

A New Approach for Solving the Absenteeism Phenomenon in Industrial Activities

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Abstract— Management of Human Factor is a key point in the competitiveness of companies with a large production capacity based on operator. The efficient use and management of these resources is essential to meet the company's performance objectives. In this article we will present, first, the research work on the problem of resource allocation under constraints, more precisely the work which took into account the impact of the integration of skills, preferences and the Polyvalence or the joint integration of these constraints in the problems linked to the allocation of human resources. Second, the works that deals with the phenomenon of absenteeism. Finally, we will propose a methodological approach allowing the resolution of the problem of allocation of human resources under absenteeism constraints for industrial Activities.

Resource allocation, Skills, Preferences, Polyvalence, Absenteeism, AHP.

I- INTRODUCTION

Management of Human Factor is a new topic in Morocco not only micro-economically but also macro-economically and whose impact is significant on the performance of companies, and a need as companies face several obstacles in the industrial world .In this regard. Companies need to be flexible and have an effective management mode of their human resources to be competitive. The multiple researches [1]-[2]-[3] carried out on the problem of allocation of human resources prove more of the importance given to the management of human capital. This research is interested in integration, competence, preference, or polyvalence, or the combined integration of competence and preference in the issue of allocation candidates to workstations. To our best knowledge, no author has studied the integration of the three constraints simultaneously for the problems related to the problem of allocation of resources.

From our research, we have noticed that the combined integration of the three constraints has never been treated. In Resource allocation issues, the existing work is essentially about the integration of the two Criteria, namely competence and preference, competence and polyvalence. In the article [Sabar, 2008] [4], the problem of allocation operators in an assembly line has been treated by proposing a modeling of the problem of flexible assignment of the operators on an assembly line while holding account of the two constraints, preferences and skills of the operators. In 2007, [Gutjahr and Rauner] [5] studied the construction of a schedule that meets both the preferences of the nurses and the needs of each shift in terms of the number of nurses of all types, grades, [Peters and Zelewski] [6], tried to solve the constraint assignment problem (skills and preferences) using the AHP method. [Raoudha, 2011] [7] Was interested in proving a correspondence between the demands of tasks and the skills acquired by human resources without eliminating the constraint preferences. To do this, he used an algorithm based on the combination of the benefits of the bee algorithm and the immune system to solve the problem. [Kharbach, 2016] [8] Interested in the assignment process of preventive maintenance tasks for which the allocation and resource displacement choices are given by CA simulation, taking into account the polyvalence of a maintenance agent as a Competency character.

Many authors ([BEHREND, H in 1959] [9], [VAN CAUWELAERT, C. and B. CORNIETY] [10], [HEDGES, JN in 1977] [11] and [J. GANDZ in 1979] [12]) considered absenteeism as a time taken away from productive activity, and has a negative if not "dangerous" impact on the operating conditions of companies, they linked absenteeism to employee satisfaction and motivation. However, our work dealt with this phenomenon on the industrial performance side and its impact on the daily management of the team.

II- OPTIMIZATION OF ALLOCATION OF RESOURCES UNDER ABSENCE CONDITIONS.

A- Problematic And Analysis of the situation:

1) Problematic

In this work, we study the case of a large-scale operator-oriented manufacturing company. The company suffers from the impact of absenteeism of production operators on the performance of the production workshop. Indeed, the production manager needs every day to reorganize the production services and to select from several operators the right candidates to build an operational team without impacting the indicators of the Efficiency service, TRS, IPPM...

The phenomenon of absenteeism is random. Indeed, the manager must study daily the various policies of allocation of available human resources according to their skills and their degrees of Polyvalence.

To do this, we are more particularly interested in the workstation assignment processes for which the assignment decisions are made on the basis of the results of the simulation by the AHP method, while taking into account the following constraints: Skills (the know-how of the operator at the workstation), Polyvalence (Number of positions that the operator can execute) and the presence of the operator (Absent or present).

2) Analysis and Proposed Solution

a- Absenteeism rate.

The absenteeism rate expresses an indicator that is calculated by establishing the ratio between the hours of absence and the theoretical conventional hours of work.

For the case of the company to study:

- The workshop contains 280 direct operators, 22 indirect operators and 12 managers.
- Working days per month (follow-up duration): March (26 days), April (24 days), May (20 Days), June (26 Days), July (24 Days), August (15 Days).
- The target set by the company is 1% absence.

There are unpaid absences, such as absences due to illness, days of strike, accidents at work and commuting and leave for occupational disease. However, there are absences paid for by the company, which are most of the times characterized by the ASPs "Special Paid Authorization" we cite; maternity and parental leave, family solidarity, death of a loved one, absences for legal obligations.

