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Military manpower planning using a career path approach applied to the Belgian defense

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Abstract. In order to accomplish the missions of the organization, military manpower planning aims to provide the required workforce with the adequate competences and ranks. The military organization specificity is the hierarchical structure which restricts personnel movements and recruitments. Military manpower planning involves two logics: statutory logic and competence logic. We combine both logics into one integrated model, which allows the simultaneous optimization of the two logics. We model the military manpower using a career path approach where each soldier is assigned to one of the possible career paths. The model was applied to the Belgian military manpower. The model helps the human resources managers study the impact of different policies on the statutory and the competence levels. Furthermore, the model contributes to planning the future policies regarding job transfers and annual recruitment.

Keywords: Human resource management, Military manpower, Career paths, Goal programming

1 Introduction

The military organization is composed of a number of job positions which have to be occupied by soldiers. Certain characteristics are required for each job position. The military organization specificity is having a strict hierarchical structure. The personnel movement in the organization is restricted by some internal mobility rules. Also the recruitment is limited to the lowest rank [1][2]. Due to these strict rules, military manpower planning is very important. The military manpower planning aims to find the adequate human resources management policies to reach and maintain the required military manpower.

Wang describes effective military manpower planning as "there will continue to be sufficient people with the required competencies to deliver the capability output required by the Government at affordable cost"[3]. To be able to tackle a military manpower planning problem, a description of the specificity of the military manpower is needed.

The military organization needs personnel to occupy a number of job positions.

These job positions require that the occupant has specific characteristics. The most used characteristics are military ranks, affiliations and individual competences. Each of these characteristics can change or evolve through time. For example, the military rank advances with promotion, and competences are improved or new ones are gained through training.

Every soldier in the organization is recruited as a trainee. He undergoes a training to gain a basic competence in the military organization, which allows him to fulfill a job position. As his seniority increases, he is likely to get rank promotions and become eligible for other job positions. A soldier can also follow advanced training throughout his career to meet the requirements of job positions with higher responsibilities. The soldiers' career can terminate by a retirement, which corresponds to a natural attrition at the end of a career. In the case of unnatural attrition [4], the soldier leaves the organization under other circumstances such as medical issues.

Military manpower planning consists of two interdependent logics. It relies on statutory logic and competence logic. The statutory logic considers the manpower evolution on the strategic level. The strategic goal is attainability and/or maintainability [5]. The attainability concerns reaching a certain statutory manpower distribution. The maintainability is getting a steady state manpower distribution where we can ensure that the manpower is maintainable [6]. The statutory logic tackles the recruitment, promotion and retirement policies in order to meet the targeted goals. On the other hand, the competence logic targets the assignment of the right person with the required characteristics to a suitable position to get the required competence manpower distribution.

We define a manpower distribution as the number of personnel in each subgroup following a certain classification of the manpower. If the considered classification uses a strategic logic classification of the manpower (such as rank) we call it statutory manpower distribution. On the other hand, if it uses a competence logic classification (such as job type) we call it competence manpower distribution.

In previous work, the statutory logic is mainly addressed with system dynamics or Markov chain models. An et al. [7] present a review about the use of system dynamics for the statutory logic of manpower planning. Also, Guerry and De Feyter [8] present a review on the use of Markov chains in the manpower context for the statutory logic. The competence logic is mostly tackled using optimization techniques. Cai et al. [9] approach manpower allocation problems using a minimum cost flow model. Hall and Fu [10] rely on a network flow model combined with linear programming to find an optimal competence manpower distribution.

However, these two defined logics are interdependent and affect each other. Therefore, considering both logics simultaneously would result in a more elaborate approach. Gass S. I. [11] uses a Markov model to approach the statutory logic which is coupled with a network flow to resolve the competence logic problem. Abdessameud et al. [12] proposes a simultaneous optimization of the two logics based on a flow network model combined with a goal programming approach to find the optimal way to reach the aimed statutory and competence distributions.

The possibilities for the evolution in a career within a military organization can be captured by a rather limited number of career paths. This motivates introducing a career path approach. In this article, we present a career path model allowing the consideration of both logics at the same time. Our model is applied to the Belgian defense manpower to find optimal policies in order to reach the demanded manpower.

2 Career path modeling approach

During his service in the military organization, each soldier is characterized by his characteristics state. The characteristics state of a soldier gathers the information regarding his characteristics (job position, rank, acquired skills and competences, etc...). The evolution through time of this characteristics state is called the soldier's career path[13]. Having a limited number of characteristics makes the number of possible career paths in the military organization limited. Moreover, not all feasible career paths have to be considered as certain career paths might be undesirable either from the point of view of the organization or the point of view of the soldier.

Baumgarten defines in his dissertation [14] a model named "Career path selection". This model aims to determine the degree to which the organization's requirement can be fulfilled by developing qualified military personnel and to assign the developed manpower into suitable career paths. The established model considers the possible career paths and focuses only on the assignment of each soldier to a suitable career path. However, the manpower initially available in the organization was not considered in this work.

2.1 Career path model construction

The career path model consists of representing the military organization using career paths. The first step is the identification of possible career paths. The military manpower is then assigned to the different career paths. Every military organization has a limited number of characteristics that could be attributed to the soldiers. Thus, for each military organization we have a limited number of possible characteristics states, which results in a limited number of career paths. However, the number of the generated career paths could be enormous and causes a heavy burden to handle. Fortunately, only the career paths that obey the human resources management policies defined by the organization have to be retained. For example, if the organization policy states that a minimum stay in a rank is 5 years, all career paths with a stay within a rank less than 5 years are ignored.

