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Assessment of Carbon Footprint and Economic Evaluation Schedule of Agriculture Workland by Theoretical Queuing

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Abstract

Objectives: To study the carbon footprints in agricultural work and to find ways to improve the performance process in order to minimise the greenhouse emissions in environment management. **Methods/Statistical Analysis**: In the first part, a methodology is developed by which an optimal ratio between the size of shovels and trucks is determined. The second part gives the fundamentals of the queuing theory and its application in analysing shovel and trucks. Using the above theory, the optimal truck fleet size in actual conditions can be estimated. Minimal operating cost of the working system (shovels trucks) represents the basic requirement of the analysed process. The methodology was validated on Caterpillar front-shovel – truck combinations. This paper shares lessons learned from the process of creating a simulation model and implementing it in the visual framework. **Findings:** Addition of equipments/modern tools in the works increases the performance of the systems and so the carbon footprint; using two independent variables analyzed by queuing theory, the final score determinate the relationship between delay reduction and greenhouse emissions. Mainly two variables data use to determinate greenhouse emissions, first one is equipment numbers and Bucket Shovel size. Increasing machine system of works permit gain in delay 300% time by shovel bucket 1.25 m^3, this increase is associated with 30% over the cost. Comparison with other system with shovel bucket 2.40 m^3 is already a 180% time less performance and 67% more economic. Definitely the economic greenhouse emission, by one loader shovel bucket 2.40 m^3 is 53.47% more performance than the more fast system composed by 3 loaders with shovel bucket 1.25. Using bigger bucket shelf capacity is a better choice than increasing the number of equipments. **Application/Improvements:** Evaluation of equipment systems where resources can be saved and the work process can be reduced can proportionately reduce carbon emissions. Trace greenhouse emissions in the agriculture works in Africa has an important consequence of global and environmental process.

Keywords: Agriculture Works, Carbon Footprint, Queuing Theory, Senegal

1. Introduction

Determining the best performance equipment system is important, especially in making agricultural irrigation canals and preparing agri-land in northern Africa. In the first part, a methodology is developed by which an optimal ratio between the size of shovels and trucks is determined. The second part gives the fundamentals of the queuing theory and its application in analysing shovels and trucks. Using the above theory, the optimal truck fleet size in actual conditions can be estimated. The minimal operating cost of the working system (shovels/trucks) represents the basic requirement of the analysed process. The methodology was validated on Caterpillar front-shovel – truck combinations.

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Each and every process in construction is strictly connected with costs and deadlines which have to be met by the investor/owner. Equipment usage will give fast and accurate results at a reduced cost. However, some machine combinations fail to achieve results under the given conditions, while other combinations will be optimal in all aspects for the given task. Thus, an effective process is required to analyse the conditions carefully and to choose the optimal type, number and combination of equipment[1]. This theory allows us to develop inclusion for this purpose of optimization, where the process of queue formations takes place and where customers are served by servers. The process of construction should be evaluated towards client satisfaction, which is waiting in the queue for service. Anticipating the congestion that might be caused by many trucks running on the mountain roads at the same time, the stochastic simulation technique was utilized to figure out whether it would affect the clay soil production. This paper shares lessons learned from the process of creating a simulation model and implementing it in the visual framework. The flow scheme of the research carried out can be seen in Figure 1.

A building management process reengineering performance measurement model is built based on queuing theory[2] to calculate process operation time in order to attain an optimal balance between manpower service capacity and process execution demand. This report offered a theoretical account that integrates efficiency and effectiveness estimators that are applicable to the construction industry needs and employs queuing theory to estimate operation time to measure efficiency. Process operation time and client satisfaction are used effectively and in efficiency evaluation indices. Study[3] uses empirical data collected at an Australian refinery to verify and check the assumptions for queue distributions in order to plan the off-road-truck hauling of titanium dioxide to a refinery-surface mining operation (earthwork and haulage) for the two models M/M/1 and M/G/1. Cycle time is taken as a function of service components, machine characteristics, machine efficiency; material characteristics swell factor and system characteristics like number of servers and waiting time and delays in the queue system. A queuing system/model all of these factors should be considered while forming the underlying distribution. The Poisson distribution can be considered for estimating the arrival rate, while the normal distribution is taken from the service rate in a queuing model. This study provides new ideas of simulation models and results to

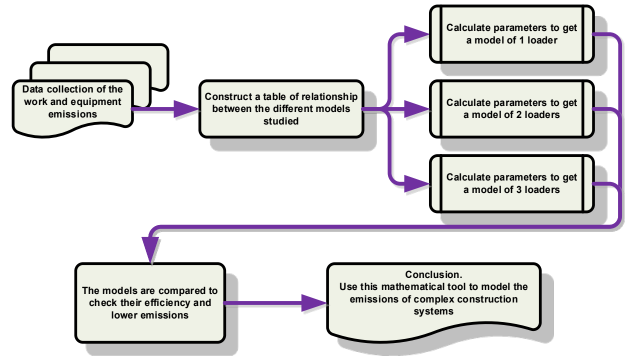


Figure 1. Research flowchart.

