Human Resource Allocation and Staffing Decisions Through an Integrated Scheduling Model: An Application to Emergency Operations Centers

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Homeland Security Presidential Directive-5 (HSPD-5) mandates the implementation of the National Incident Management System (NIMS) beginning in fiscal year 2005. As agencies across the country are beginning to make the adjustments necessary to meet the requirements of NIMS, many will restructure their Emergency Operations Centers (EOCs). Under NIMS, EOCs will share a uniform organizational structure with specific tasks associated with each section of the organization. In order to support EOC managers and coordinators as they plan for the new organization, an integrated, multidisciplinary model is being developed to determine the optimal staffing levels to train who could be called to work in the EOC. This model considers specific tasks that are required of all emergencies and includes variables which consider efficiency, priorities, staff training competency, and a probabilistic element of processing time per task. The model also considers the EOC manager's decision making characteristics by integrating the Driver Decision Style.

There are two major players in the interaction described by the model: the EOC manager, who is the decision maker, and the analyst or scheduler who is outside the scope of the EOC, as an external consultant to the EOC manager. The EOC manager is responsible for accessing and training workers for each section, therefore, he is the decision maker (DM) regarding personnel allocation. The analyst in this case is the model with which the EOC manager will interact BEFORE a major event. The model will aid the EOC manager in identifying the optimal number of staff for each section based on his or her input. Once the optimal number of people per section is determined, organizational characteristics and the decision style of the manager are considered. This input to the model is the main factor that determines the recommendation for the total number of people that should be trained to work in the EOC in order to provide the best support to First Responders in the field. Because much of the process in determining staffing levels is driven by the human making the decision, it is imperative that the human behavioral elements of decision making are considered. As the model functions, it will consider the

Decision Style according to Driver (1993) in order to integrate the human elements of decision making.

Using Scheduling Theory the analyst determines the optimal allocation of resources. Scheduling allocates *resources* (material, machines, capacity, processing time) to *jobs* (tasks) in order to meet specified *goals* (number of items produced, minimize total lateness, maximize profit). The allocation of the limited resources to best achieve the specified goal is a primary result of scheduling algorithms. In 1991, Dessouky, Moray, Kijowski, and Adapatha began to outline the application of scheduling theory to human strategic behavior. The strategic behavior investigated was specifically that of task scheduling. They found that human behavior could be modeled through the use of scheduling theory without major changes to the scheduling algorithms. Then, in 1995, Moray, Dessouky, and Kijowski solidly outlined the application of scheduling theory to human behavior. Their research clearly matched one-for-one the scheduling theory parameters with their equivalent measure in human behavior. Thus, it is possible to apply scheduling algorithms to determine the optimal number of people to perform a series of tasks, such as those found in the new EOC organization.

It is imperative to recognize that the EOC manager is responsible for the success or failure of the organization regardless of the results of the algorithm. Hence, organizational behavior, especially in emergency situations, must be addressed to fully understand the potential for success of the team in the EOC. Early in the model, the EOC manager controls the variable input to the scheduling algorithm based on his or her estimation of: efficiency of staff, variability of task processing time, preemption of tasks, and specific task hierarchy. This allows the EOC manager to use his or her estimation regarding elements of the organization that could affect the mathematical aspects of the model. Then, human and organizational behavior factors are considered when translating the algorithm results into a recommendation of the total number of people to train for the EOC potential staff. The pool of staff to be trained to operate the EOC will depend on the EOC manager's estimation of the potential scope of events, the value gained through rehearsal, and the EOC manager's personal risk taking propensity. The result of the model is a solid recommendation of the number of people that should be trained to staff an EOC at a level that will provide the best support of First Responders and complete command and control of the incident triggering the activation of the EOC.

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