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Investigating the road safety management capacity: Toward a lead agency reform

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ABSTRACT

An efficient management system and leadership body is one of the key requirements for a road safety improvement program. In low- and middle-income countries, the organizational structure of the management system may suffer from deficiencies weakening the institutional functions across key road safety players. Hence, it is necessary to form an inner- and inter-organization evaluation framework encompassing all the processes, events, dependencies, and causation among road safety players. In this paper, a (three-stage) system thinking approach is developed to evaluate the behavior of inter-organizational complex system and to determine major deficiencies in the role of the road safety lead agency. The first stages of the system thinking approach starts with drawing diagrams (i.e. multiple-effect and multiple-criteria trees) that allows identifying the chains of reasoning behind events or consequences. The next stage of the system thinking approach embodies the analytic network process (ANP), an advanced multi-criteria decision-making technique, which handles the lead agency capacity evaluation and helps to determine how and by what magnitude any of the players can affect the national road safety. The proposed method applies to the case of Iran, a middle-income developing country in the Middle East. Since in Iran, the Road Safety Commission (RSC) has been established as the lead agency, it was expected that RSC owns the greatest influence on the status of road safety. However, our results show that the overall influence of RSC on road safety is far less than what was expected. Subsequently, a supplementary procedure is proposed to specify institutional reforms in order to avoid such organizational inefficiencies.

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1. Introduction

In 1990, road crashes were the 9th leading cause of global fatalities [1], and it is predicted to take the 5th position by 2030 [2]. They also result in 1.3 million deaths and between 20 and 50 million nonfatal injuries each year, and are the leading cause of death among young people aged 15–29 years [3]. Although the constant crash fatalities between 2007 and 2010 in 88 countries (monitored by WHO) is a good sign of improved road safety, the number of fatalities is still high especially in developing countries [3–5].

Specifically in low and middle-income countries, road crash deaths and injuries are projected to be the 4th largest cause of healthy life years lost by the total population in 2030 [6]. To address road safety issues for such countries, one of the outstanding efforts was made when the United Nations (UN) General Assembly Resolution 58/289 (c.f. [7]) invited the WHO (in 2004) to act as a coordinator on road safety issues within the UN system, working in close cooperation with the UN regional commissions [8]. Shortly afterwards the World Health Organization (WHO) and World Bank jointly recommend strategies, named World Report [1], to prevent and lessen the global impact of road crashes. It sets out the strategic initiatives necessary to improve country road safety performance. It "stresses the importance of accountable institutional leadership which derives from a designated legal authority that confers the power to make decisions, manage resources and coordinate the efforts of all participating sectors of government."

To specify a management framework to support the successful implementation of the World Report recommendations, in 2009, a guideline was published by World Bank (c.f. [9]). It helps to increase the chance of successfully applying road safety interventions and to overcome the institutional barriers impeding the effective implementation of the road safety interventions.

The role of institutional arrangements on road safety was reviewed for US, Australia, and Japan by Trinca et al. [10], winner of the 1988 Volvo Traffic Safety Award. The review found that as there is considerable diversity in institutional arrangements among the nations with "success stories," there is unlikely to be a single optimal arrangement. The institutional forms that safety leadership can take are classified

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into three broad categories as (i) lead agency, (ii) multi-sectorial committee, or (iii) an NGO [11].

In line with these findings, In Iran, a middle-income developing country in the Middle-East, when the road safety fatalities posed a growing concern, the Road Safety Commission (RSC) Secretariat as the official and national road safety lead agency was established in 2003 and several National Road Safety Projects through a loan received from World Bank were launched. However, after a marked decrease in the number of road traffic fatalities in 2007, the trend of the road traffic fatalities has not been steadily and considerably decreasing.

Regarding the road safety issues in Iran, the first idea that comes to mind and this study seeks to investigate for Iran points to the institutional capacity building barriers and, more importantly, unwanted implementation drawbacks within inter-organizational relationships, which did not allow the activities to ensure sustainable long-term country's road safety performance.

Road safety has a multidisciplinary nature. It is tied to several sectorial policies (e.g. environmental agendas and health sector policies) [12]. The World Report, as the first recommendation, has stressed the importance of institutional coordination, which is derived from a designated legal authority with enough power to make decisions, manage resources, and coordinate efforts of all participating sectors of the government [1]. It is a well-established belief that without efficacious institutional management across road safety strategies, a country has little opportunity of successfully applying road safety interventions. It requires an orchestrating accountable player that goes beyond a consultation role in managing decision-making processes across agreed road safety partnerships [6].