predict and corroborate the queuing theory, and can be used in the construction management field as well. Attention is focused on establishing server utilization. The server equipment must not be idle. The haul segments, the dump segment, and the loading segment of a truck cycle may all be considered simultaneously rather than having to consider one segment at a time as is the case of a finite source analysis. This means that segmentation of the most convenient and effective for analysis and application of the theory[4]. The queue theory is used to examine operating channels in excavations, where queue formation takes place and then subsequent servicing of customers by the servers[5]. It demonstrates the use of a mathematical simulation model which shows that some machine combinations achieve the tasks while some others fail to do so. It assumes a closed system where customer servicing is done according to FIFO[6,7]. Input parameters for the model include construction process, volume of task, working shift, construction task, time limitations, etc., and also random values accounting for the random effects. This study shows that it is possible to model mathematically and technically the whole complicated construction processes, with a number of simplifications and then to perform various calculations and changes for effective, efficient and long term planning of construction. The limits are reduced till only three variants of excavators (server) and trucks (customer) are taken into account. The queuing theory formulae are simplified for practical applications in the construction industry using the queuing rule of thumb, and this is achieved through considering two case studies of concreting and earth moving, where two main components of the queue system are stated to be customers and servers. Also, it has been discovered that lower hiring or a lower number of servers or customers incurs loss. Cost is minimized only under optimal conditions for both customers and servers. It provides a simpler formula that can be easilymemorized[8,9]. However, the queuing rule of thumb only provides very rough approximations and it is rather conservative when compared to the standard stochastic queuing formula[3,6].

The irrigation canals are made from layers of clay soil. For the first one to be irrigated, it is necessary to extend the land with the grader by a second step, and finally, the compactor leaves the task finished to start the process over time. 4 Axle trucks have more performance in the first layers, but perform less for second layers due to reduced Space. The performance varies according to the system configuration[7].

2. Materials and Methods

A simulation model was created to find out whether or not the given combination of loader and truck equipments could move a given amount of clay soil depending on the teams of Land fillings worked, take into account the swelling rate of around 18% as obtained by laboratory tests of soil mechanics. Assumptions made for creating input data simulation model they are in Table 1.

The goal of this calculus is to have a predicted model arrives on a queuing system using MS Excel.

This model follows an exponential assumption of service work of various loaders. A (M/M/c), this kind of models its allow to apply not only tracks systems, either other kind of chain works.

2.1 Model Proposed

Loader number determinate the truck rate arrivals and the performance system. Which is the most important factor to evaluate the efficacy systems, that is determinate by loaders numbers. So λ (arrival rate) forwards μ (Load/hour) will be a relationship by input[3,10,11].

$$r = \lambda / \mu \qquad (1)$$

$$\rho = r/c = \lambda / c\,\mu \qquad (2)$$

$$P_O = \sum_{n=0}^{C-1} \frac{r^n}{n!} + \left(\frac{r^c}{c!\,(1-\rho)}\right)^{-1} \qquad (3)$$

$$L_q = \left(\frac{r^c}{c!\,(1-\rho)}\right) P_0 \qquad (4)$$

$$L = \lambda\, W \qquad (5)$$

$$La = \lambda\, W_q \qquad (6)$$

$$W_q = \left(\frac{r^c}{c!\,(c\mu)(1-\rho)^2}\right) P_0 = L_q/\lambda \qquad (7)$$

$$W_q = \frac{1}{\mu} + \left(\frac{r^c}{c!\,(c\mu)(1-\rho)^2}\right) P_0 \qquad (8)$$

Where "Po" is the probability being idle, "c" is the number of loaders, "L" is the trucks numbers, "λ" is the arrived rate, "Us" is the expected waiting time for a customer in the system, "Wq" is the expected waiting time in queue, "Las" is the expected number of customers in the system or length of the system, "La" is the expected number of customers in queue, "Of" is the utility factor, "μ" is the service pattern, "C" is the number of servers in the system which is the arrival rate and "N" is the trucks numbers systems.

Table 1. Input data simulation

Input data	Value	Notes
Time to make a round trip	18 minutes	Average
Daily excavation	2.320 m^3	Target
Distance from clay soil to agricultural soil	610 m	Average
Time working day	10 hours	Average
The loading capacity	28 ton	Average
Time to load into a truck	3,8 minutes	Target
Time needed to unload	5,4 minutes	Average
Time stop at each intersection on the road network.	1 to 2 minutes	Approximate
The truck's speed	25 km/hr	Average

2.1.1 Constructions Process

The purpose of this paper is to predict a model to minimize working hours and reduce greenhouse gas emission by using mathematical models, because all the construction process is needed to be supported the multimedia elements[12,13].

A time event is a convenient way to generate random arrivals to a process[14,15]. A time event is fired automatically according to a specified time pattern. This time pattern can be either a stationary or a non-stationary pattern. In the case of a stationary pattern the properties specify the time of the first event, the time between each successive event, and the maximum number of events to fire[16].

