Chapter 122
Intelligent Freight Transportation System:
The Effects on Transportation Operations Performance

Gunnar Stefansson
Chalmers University of Technology, Sweden & University of Iceland, Iceland

ABSTRACT

The purpose of this chapter is to identify the necessary components of Intelligent Freight Transportation System (IFTS) and analyze the potential effects on transport operations performances in all the three pillars of sustainability, namely the economics, environmental and social impacts. In order to achieve this objective, a literature study was conducted, looking for relevant up-to-date literature within the fields of transportation, logistics, and information and communication technology (ICT) and environmental impacts of freight transportation. In addition, two separate rounds of empirical studies were made. From literature, as well as from part of the empirical data collection, a requirement analysis was done to understand issues and problems in transport operations that can be addressed with more sophisticated information and communication systems. The second round of empirical data collection was done to identify potential solutions of the identified issues. Finally an analysis was made to understand the functionalities of possible IFTS solutions. Many effects were found that can contribute to increased performance of transport operations including automatic item identification, safety and security prevention, real-time navigation, traffic situation notification and carbon footprint registration.

INTRODUCTION

In recent years, the transport industry has been exposed to various challenges related to different operational issues. Some of the major challenges have been to deal with the increased globalization in the two last decades of the 20th century involving longer supply chains and increased complexity; capacity limitations due to increased freight volume in the beginning of the 21st century for more or less all transportation modes; increased congestion on roads, rail tracks and in ports that reduces efficiency of the transportation infrastructure and increases travel time, fuel consumption

DOI: 10.4018/978-1-4666-2038-4.ch122

and air pollution; more attention on risk issues as a consequence of the terrorist attack in September 2001; increases in cost of transportation operations due to increase in fuel price and taxes; increased requirements on environmental and social impacts; and now the sudden decrease in freight volume due to the wide spread economic recession in last years.

At the same time opportunities have surfaced with increased knowledge in the transportation industry that allows better design of transportation solutions and new technologies that opens up possibilities to face many of these challenges by increasing monitoring, control and planning capabilities. Without any doubt, ICT can create many utilities, but it does not come free of charge. A particular case is the transport operators who are currently subjects of significant pressure to incorporate new ICTs into their operations from vehicle suppliers, government as well as their customers directly or via their contracted logistics service providers (LSPs). Transport operators are often not able to employ or develop own technical competence, as they are generally very small companies operating at very small profit margins.

Although transport operators and logistics service providers are at the heart of the current development of distributed data capture, processing and communication in supply chains, most literature in the field of logistics and ICT takes the perspective of the transport buyers e.g., (Landers, 2000; Spekman, 2006), LSPs e.g., (Stefansson, 2006; Durr, 2003) or government e.g., (McKinnon, 2006; Tsai, 2006). Very few publications analyze effects of advanced ICT beyond operational benefits, i.e. not taking into consideration the three different sustainability impacts.

The purpose of this chapter is to identify the necessary components of intelligent freight transportation system and analyze the potential effects on transport operations performances in all the three pillars of sustainability, namely: economics, environmental and social impacts.

BACKGROUND

The relevant literature related to the transportation, logistics, information and communication technology (ICT), environmental impacts of freight transportation will be discussed in this section.

Information and Communication Systems

Different types of information systems (ISs) are available and used by industry today. These include proprietary legacy systems, off-the-shelf systems provided by major enterprise resource planning (ERP) system suppliers, and single user simple office applications (Stair *et al.*, 2008). Off-the shelf systems provide a certain degree of integration capability, not the least if the applications are from the same supplier. Although middleware is needed, the implementations are likely to have experience with these systems, so it makes integration easier even if the applications come from different suppliers, assimilar database approaches can be used in most instances (Narasimhan and Kim, 2001; Edwards *et al.*, 2001; Helo and Szekely, 2005). In addition to the variety of different systems that exists, communication systems are a vital enabler oforganisations' integration efforts. Large organisations use electronic data interchange (EDI) applications to automate their data exchange (Stair *et al.*, 2008) while others, often smallerorganisations, use less cutting-edge methods, such as phone and fax. Technology is emerging that allows Internet based approaches to follow the extensible markup language (XML) data exchange methods. This method allows organisations of all sizes to participate in a relatively inexpensive data exchange setup where one or more actor in a supply chain establishes an Extranet web page for others to use without needing any backbone IS (Stair *et al.*, 2008). This is of possible interest for mobile applications where data exchange partners can be on the move, i.e. carrying out transportation assignments or assignments in distribution centers (Wang, 2009).