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Research Article

MODELING THE ALLOCATION OF RESOURCES IN A TYPICAL PRODUCTION UNIT

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ABSTRACT

The allocation of limited resources is the key to the success of a given production process and its maintenance. By reducing costs, companies can derive a decisive and immediate competitive advantage. We aim to model the allocation of resources in a typical production unit in order to be able to propose improvements at a later stage. A model: workers, resources, tasks will be adopted as part of our model. Once developed, this model can be the starting point for further optimization efforts aimed at any component of the value chain of any production process.

INTRODUCTION

The allocation of resources is of paramount importance in the production process. Resources are intrinsically limited. Therefore, their distribution needs to be optimized in order to meet the following challenges:

1. Minimize capital expenditure gold Capital expense, CAPEX) [1,2].
2. Optimize permanent (non-depreciable) expenses in terms of variable cost of production (operating expense, Operating expenditure, Operational expense, Operational expenditure gold Opex) [3,4,5].
3. Improve performance in terms of HSE (Health, Safety and Environment) [6,7]

In this work, we focus on the modeling of the allocation of resources in a typical production unit. The objective of this paper is to maximize production by considering the following model: A given number of workers, use a given number of resources, in order to be able to perform a given number of tasks. Tasks can vary from production, to maintenance or support functions. Our goal is to introduce the novice player to a problem of optimizing limited resources by using the standard tools of operations research in a simple and comprehensive approach. The experienced reader is endowed throughout this report with a manageable interactive tool that can be made even more sophisticated by increasing the number of variables and variability. It should be noted that a considerable effort has been made so that mathematicians and interested parties far from the field of application studied can find in our work of scientific matter formulated in a simple way. Experts from production units may object to the validity of a number of assumptions. We invite them to contact the authors.

Presentation of the Models

We perform the optimization on the interval of a work station (between 8hr and 12hr) and summarize the parameters used in our approach, as well as their notation in Table 1:

Objective of Optimization

The optimization program takes as input the places where the tasks are performed, the places where resources are endowed, and the workers with their characteristics and aim to give as output the assignment translated in terms of. It should be noted that our approach will allow an exchange between unknowns and parameters according to the need of the user: This is outside the perimeter of the report [13,14,15].

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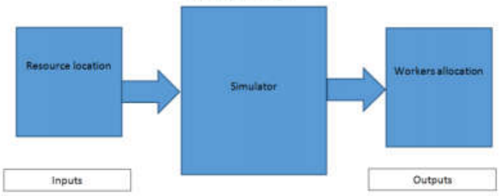
Parameter	Notation or significance
A Resource Endowment Site	Varies with the different fields of application
D	The number of tasks
producitvite	The total productivity achieved on the production unit being studied
i, between 1 and D	A task *i*
Productivite_i	Productivity during the task
M	The number of resources in the production unit being studied.
J, between 1 and M	A Resource Endowment Site
N_ij	The number of workers assigned between the place of performance of the task And the resource endowment
L, between 1 and n_ij	Worker Assigned between the place where the task was And the resource endowment.
C_l	Capacity in terms of worker productivity
N_ijl	The productivity achieved by, Which is assigned the place of performance of the task And the resource endowment.
C_ijl	The cycle carried out by the worker, Which is assigned the place of performance of the task And the resource endowment.
D_ijl	The distance traveled (it is possible to include the various difficulties to be overcome in order to be able to carry out a given task [8,9]) by the worker The place where the task was carried out And the resource endowment.
T_p	Duration of the workstation (typically 8hr for three shifts per day, or 12hrs for two shifts per day)
	Mean velocity (one can include the operative efficiency [10,11,12]) of the workers in the production unit studied

We illustrate the approach as follows

Tableau 2: optimization goal



We schematize the optimization problem in question as follows

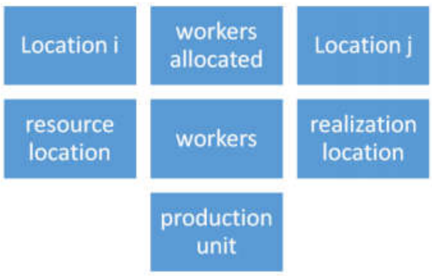


Figure 1: Optimization Framework

Formulation

In the discussion cited above, we explained that our objective is to maximize the function productivity which can be represented as following:

$$productivite = \sum_{i=1}^{D} productivite_{i}$$

n: Number of tasks.

The producitivite _ *i* Associated with the place of performance of tasks, comes from all resource endowment sites *j*. Moreover, between the place where tasks are carried out *i* and a place for performing tasks j ago Affected workers. Each worker the workers from the place of performance of tasks and place of realization of tasks carried a total number of tasks and has a capcaité in producitivté. Therefore, producitivite_*i* can be written as follows:

$$productivite_{\,i} = \sum_{j=1}^{M} \sum_{l=1}^{n_{ij}} N_{ijl} C_j$$

The number of tasks carried out by the worker, which is assigned between the place where tasks are carried out and the place where tasks are carried out, can be written according to the cycle as follows:

$$N_{ijl} = \frac{T_p}{C_{ijl}}$$

In addition, the cycle of said worker, can also be written as follows:

$$C_{ijl} = \frac{d_{ijl}}{v}$$

Thus, a producitivite associated linker realization in question can be written as follows:

$$productivite_{\,i} = vT_p \sum_{j=1}^{M} \sum_{l=1}^{n_{ij}} \frac{C_j}{d_{ijl}}$$

In the end, our objective productivite can be written as follows:

$$\mathbf{productivite} = vT_p \sum_{i=1}^{D} \sum_{j=1}^{M} \sum_{l=1}^{n_{ij}} \frac{C_j}{d_{ijl}}$$

CONCLUSION

In this work, we successfully modeled the resources allocation in a typical production unit. This achievement can have the following uses:

- Reduce costs by eliminating leaks and losses.

- Easily evaluate workers on quantifiable basis.
- Develop software to solve the optimization problem.
- Automatically allocate resources in a resource-short environment.

In future work, we aim to implement our method in user-friendly software and apply it to real data. Preliminary results have shown a significant reduction of OPEX without a need to heavy investment in CAPEX."

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