A model can be developed for this purpose. In order to reduce the idle time of the server, the arrival rates have to be increased[15–17]. This can be achieved by improving the efficiency and capacity of the servers[7]. On the other hand, to reduce the waiting time of customers, the service time is reduced (by using more efficient server or wit a server of higher capacity)[17].

2.2 Data Out

Appropriate inputs do output, optimal values, especially loader number and rate time for arrival. Work sequence to create land layers is previously extracted by Bulldozer which moves the land to be amazed with water before charging into the trucks[7,18,19]. Equipments include Loader, Bulldozer and Irrigation Truck in Quarry area, by the other hand Grader, Irrigation Truck, Compactor and Trucks 4 axes in the Clay spreading area[7,19,20]. The Loader numbers are always associated a truck number to avoid the maximum time queuing. Loader varies with number clay spread, total truck capacity transportation is according to the system (Figures 2, 3, 4, 5).

The total capacity of the clay soil transportation system depend on the equipment capacity. This will be directly impact cost and green house green emissions. Definitely performance system depends the numbers Trucks and shovel bucket capacity[18] (Figure 6).

3. Results

The work systems are composed by in determinate the number of machines which compact more over meters

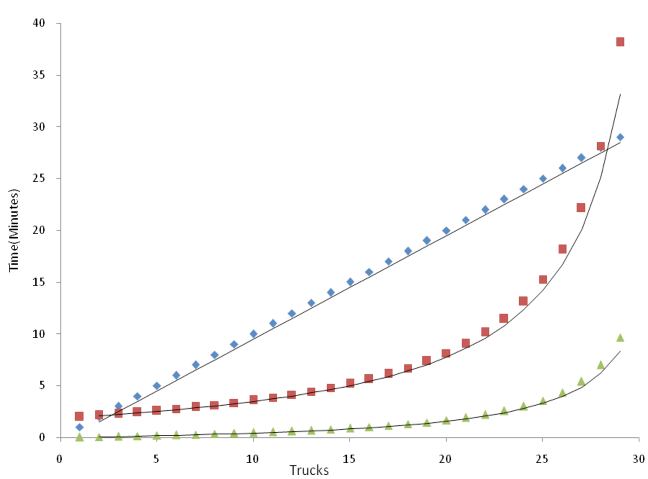


Figure 2. Cyclic queuing system, 1 parallel loaders, shovel bucket 1,25 m^3.

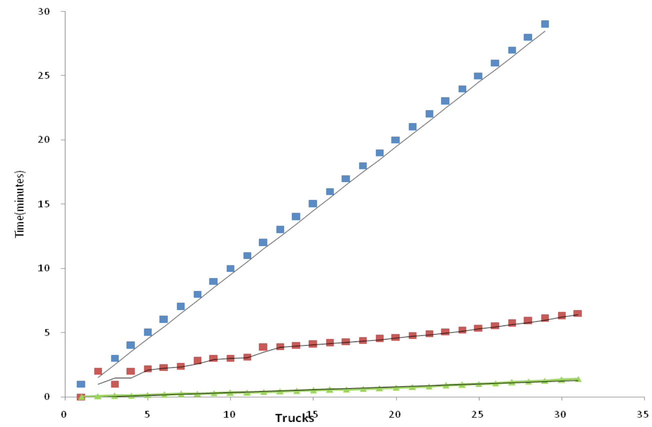


Figure 3. Cyclic queuing system, 1 parallel loaders, shovel bucket 1,25 m^3.

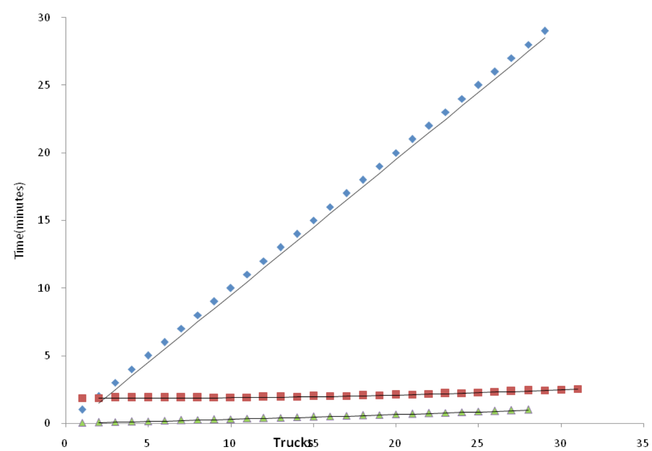


Figure 4. Cyclic queuing system, 3 parallel loaders, shovel bucket 1,25 m^3.