Absenteeism is a ration that can be expressed as follows:

- Number of days of absence (or hours) during a period x / Number of theoretical days (or hours) during the same period.
- Average duration of absences: Hours of absence / Average workforce
- The frequency of absences: Number of absences / Average workforce

They are very significant measuring instruments and essential for any analysis of absenteeism, allows companies to compare themselves with national statistics. They can be calculated for the company as a whole, but also for a given department, department, category or status of employees. These are major tools that allow the company to locate itself, but also to locate where its problems lie internally.

After 6 months of presence in the production workshop we found the following results:

We are particularly interested in the absenteeism rate of the MOD direct workforce since they are operators who generate added value for the company and their absence directly impacts the performance of the workshop. Indeed, an absent operator means an empty workstation.

b- Calculation of the cost related to absenteeism.

Absent operators represent an unfair overhead for those present, as they affect the mood while generating additional costs, delays, and loss of efficiency.

We calculated the cost generated by the absence rate during the follow-up period:

Supposedly:

According to the calculation for 6 months of production, the company lost 53,290 equivalent pieces worth 6,395,811 MAD.

- The cost of recruiting an Operator in Morocco per month:

$2570 * 1.27 = 3263.9$ MAD therefore the cost of recruiting 16 operators is 313 334.4 MAD

By comparing the direct labor force) and the cost of the loss of efficiency linked to the phenomenon of absenteeism (cost of recruitment much lower than the cost of loss), we proposed to recruit absence replacements, and this will allow the manager to have a complete team to produce at Normal rate without loss of efficiency.

After having completed the production team, the manager finds himself faced with the problem of resource allocation; he must reorganize the team by allocating the available resources authorized to workstations.

In order to have a basis for the choice of allocation employees to the needs positions at the cutting workshop of the company studied, we have designed a synthesis and decision-making tool allowing such decisions to be taken. For this, we have adapted the problem of concrete allocation specific to this business context to the method of decision support Analytic hierarchy / Network Process, this method previously introduced is very useful and supporting both quantitative as well as qualitative criteria

B- AHP method for resolving of the Problem.

In order to have a basis for the choice of allocation employees to the positions needed at the cutting workshop of the company studied, we have designed a tool for synthesis and decision support to make such decisions. For this, we have adapted the problem of concrete and specific assignment to this business context to the decision support method Analytic hierarchy / Network Process, this method introduced before is very useful and supporting both quantitative and qualitative criteria.

1) Modeling of problem.

The first step is to model the problem by introducing all the influencing criteria. This structure will be the basis of all our calculations. There may be one or more levels of sub-criteria; the goal is to go through all the factors that come into play with the problem.

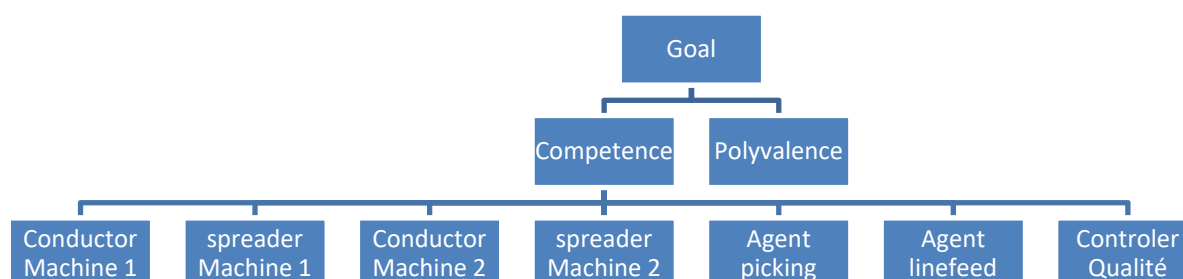


Fig. 1 Modeling AHP of Problem

The modeling of the problem of assignment of the cutting workshop will arise as above, we notice that the goal is formed from the three criteria Competence, Polyvalence and Preference.

The competence of an operator is the level of mastery of a workstation, for our case study the competence is formed from seven criteria (there are seven workstations, Driver Machine 1, Machine 1, Driver 1 Machine 2, Quilting Machine 2, Linefeed Agent, Picking Agent and Quality Controller).

Polyvalence (Polyvalence) is defined from all of these skills (The Polyvalence rate of an operator is number of positions mastering the total of positions).

2) Parametrize

Parametrize level 1: In the first level defining the Goal function, the importance of the three criteria (Skill, Polyvalence and Preference) is judged based on our objective of Building an operational and seamless team.

Using the metalinguistic scale of the judgments proposed by Saaty, we judge the criteria two by two according to their importance and, according to our case; we gave the criteria the following values.