2.2 Optimal solution construction

Representing the organization with a career path approach means that the manpower in the organization is divided into subsets according to the identified

possible career paths. If we suppose that the organization has a known capacity of recruitment each year, the operational goal of the organization as well as the strategic one are translated into finding the optimal amounts to recruit in each career path.

The recruited amounts in each career path are fractions of the recruitment capacity of the organization. In order to find the optimal fractions, we resort to mathematical programming. An important aspect to take into consideration is the fact that the available workforce is not always equal to the demand. Having this deviation between the required and the available manpower, goal programming is an appropriate approach to use.

To write the goal program, we consider three types of variables: On the one hand the number of recruited soldiers that are assigned to each career path. On the other hand the number of the initial employees in each of the career paths, and finally the deviations. The deviation variables are used in the soft constraints to define the deviation from the targeted goal.

3 Career path approach applied to the Belgian defense

We applied the career path approach to the Belgian defense. In order to define the characteristics state, we considered for this application some specific characteristics which are: the frame, the career type, the affiliation and the job position type. The frame is defined by the academic level of the soldier and his rank class. The frame has five possible values, two values for the officers' class, two for the noncommissioned officers' class and one for the enlisted personnel. The career type expresses whether the soldier is engaged for short-term or he will continue until retirement. The affiliation defines the main component of the soldiers. In our application, we consider 16 affiliations including: aviation, marine and infantry. The job position type, which has three possible values, defines if the soldier is under training, working on his first occupation in the organization or working on advanced occupation.

Based on the defined characteristics state and the human resource management directorate of the Belgian defense information, we identify 432 possible career paths. We received a personnel database sized 27700 current soldiers. The goal is to reach a population of 25000 as soon as possible with certain distributions on the statutory level and the competence level. As for the distribution over the different affiliations, we want to have an equal distribution. The other targeted distributions will be shown with the results.

For a simulation of 25 years, the generated goal program is sized at 26752 variables and 1073 constraints. We use a CPLEX solver to solve the problem. The following figures are derived from the obtained results. They represent the evolution of the distributions based on each considered characteristic. The targeted distributions are shown in dotted lines.

Figure 1 shows the evolution of the total manpower through time. We notice that we could reach the targeted population size within seven years. Figure 2 illustrates the statutory distributions based on the frame and the career type.

We notice that both statutory distributions are fulfilled by the seventh year. The competence distributions are shown in figure 3. The affiliation distribution in figure 3a is fulfilled within 7 years. We have equal manpower in each affiliation. However, the distribution based on the job type (figure 3b) is not fully satisfied. This is due to the restrictions made by the career paths reflecting the organization’s policies which do not allow the targeted distribution to take place.

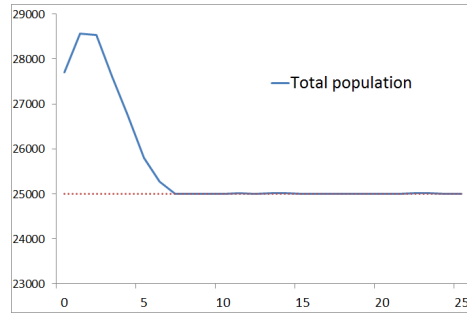
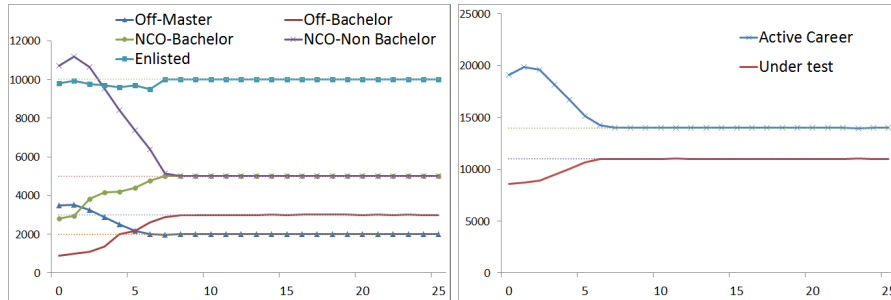


Fig. 1: Total population evolution



(a) Distribution based on the frame. (b) Distribution based on the career type.

Fig. 2: Statutory distributions of the manpower

4 Conclusions

The proposed model is able to propose a solution to our problem. The solution is an assignment plan for the available manpower and a recruitment plan for the coming years. These plans allow the military organization to reach the targeted manpower distribution on both the statutory level and the competence one. The strength of this model is the ability to adapt career paths to the organization’s policies, also the simultaneous optimization of statutory and competence logics.

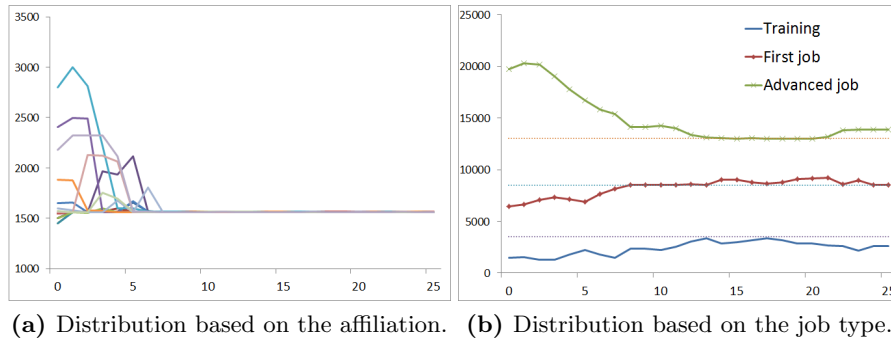


Fig. 3: Competence distributions of the manpower

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