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A sequential group decision-making approach to strategic planning for the development of commercial vehicle operations systems

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Abstract

This paper explores a new sequential decision methodology which integrates a generalized sequential probability ratio testing approach with a strategy-value matrix analytical tool to determine the developmental priorities of commercial vehicle operations (CVO) technical packages for CVO time-based strategic planning. The proposed method executes a sequential decision algorithm utilizing the strategic elements of strategy-value matrices which are estimated on the basis of the data collected from the survey respondents. In the process of sequential decision making, the identification of a specific CVO value-added technology package can be made once the condition of the minimum group decision-making cost is met. In addition to methodology development, a real case study together with a nation-wide mail survey to aid the estimation of the strategy-value matrix samples which were used as inputs to the proposed sequential decision algorithm was conducted in Taiwan to demonstrate the feasibility of the proposed method. Utilizing the proposed method, we determined efficiently the developmental priorities of CVO technology packages for short-term, mid-term, and long-term strategic plans, respectively. Our analyses results indicated that the CVO package used for fleet management appears to be the most urgently needed in the short-term CVO strategic plan; value-added technology packages including: (1) data warehousing, (2) information technology, (3) integration with the supply chain management (SCM) platform, (4) freight mobility, (5) integration with advanced traffic management systems (ATMS), and (6) extension for intermodal operations are assigned to the mid-term CVO strategic plan; and others including: (1) freight administration, (2) HAZMAT management, (3) on-board safety monitoring, and (4) roadside safety inspections are involved in the long-term CVO strategic plan. We expect that this study can make available the proposed decision-making support method with benefits not only for planning CVO development strategies, but also for re-

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examining the role of commercial vehicle operations in a comprehensive extent.

Keywords: Generalized sequential probability ratio testing; Strategy-value matrix; Commercial vehicle operations

1. Introduction

The increasing application of advanced electronic and communication technologies exerts a profound influence on transportation as well as logistics, and commercial vehicle operations (CVO) is one of the most impressive examples. CVO has been regarded as one of the fundamental subsystems in the architecture of intelligent transportation systems (ITS). Related technologies such as automatic vehicle location (AVL) systems, mobile communication systems, on-board computers (OBCs), dynamic routing and dispatching software have made commercial vehicles more technologically sophisticated and operationally flexible over the past decade. As a result, private sectors including shippers and carriers may obtain economic benefits by using CVO-related technologies.

The development of CVO-related technologies has contributed much to enhancing distribution efficiency in logistical operations because it can control the flow of goods better. However, these benefits can be realized only when the potential of CVO-related technologies coincides with the strategic distribution objectives of logistics.

In spite of the potential benefits provided by ITS-CVO, further efforts are needed to clarify the role of CVO in logistical systems. First, transportation cost does not correspond to logistical cost though it represents a significant item in the logistical cost. It is worth noting that physical distribution dealing with freight transportation is merely one of the activities in logistics rather than an entire process executed in the conventional field of freight transportation. In addition to minimum transportation cost, the operations of an integrated logistical system should seek to achieve other objectives such as minimum inventory cost, continuous quality improvement, and life-cycle support (Bowersox and Closs, 1996). Second, the potential of CVO-related technologies has not been fully utilized by either motor carriers or logistical operators although the adoption of CVO in ITS is rapidly growing. Results of a previous survey (Regan and Golob, 1999) indicated that almost 60% of the major carrier fleets in California are equipped with advanced location-communication devices such as AVL, electronic data interchange (EDI), and mobile communication devices; however, only a few of them are aware of utilizing these technologies efficiently to support decision-making for fleet management. Third, scant effort has been paid on examining the contribution of advanced transportation technologies to the improvement of logistical competence in the field of logistics. On the other hand, there are numerous studies devoted to exploring new operational strategies such as time-based control (e.g., just-in-time (JIT) and quick response (QR)) and system integration (e.g., the supply-chain management, and integration of supply chains with demand chains) for effective logistical management.

A strategic plan designed systematically for the application of advanced CVO-related technologies to logistical management as well as freight transportation appears urgently needed. It should be noted that a critical issue on the development of CVO strategies is the difficulty in exploring the priority with respect to implementing specific CVO value-added technology