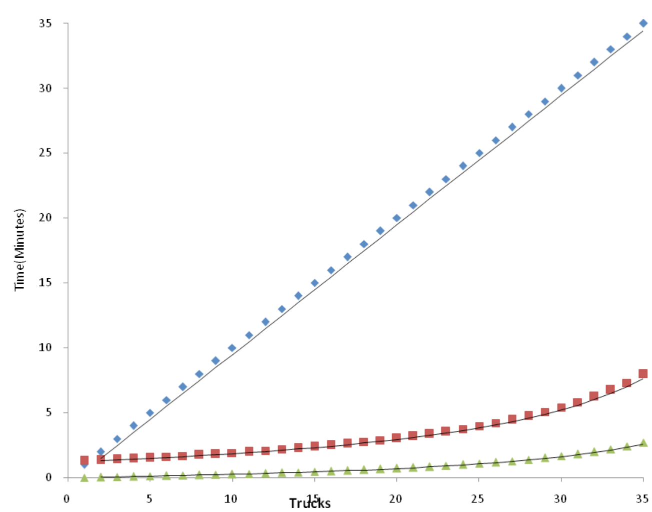


Figure 5. Cyclic queuing system, 1 parallel loaders, shovel bucket 2,45m^3.

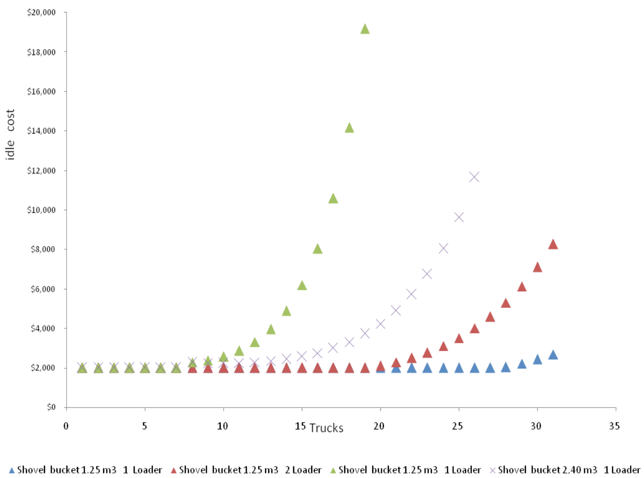


Figure 6. Total amount lost due to idleness with change in arrival rate.

Table 2. Results of simulation

Loader	As loaders numbers increases (shovel bucket capacity 1.25 m)³		One loader (shovel bucket of 2.40 m³)	
	Time minutes	CFD Emited Kg/CO_2	Time minutes	CFD Emited Kg/CO_2
One loader	427	2,43	473,48	1,13
Two loaders	76,71	2,17		
Three Loaders	64,38	1,97		

cubic of clay soil as equips have and increases his clay soil loader capacity. Results are shown in Table 2.

The first system increases the resource system by adding loaders, considering 32 Loads/hour and the loader needs an equipe to spread and compact the clay soil. Meanwhile, the second system completes the whole process with one loader with a bigger shovel bucket and 48 Loads/hour. By the other hand difference delay time between first and second is not lineal equally to emitted emissions green house.

This means that in the first case (shovel bucket capacity1.25 m³) as we increase the equipment we have more performance and hence shortened the waiting time. Meanwhile by the second system (shovel bucket of 2.40 m³) obviously has queuing time highest, but emissions increase of first systems are over 74% to save 60% of delay.

Table 3. 1 Loader shovel bucket 1,25 m³

μ	λ	Po	% Utilitation	Ls	Lq	N	Ws	Wq	Total
32	1	0,97	3%	0,03	0,00	0,03	0,03	0,00	2,00
32	2	0,94	6%	0,07	0,00	0,07	0,03	0,00	2,13
32	3	0,91	9%	0,10	0,01	0,11	0,03	0,00	2,26
32	4	0,88	13%	0,14	0,02	0,16	0,04	0,00	2,41
32	5	0,84	16%	0,19	0,03	0,21	0,04	0,01	2,57
32	6	0,81	19%	0,23	0,04	0,27	0,04	0,01	2,74
32	7	0,78	22%	0,28	0,06	0,34	0,04	0,01	2,93
32	8	0,75	25%	0,33	0,08	0,42	0,04	0,01	3,13
32	9	0,72	28%	0,39	0,11	0,50	0,04	0,01	3,34
32	10	0,69	31%	0,45	0,14	0,60	0,05	0,01	3,58
32	11	0,66	34%	0,52	0,18	0,70	0,05	0,02	3,84
32	12	0,63	38%	0,60	0,23	0,83	0,05	0,02	4,13
32	13	0,59	41%	0,68	0,28	0,96	0,05	0,02	4,44
32	14	0,56	44%	0,78	0,34	1,12	0,06	0,02	4,79
32	15	0,53	47%	0,88	0,41	1,30	0,06	0,03	5,18
32	16	0,50	50%	1,00	0,50	1,50	0,06	0,03	5,63
32	17	0,47	53%	1,13	0,60	1,74	0,07	0,04	6,13
32	18	0,44	56%	1,29	0,72	2,01	0,07	0,04	6,70
32	19	0,41	59%	1,46	0,87	2,33	0,08	0,05	7,36
32	20	0,38	63%	1,67	1,04	2,71	0,08	0,05	8,13
32	21	0,34	66%	1,91	1,25	3,16	0,09	0,06	9,03
32	22	0,31	69%	2,20	1,51	3,71	0,10	0,07	10,13
32	23	0,28	72%	2,56	1,84	4,39	0,11	0,08	11,46
32	24	0,25	75%	3,00	2,25	5,25	0,13	0,09	13,13
32	25	0,22	78%	3,57	2,79	6,36	0,14	0,11	15,27
32	26	0,19	81%	4,33	3,52	7,85	0,17	0,14	18,13
32	27	0,16	84%	5,40	4,56	9,96	0,20	0,17	22,13
32	28	0,13	88%	7,00	6,13	13,13	0,25	0,22	28,13
32	29	0,09	91%	9,67	8,76	18,43	0,33	0,30	38,13
32	30	0,06	94%	15,00	14,06	29,06	0,50	0,47	58,13
32	31	0,03	97%	31,00	30,03	61,03	1,00	0,97	118,13