Skill: 9 (Competency is a factor that is extremely important to build is an operational team)

Polyvalence: 3 (Polyvalence is of moderate importance, since it does not have the same degree of priority as the other two criteria).

It is imperative to note that these judgments are unidirectional, that is to say that to reverse the meaning of the two compared criteria amounts to giving the opposite of the predicted judgment.

TABLE I. Judgments Matrix, Priority and Consistency level 1

Criteria	Polyvalence	Competence	Sum	VP
Polyvalence	0,4	0,3	0,7	0,4
Competence	0,6	0,6	1,3	0,6
Total	1,0	1,0		

The equation of the Goal function of the first level has become:

$$\text{GOAL} = \text{GOAL Function (Competence)} * 0,6 + \text{GOAL Function (Polyvalence)} * 0,4 \quad (1)$$

The next step serves to consolidate judgments, through a measure of the inconsistency of judgments that is done in three sub-steps:

- Computes the measure of consistency: By multiplying the original line of judgments, before normalization by the obtained priority vector divided by the current element in the priority vector, For this case we will have:

TABLE II. Normalized Judgments Matrix, Priority and Consistency Vector, Level 1

Criteria	Polyvalence	Competence	Sum	VP	Consistency
Polyvalence	0,4	0,3	0,7	0,4	2
Competence	0,6	0,6	1,3	0,6	2
Total	1,0	1,0			

- Calculation of the consistency index: we find: $CI = 0$.
 - Calculation of the consistency ratio: The calculation of the consistency index gives a value of zero ($CI = 0$). So it is not necessary to calculate the consistency ratio, that is automatically zero, $CR = 0$ and the judgments are acceptable since CR does not reach by 0.1.

Parametrize level 2: The second level contains the two Criteria, so in the same way we will set each criterion purpose function.

- The GOAL function of Polyvalence: is defined as the number of positions that the operator masters, to do this we have built a Competence Matrix of the workshop operators based on the skill scale C_{ij} defined by the business experts of the company:

- Trainer operators (he masters the workstation); corresponds to a skill level of 100%.
- Authorized operators (he masters the workstation); corresponds to a proficiency level of 75%.
- Trained operators; corresponds to a skill level of 50%.
- Operator in training or not yet trained; corresponds to a skill level of 0%.

Where:

Cij: the skill of the operator i at workstation j, (i, j) natural integers.

TABLE III. Workshop Cutting Polyvalence Matrix

Operator s	Competence							Polyvalence
	Machine 1 conductor	Spreader Machine 1	Machine 2 Conductor	Spreader Machine 2	Agent Picking	Agent linefeed	Quality Control	
497	75%	0%	75%	0%	0%	0%	75%	43%
584	0%	0%	0%	0%	0%	0%	75%	14%
692	0%	100%	0%	100%	0%	0%	100%	43%
741	75%	0%	0%	0%	0%	0%	75%	29%
745	75%	100%	75%	100%	75%	100%	100%	100%
820	75%	75%	0%	0%	75%	0%	75%	57%
851	75%	100%	0%	100%	0%	0%	100%	57%
864	100%	100%	100%	100%	100%	0%	100%	86%
866	75%	0%	0%	0%	0%	0%	75%	29%
876	0%	100%	0%	100%	0%	0%	75%	43%
889	75%	75%	0%	50%	0%	0%	75%	43%
891	75%	75%	0%	0%	75%	0%	75%	57%
892	100%	100%	100%	100%	0%	100%	100%	86%
922	75%	0%	0%	0%	0%	0%	75%	29%
1027	100%	100%	0%	0%	0%	0%	100%	43%
1119	75%	0%	75%	0%	0%	0%	75%	43%
1120	100%	100%	0%	0%	0%	100%	100%	57%
1157	0%	75%	0%	75%	0%	0%	75%	43%
1723	100%	100%	0%	0%	100%	0%	100%	57%
1740	75%	75%	0%	0%	0%	0%	75%	43%
1781	75%	0%	75%	0%	0%	0%	75%	43%
2125	75%	0%	0%	0%	0%	0%	75%	29%
2128	0%	0%	75%	0%	0%	0%	75%	29%
2126	0%	0%	75%	0%	0%	0%	75%	29%
2127	0%	0%	75%	0%	0%	0%	75%	29%
2064	75%	0%	0%	0%	0%	0%	75%	29%
2145	75%	50%	0%	0%	0%	0%	75%	29%
2148	0%	0%	75%	0%	0%	0%	75%	29%
2149	0%	75%	0%	75%	0%	0%	0%	29%
2168	75%	0%	0%	0%	0%	0%	75%	29%
2170	75%	0%	0%	0%	0%	0%	75%	29%
2178	0%	75%	0%	0%	0%	0%	0%	14%
2302	0%	75%	0%	0%	0%	0%	0%	14%

