



## Decision Support

# A mathematical model proposal for cost-effective course planning in large hierarchical organizations

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## ABSTRACT

Hierarchical organizations, especially in government agencies, are known by their pyramidal structures and continuous training needs resulting from promotions and/or assignments. Using scientific and rational methods in the job analysis/description, recruitment/selection, assignment, performance appraisal and career planning functions of human resource management (HRM) process decreases training costs. In this study, we develop a new chain of methodologies (the cost-effective course planning model (CECPM)) to decrease training costs and increase the level of specialization. This methodology is implemented in the following steps of the HRM process: (1) the job analysis/description step, where our Mission Description Matrix defines in measurable units the amount of training needed for an employee assigned to a position, (2) the career matrix step, where the minimum training costs for an employee's career path are determined using our network-flow model and (3) the assignment step, where we propose a decision support system composed of an analytical hierarchy process, linear programming and Pareto optimality analysis. The results indicate that our proposed system ensures minimum training needs while satisfying person-to-position compatibility and personnel's preferences.

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## 1. Introduction

With many personnel in different categories and levels, large hierarchical organizations engage in bottom-up assignments due to promotions and horizontal assignments. In this process, to build on the knowledge and experience gained in lower levels, supplemental training is inevitably necessary and training costs are a major aspect of the organization's budget. Hence, measures should be taken to lower training costs while still fulfilling training requirements.

Course planning is carried out within the training and development function of HRM. However, as this function should be implemented compatibly with the HRM sub-functions of job analysis, performance management, career management, and assignments an integrated approach to course planning is best.

To determine a training need, one compares personnel qualifications with position competencies. Choosing personnel with the best skills for the position reduces the amount of training needed. Often, however, other factors such as period of service, promotion

needs, specialization, job diversity and a large number of personnel (several ten thousands) must be considered. Career planning for personnel increases motivation and the quality of an organization. It should also take into account specialization and minimum-cost training. For these reasons, career management and course planning should be simultaneously considered in HRM.

Job analysis/description and training requirements are also strongly connected. Job analysis/description processes measure the relationships between different positions and can thus determine the amount of training a person needs.

Fig. 1 shows a frequently used course planning activity in hierarchical organizations. Each factor resulting in a training need is considered as an input. Training needs are then evaluated in coordination and cooperation with internal and external training centers and an output "course plan" is constructed. In such an activity, the only attempt at decreasing training costs takes place in the process stage. Once the plan is determined, the planner may decide to organize a course at external course centers instead of internal course centers or may consider whether to plan a course for a group of personnel under a certain number.

Significant reductions in training costs can be achieved by decreasing training needs resulted from assignments. The traditional course planning activity assumes that course planning is

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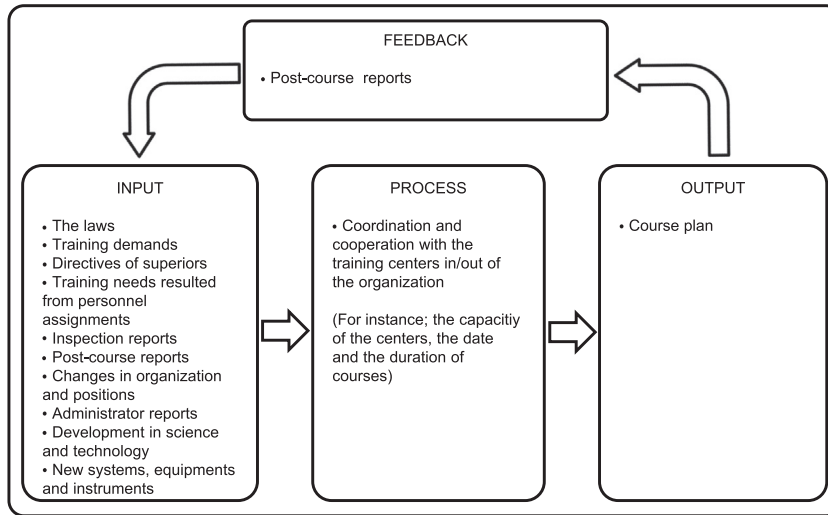


Fig. 1. Traditional course planning in organizations.

independent from the job analysis/description, career planning and assignment functions of HRM. Operations related to these functions are conducted according to their own methodologies; in general no measure is taken to reduce training costs. Problem areas in traditional course planning include excessive courses, long course periods, large number of personnel out of office, overloaded training centers, high costs and insufficient specialization.

The aim of this study is to set forth a chain of methodologies (our cost-effective course planning model (CECPM)) for HRM functions that re-forms training needs to decrease training costs. Basically our CECPM assigns the best personnel (satisfying all assignment criteria) who would need the least training (depending on her/his past experiences) to a position. Thus CECPM intends to guarantee a minimization of training needs just when they are on the verge of occurrence. However achieving minimum training needs may not guarantee minimum training cost. Organizations may need training as a consequence of organizational and performance analyses. On the other hand, a training need turns into cost only when the organization tends to meet this need with a course. The duration, location, method, number of attendees and instructors of the courses affect the cost. Customizing such parameters is a major concern in minimizing the training costs. Although our CECPM or any other study succeeds to minimize the training needs, the cost of the courses may not be optimal depending on the parameter settings. Nevertheless one should assume that minimum amount of training need means less training i.e. lower cost for the same course planning parameter settings. With many personnel in different categories and levels, large hierarchical organizations engage in bottom-up assignments due to promotions and horizontal assignments. When designing courses for newly assigned personnel, the only controllable part in terms of

assignment is job analysis-based-trainings. Job analysis-based-trainings also occupy the greatest part in course design and planning process. Therefore we have focused on decreasing job analysis-based-training needs in our study.

The primary objective of our model is to ensure that, according to a workflow, the output of one sub-model is the input of the next sub-model (see Fig. 2). In reality, there is no such order between the functions of HRM, but for the purpose of achieving low-cost training we place HRM functions into this workflow. The steps of our CECPM are listed below:

- Develop a scenario resembling hierarchical organizations.
- Determine the best methodology for each HRM function.
- Implement the methodology into the scenario.
- Present the comparative results.

In Section 2, a brief survey of previous studies is given. Section 3 introduces a scenario for analysis. Section 4 suggests methodologies and/or mathematical models that can be used for the job analysis/description, career planning and assignment functions of HRM to develop low-cost course plans. Section 5 presents the results, and Section 6 concludes the paper.

2. Literature review

The main idea of CECPM is to ensure minimum training needs for cost-effective course plans by satisfying both person-to-position compatibility and personnel preferences. Within this scope, literature embodies several studies focused on assigning people to jobs in some optimal sense.

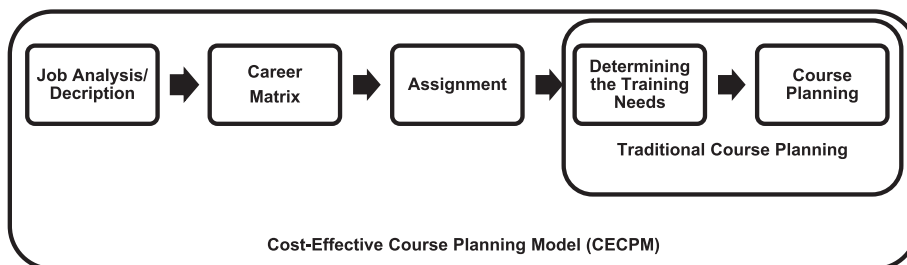


Fig. 2. Cost-Effective Course Planning Model (CECPM).

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