4. Discussion and Conclusions

Agriculture area has 28.000 m³ of compacted clay soil for canals and dams with swelling coefficient which needs 33.500 m³ to move, that's over 3.400 trucks cycles. Figure 6 shows the minimum truck number to systems works within economical performance[18,19], this was applied to Tables 3-6 which detail the idle cost per system, loader number and shovel bucket capacity.

Table 4. 2 loader shovel bucket 1,25 m³

μ	λ	Po	% Utilitation	Ls	Lq	N	Ws	Wq	Total
32	1	0,97	3%	0,03	0,00	0,03	0,03	0,0000	1,88
32	2	0,94	6%	0,06	0,00	0,06	0,03	0,0001	1,88
32	3	0,91	9%	0,09	0,00	0,09	0,03	0,0001	1,89
32	4	0,88	13%	0,13	0,00	0,13	0,03	0,0002	1,90
32	5	0,85	16%	0,16	0,00	0,16	0,03	0,0004	1,92
32	6	0,82	19%	0,19	0,00	0,19	0,03	0,0005	1,94
32	7	0,79	22%	0,22	0,01	0,23	0,03	0,0007	1,96
32	8	0,76	25%	0,26	0,01	0,27	0,03	0,0010	1,99
32	9	0,73	28%	0,29	0,01	0,30	0,03	0,0012	2,02
32	10	0,70	31%	0,33	0,02	0,34	0,03	0,0015	2,06
32	11	0,67	34%	0,36	0,02	0,38	0,03	0,0018	2,09
32	12	0,65	38%	0,40	0,03	0,43	0,03	0,0022	2,13
32	13	0,62	41%	0,44	0,03	0,47	0,03	0,0025	2,18
32	14	0,59	44%	0,48	0,04	0,52	0,03	0,0029	2,22
32	15	0,57	47%	0,52	0,05	0,57	0,03	0,0033	2,28
32	16	0,55	50%	0,56	0,06	0,62	0,04	0,0038	2,33
32	17	0,52	53%	0,60	0,07	0,68	0,04	0,0043	2,39
32	18	0,50	56%	0,65	0,09	0,73	0,04	0,0048	2,45
32	19	0,48	59%	0,69	0,10	0,80	0,04	0,0053	2,51
32	20	0,46	63%	0,74	0,12	0,86	0,04	0,0059	2,58
32	21	0,44	66%	0,79	0,14	0,93	0,04	0,0065	2,65
32	22	0,42	69%	0,84	0,16	1,00	0,04	0,0071	2,73
32	23	0,40	72%	0,90	0,18	1,08	0,04	0,0078	2,81
32	24	0,38	75%	0,95	0,20	1,16	0,04	0,0085	2,89
32	25	0,36	78%	1,01	0,23	1,24	0,04	0,0092	2,98
32	26	0,34	81%	1,07	0,26	1,33	0,04	0,0100	3,08
32	27	0,33	84%	1,14	0,29	1,43	0,04	0,0108	3,17
32	28	0,31	88%	1,20	0,33	1,53	0,04	0,0117	3,28
32	29	0,29	91%	1,27	0,37	1,64	0,04	0,0126	3,39
32	30	0,28	94%	1,34	0,41	1,75	0,04	0,0135	3,50
32	31	0,26	97%	1,42	0,45	1,87	0,05	0,0146	3,62

The rate of performance between system capacities and work delays clearly increase as less equipment is used, as shown in Figure 7; otherwise the carbon footprint of minimum greenhouse emissions is 37.873 Kg/CO_2 for one loader with a shovel bucket of 2.40 m³ (Figures 8, 9).