The equation of the GOAL function Polyvalence will be as follows:

GOAL = (Number of positions i whose Operator j competence is greater than 75%) / Total Number of Workstations

$$\sum (C_{ij}/n); C_{ij} \geq 75\% \quad (2)$$

• The GOAL function Competence (Skill): is defined by the set of competencies, so the judgments matrix at this level must express the decision-maker's need in terms of the desired skills (the station to be occupied). To simplify the calculation, we consider that the first level goal is to choose the Spreader Machine 1 (MM1) workstation. That is to say, this position is more important compared to all other positions.

So by following the same previous steps as the Goal Level 1 function we will have the following calculation:

TABLE IV. Standard Judgment Matrix, Priority Vector and Measured Consistency

Polyvalence	Conductor Machine 1	Spreader Machine 1	Conductor Machine 2	Spreader Machine 1	Agent Picking	Agent Linefeed	Contrôleur Qualité	Sum	Vecteur de Priorité	Consistency	Moyenne
Conductor Machine 1	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,47	0,07	7	0,07
Spreader Machine 1	0,60	0,60	0,60	0,60	0,60	0,60	0,60	4,20	0,60	7	0,60
Conductor Machine 2	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,47	0,07	7	0,07
Spreader Machine 1	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,47	0,07	7	0,07
Agent Picking	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,47	0,07	7	0,07
Agent Linefeed	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,47	0,07	7	0,07
Quality Controller	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,47	0,07	7	0,07
Sum	1	1	1	1	1	1	1		1		

In fact, we see that Machine 1 (MM1) is 0.6 or 60% of the Skill function, making it the highest priority in the selection.

The equation of the Competency Goal function will be as follows:

$$GOAL = C1*0,07+ C2*0,6+ C3*0,07+ C4*0,07+ C5*0,07+ C6*0,07+ C7*0,07 \quad (3)$$

3) Calculation of satisfaction GOAL / candidate

GOAL function “select the optimal candidate to occupy the conductor Machine 1 station”: In this final step, we calculate the degree of satisfaction of each Goal defined by candidate; this is calculated by multiplying the connecting factors between candidates and the lowest level of the criteria by the priority vectors defining each Goal, Criteria or sub criterion.

Equation (1) becomes:

$$GOAL = (C1*0,07+ C2*0,6+ C3*0,07+ C4*0,07+ C5*0,07+ C6*0,07+ C7*0,07)*0,6+ (\sum C_{ij}/n)*0,4.$$

TABLEAU VI. Degree of satisfaction of the Goal "functions station MMI".

Operator	Polyvalence	Satisfaction Competence Poste MMI	BUT MMI
497	43%	15%	26%
584	14%	5%	9%
692	43%	73%	61%
741	29%	10%	18%
745	100%	95%	97%
820	57%	60%	59%
851	57%	79%	70%
864	86%	94%	91%
866	29%	10%	18%
876	43%	72%	60%
889	43%	59%	52%
891	57%	60%	59%
892	86%	94%	90%
922	29%	10%	18%
1027	43%	74%	61%
1119	43%	15%	26%
1120	57%	80%	71%
1157	43%	55%	50%
1723	57%	80%	71%
1740	43%	55%	50%
1781	43%	15%	26%
2125	29%	10%	18%
2128	29%	10%	17%
2126	29%	10%	17%
2127	29%	10%	17%
2064	29%	10%	18%
2145	29%	40%	36%
2148	29%	10%	17%
2149	29%	50%	41%
2168	29%	10%	18%
2170	29%	10%	18%
2178	14%	45%	33%
2302	14%	45%	33%

The table above represents the level of satisfaction of the objective "Spreader Machine 1 shift C" for each operator in the workshop. So the operator (864, numbers) is the optimal candidate for this position.

According to this table we have a database of choice for the position in question that will allow us to choose the right candidate.

The goal is to select the right candidate to fill the vacant position due to the absence of an operator, only changes the Workstation (Machine 1 conductor, Machine 1 Spreader, Machine 2 conductor, Machine 2 Spreader, Picking Agent, linefeed Agent and Quality Controller) to have the optimal Candidate.

III- CONCLUSION

As part of our work, we have aimed. First, enrich the research base on the issue of resource allocation by highlighting the impact of the joint introduction of the two constraints on the allocation problem. Then, solve the problem of loss of productivity and efficiency due to absenteeism. Then, propose a new method of scheduling the workshop to take into account the different types of Constraints to react in real time to the vagaries of human resources management.

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