Figure 4. Cashflow variation for financial analysis (EURO)

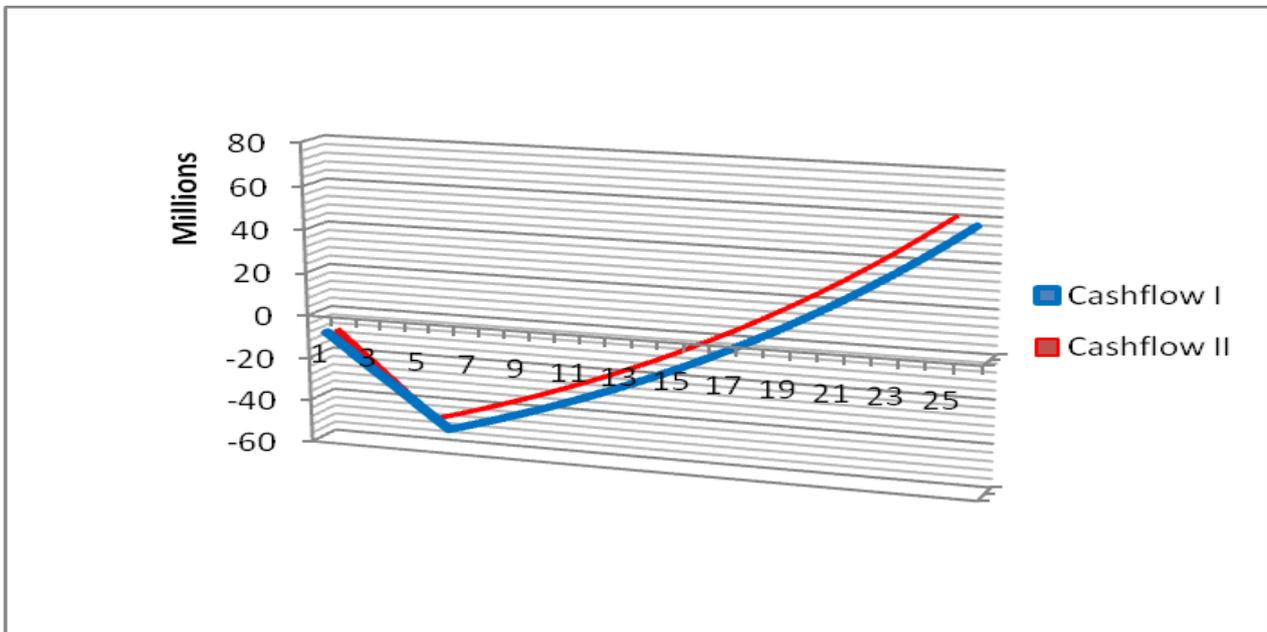


Figure 5. Cashflow variation for economical analysis (EURO)

4. Synthesis and perspectives

4.1 Synthesis of the research

The resolution of this paper presents a new and unavoidable step in the modernisation of constructions. This automatization of a construction site's functions will transform the execution process into a continuous, fluent and rapid one, at the same time ensuring the safety of the participants. The sites' safety will considerably rise through the usage of video supervision. The ones involved in the execution or production process will be permanently monitorised and clocked so as they will not have time losses, route deviations and low efficiency [4].



Figure 6. Life Cycle Concept

The following graphic presents the execution of works through the classic clocking method, with a construction evaluated time duration of 6 years, and the execution through modern supervision methods, using new technologies, evaluated at a length of 5 years.

Having taken into consideration through a methodological calculus the evolution system maintained at a performance of 80%, we can observe a drop in the execution time of 12,5% (6 month) with a work progress of 50% and a drop of 16,7% (6 months) of the total execution time with a work progress of 100%.

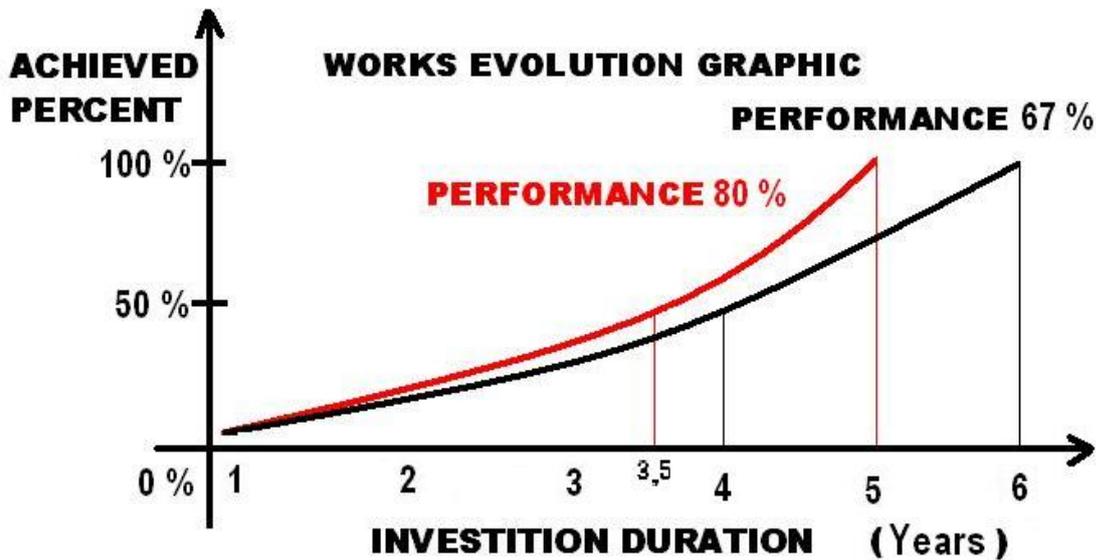


Figure 7. Variation of the investition's evolution by using the two methods

4.2 Perspective on constructions in Romania

The usage of new technologies for monitoring, supervision and clocking will make possible a public auction with lower prices and shorter terms. The rise of efficiency involves a drop in financial and human resources, which interests both the constructor and the beneficiary. Road construction is hardened by lacks of funds and financing strategies during the established time. Involving more entities through public-private partnerships will also harden the organisation and coordination of investition works. Public-Private partnerships are successful solutions for future investition works which will be sustained and coordinated through the implementation of modern supervising systems [6].

5. Conclusions

The usage of CSM system will have a major impact over the future of constructions in Romania, enhancing the rhythm of executions, rising their quality and minimalising any loss that can be reflected from entrepreneur to beneficiary. The implementation of this supervision system, called Construction Site Monitoring (CSM) will be easy, taking into consideration the relatively small price in report with the major benefits the system can bring. The conclusions show us that the study of feasibility, necessity and implementation costs are tightly connected to the activity of supervision

which leads to economy, coordination and full safety during the exploitation. The accent must be put on the execution of work, the steps need to be respected, as well as the quality control program, which is entitled to the work with dated images of the contractual parts. The implementation of CSM systems will have a major impact on the future of constructions in Romania, enhancing the rhythm of executions, rising their quality and minimalising any loss that can be reflected from entrepreneur to beneficiary.

Acknowledgements

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