Table 5. 3 loader shovel bucket 1,25 m³

μ	λ	Po	% Utilitation	Ls	Lq	N	Ws	Wq	Total
32	1	0,97	3%	0,03	0,00	0,03	0,03	0,0000	1,88
32	2	0,94	6%	0,06	0,00	0,06	0,03	0,0000	1,88
32	3	0,91	9%	0,09	0,00	0,09	0,03	0,0000	1,88
32	4	0,88	13%	0,13	0,00	0,13	0,03	0,0000	1,88
32	5	0,85	16%	0,16	0,00	0,16	0,03	0,0000	1,88
32	6	0,83	19%	0,19	0,00	0,19	0,03	0,0001	1,88
32	7	0,80	22%	0,22	0,00	0,22	0,03	0,0001	1,89
32	8	0,77	25%	0,25	0,00	0,25	0,03	0,0001	1,89
32	9	0,74	28%	0,28	0,00	0,29	0,03	0,0002	1,90
32	10	0,72	31%	0,32	0,00	0,32	0,03	0,0003	1,91
32	11	0,69	34%	0,35	0,00	0,35	0,03	0,0004	1,92
32	12	0,66	38%	0,38	0,01	0,39	0,03	0,0005	1,93
32	13	0,64	41%	0,41	0,01	0,42	0,03	0,0006	1,95
32	14	0,61	44%	0,45	0,01	0,46	0,03	0,0007	1,96
32	15	0,59	47%	0,48	0,01	0,50	0,03	0,0009	1,98
32	16	0,56	50%	0,52	0,02	0,53	0,03	0,0011	2,00
32	17	0,54	53%	0,55	0,02	0,57	0,03	0,0012	2,02
32	18	0,52	56%	0,59	0,03	0,61	0,03	0,0014	2,05
32	19	0,49	59%	0,63	0,03	0,66	0,03	0,0017	2,08
32	20	0,47	63%	0,66	0,04	0,70	0,03	0,0019	2,10
32	21	0,45	66%	0,70	0,05	0,75	0,03	0,0022	2,13
32	22	0,43	69%	0,74	0,05	0,79	0,03	0,0024	2,17
32	23	0,41	72%	0,78	0,06	0,84	0,03	0,0027	2,20
32	24	0,39	75%	0,82	0,07	0,89	0,03	0,0030	2,24
32	25	0,37	78%	0,86	0,08	0,95	0,03	0,0033	2,27
32	26	0,35	81%	0,91	0,09	1,00	0,03	0,0037	2,31
32	27	0,33	84%	0,95	0,11	1,06	0,04	0,0040	2,35
32	28	0,31	88%	1,00	0,12	1,12	0,04	0,0043	2,40
32	29	0,30	91%	1,04	0,14	1,18	0,04	0,0047	2,44
32	30	0,28	94%	1,09	0,15	1,24	0,04	0,0051	2,48
32	31	0,26	97%	1,14	0,17	1,31	0,04	0,0055	2,53

Despite one loader system with a shovel bucket of 2.40 m³ having long delays- the cost of works using the system is as shown in Figure 10. Second system is the most profitable, Figure 11 shows the carbon footprint performance.

Table 6. 1 loader shovel bucket 2,40 m^3

μ	λ	Po	% Utilitation	Ls	Lq	N	Ws	Wq	Total
48	1	0,98	2%	0,02	0,00	0,02	0,02	0,00	1,30
48	2	0,96	4%	0,04	0,00	0,05	0,02	0,00	1,36
48	3	0,94	6%	0,07	0,00	0,07	0,02	0,00	1,42
48	4	0,92	8%	0,09	0,01	0,10	0,02	0,00	1,48
48	5	0,90	10%	0,12	0,01	0,13	0,02	0,00	1,54
48	6	0,88	13%	0,14	0,02	0,16	0,02	0,00	1,61
48	7	0,85	15%	0,17	0,02	0,20	0,02	0,00	1,68
48	8	0,83	17%	0,20	0,03	0,23	0,03	0,00	1,75
48	9	0,81	19%	0,23	0,04	0,27	0,03	0,00	1,83
48	10	0,79	21%	0,26	0,05	0,32	0,03	0,01	1,91
48	11	0,77	23%	0,30	0,07	0,37	0,03	0,01	1,99
48	12	0,75	25%	0,33	0,08	0,42	0,03	0,01	2,08
48	13	0,73	27%	0,37	0,10	0,47	0,03	0,01	2,18
48	14	0,71	29%	0,41	0,12	0,53	0,03	0,01	2,28
48	15	0,69	31%	0,45	0,14	0,60	0,03	0,01	2,39
48	16	0,67	33%	0,50	0,17	0,67	0,03	0,01	2,50
48	17	0,65	35%	0,55	0,19	0,74	0,03	0,01	2,62
48	18	0,63	38%	0,60	0,23	0,83	0,03	0,01	2,75
48	19	0,60	40%	0,66	0,26	0,91	0,03	0,01	2,89
48	20	0,58	42%	0,71	0,30	1,01	0,04	0,01	3,04
48	21	0,56	44%	0,78	0,34	1,12	0,04	0,02	3,19
48	22	0,54	46%	0,85	0,39	1,23	0,04	0,02	3,37
48	23	0,52	48%	0,92	0,44	1,36	0,04	0,02	3,55
48	24	0,50	50%	1,00	0,50	1,50	0,04	0,02	3,75
48	25	0,48	52%	1,09	0,57	1,65	0,04	0,02	3,97
48	26	0,46	54%	1,18	0,64	1,82	0,05	0,02	4,20
48	27	0,44	56%	1,29	0,72	2,01	0,05	0,03	4,46
48	28	0,42	58%	1,40	0,82	2,22	0,05	0,03	4,75
48	29	0,40	60%	1,53	0,92	2,45	0,05	0,03	5,07
48	30	0,38	63%	1,67	1,04	2,71	0,06	0,03	5,42
48	31	0,35	65%	1,82	1,18	3,00	0,06	0,04	5,81
48	32	0,33	67%	2,00	1,33	3,33	0,06	0,04	6,25
48	33	0,31	69%	2,20	1,51	3,71	0,07	0,05	6,75
48	34	0,29	71%	2,43	1,72	4,15	0,07	0,05	7,32
48	35	0,27	73%	2,69	1,96	4,66	0,08	0,06	7,98
48	36	0,25	75%	3,00	2,25	5,25	0,08	0,06	8,75
48	37	0,23	77%	3,36	2,59	5,96	0,09	0,07	9,66
48	38	0,21	79%	3,80	3,01	6,81	0,10	0,08	10,75
48	39	0,19	81%	4,33	3,52	7,85	0,11	0,09	12,08
48	40	0,17	83%	5,00	4,17	9,17	0,13	0,10	13,75
48	41	0,15	85%	5,86	5,00	10,86	0,14	0,12	15,89
48	42	0,13	88%	7,00	6,13	13,13	0,17	0,15	18,75
48	43	0,10	90%	8,60	7,70	16,30	0,20	0,18	22,75
48	44	0,08	92%	11,00	10,08	21,08	0,25	0,23	28,75
48	45	0,06	94%	15,00	14,06	29,06	0,33	0,31	38,75
48	46	0,04	96%	23,00	22,04	45,04	0,50	0,48	58,75
48	47	0,02	98%	47,00	46,02	93,02	1,00	0,98	118,75

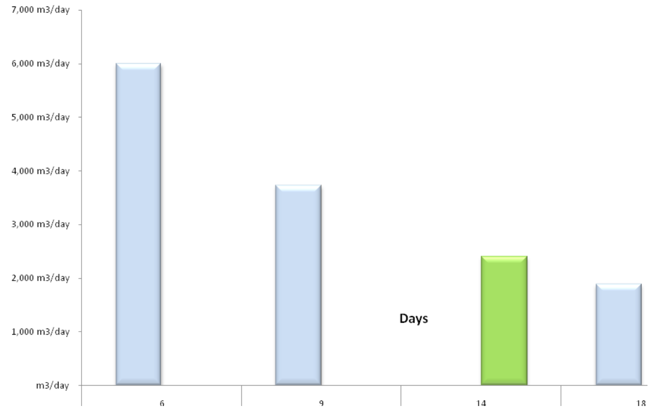


Figure 7. Daily performance system.

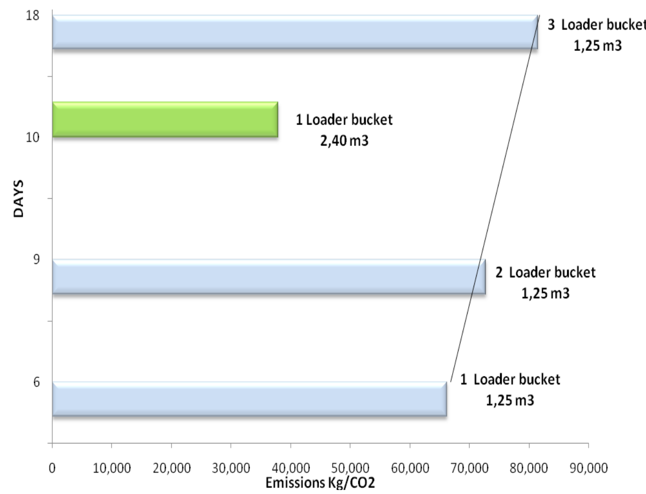


Figure 8. Carbon footprint 3 loader system quarry and clay spreading.

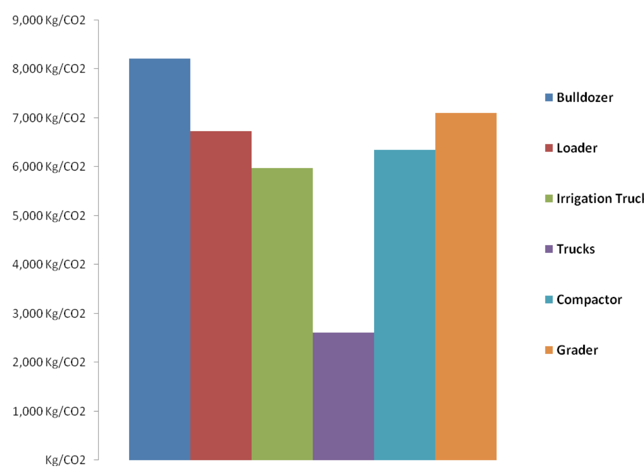


Figure 9. Carbon footprint 1 loader system quarry and lay spreading.

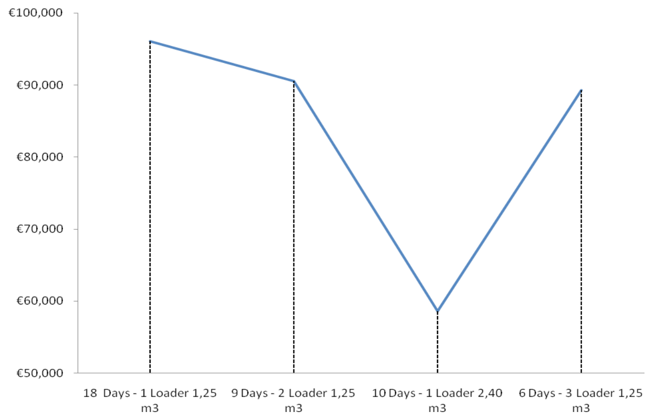


Figure 10. Works total cost performance systems.

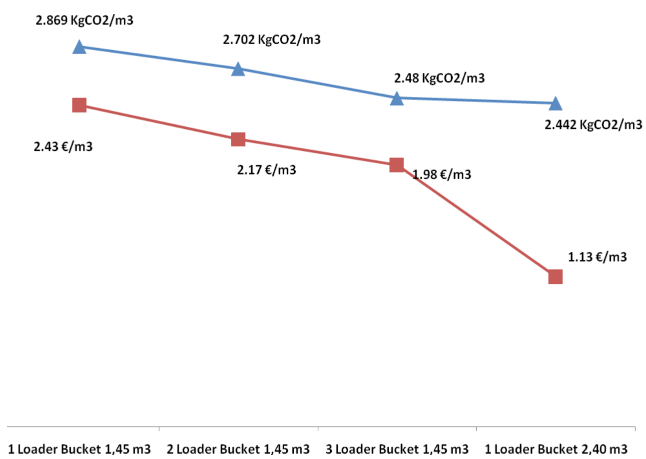
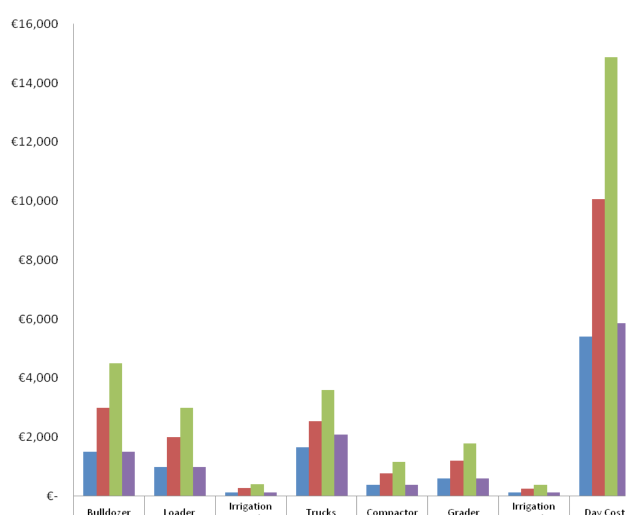


Figure 11. Metre cubic rate estimation.



	Bulldozer	Loader	Irrigation Truck	Trucks	Compactor	Grader	Irrigation Truck	Day Cost
1 Loader 1,25 m3	€1,500	€1,000	€140	€1,650	€390	€600	€130	€5,410
2 Loader 1,25 m3	€3,000	€2,000	€280	€2,550	€780	€1,200	€260	€10,070
3 Loader 1,25 m3	€4,500	€3,000	€420	€3,600	€1,170	€1,800	€390	€14,880
1 Loader 2,40 m3	€1,500	€1,000	€140	€2,100	€390	€600	€130	€5,860

Figure 12. Daily cost system.

The working system cost by engine is shown in Figure 12, which is directly related to the greenhouse emissions of the different models studied. Meanwhile, the delay is not proportional to the improvement in the environmental system.

5. Conclusions

Trace greenhouse emissions in the agriculture works in Africa has an important consequence of global and environmental process. Mainly two variables data use to determinate greenhouse emissions, first one is equipment numbers and Bucket Shovel size. Increasing machine system of works permit gain in delay 300% time by shovel bucket 1.25 m^3, this increase is associated with 30% over the cost. Comparison with other system with shovel bucket 2.40 m^3 is already a 180% time less performance and 67% more economic. Definitely the economic greenhouse emission, by one loader shovel bucket 2.40 m^3 is 53.47% more performance than the more fast system composed by 3 loaders with shovel bucket 1.25.

Agricultural and trade policies in many cases have caused environmental harm by distorting price signals through and lowering the costs of inputs, such as energy and increases of pollution in process, by the other hand environmental processes relate to the interaction between agriculture and natural environmental processes. Particularly relevant in this respect, is that agriculture parcels forms a part of the ecosystem rather than being external to it, unlike most other economic activities.

6. References

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