In France it was understood that [13] the lead agency (Comité Interministériel de Sécurité Routière – CISR) must coordinate itself with other players, who are detached from different ministries, such as Interior, Justice, Education, Health, and Sustainable Development, to create harmony between them. In the national road safety strategy of Australia, it was pointed out that the effective coordination of activities among all key players with shared responsibility must be ensured [14]. "Institutional organization, coordination and stakeholders' involvements" was considered as one of the main investment proposals in "Road safety in South East European region (ROSEE) program [15].

In line with these facts, Hughes, Anund and Falkmer [14] stressed the essence of a model that describes components, processes, organizations, events, dependencies, factors, causation, etc. That is to say, a framework contributing to the holistic coordination of interrelated road safety strategies or interventions is expected [16]. Such a holistic approach helps to design system components integrally and deals with the whole system, not just "spikes in distributions" that can ensure optimal and proactive road safety approaches [17]. The first step now is to examine the institutional arrangements for the management of road safety within such a multi-disciplinary and multifaceted nature (e.g. see the one made in Malaysia [18]).

On the examination of organizational settings in the context of (road) safety, we may refer to [19–22] selected among several studies performed in this domain. This evaluation requires a framework for supporting complex administrative situations with various and often contradictory purposes that stakeholder groups value differently. Nevertheless, the utilization of a sub-discipline of operation research, which could evaluate multiple conflicting criteria in the evaluation framework through appropriate problem structuring and criteria aggregation, is rare in this domain.

Based on this necessity, Bliss and Breen [9] tried to provide a simple controlling framework which specifies a management and investment evaluation framework to evaluate the successful implementation of the World Report recommendations. It is a checklist-based evaluation mechanism that rates interventions or situations through 12 checklists rated on a 4-point scale ("Yes", "Partial", "Pending", and "No"). Our review on the country road safety status based on this checklist did not deliver compelling results and the questions mostly got "Partial" rates. Our investigation revealed that this method was associated with some drawbacks: we confronted different responses depending on the authorities filling the checklists, we could not interpret the responses because the evaluation framework does not bring the source of causalities, and we could not identify the origin of events, especially in the absence of explicit "no" or "yes" rates.

Difficulty to interpret the findings of the checklists using normal expert safety management judgment and failing to know the complexity of inter-organizational relations within the political-administrative structure of a developing country context, which is very different from the West, lead us to more competent evaluation methods: Multi-Criteria Decision-Analysis (MCDA). In the domain of road safety analyses, there are several studies developed MCDA methodologies to address complex evaluation problems involving multiple criteria goals or objectives of conflicting nature, e.g. see [23–35]. They explore a comprehensive composite safety performance indicator, which cannot be captured by a single criterion. Several studies have incorporated MCDA techniques to better examine the organizational settings in the context of (road) safety. However, none of them entered into a complex problem of interdependence among the key players of national road safety that have different levels of mutual interdependent relations with sometimes shared resources or activities, or in some cases, with hidden order of dominations and contradictory privileges.

In this paper, we aim to develop a tailor made evaluation tool by proposing a systems thinking approach, especially for Iran as a third word developing country, to:

1. Discover and evaluate the behavior of road safety inter-organizational complex system,
2. Identify the problems in this context, and
3. Propose a procedure to establish an efficient organizational structure for road safety management.

The evaluation tool contains a three-stage system thinking tool that creates a structure of the evaluation problem in the form of an Analytics Network Process (ANP) model [36–38]. The system thinking tool determines how and by what magnitude any of the related organizations influence the status quo of the road safety situation.

The structure of the paper is as follows. Section 2 describes, systematically, how the proposed method is applied to a case study. Section 3 presents and discusses the results of the evaluation of the complex system of road safety management in Iran. A discussion on the results is provided in Section 4 and suggestions are presented in Section 5. The paper ends with concluding remarks.

2. Tools and techniques: a systems thinking approach

The four stages below explain how an ANP model could be constructed for the evaluation of road safety organizations.

2.1. Stage 1: constructing the multiple-effect tree

Multiple-effect tree, as its name implies, is a tree diagram used here to explore what will proceed when a given organizational task is performed. This diagram is used to explore the intended and unintended effects of the road safety tasks and their sequences by focusing on each entity like an organization, agency, etc. Fig. 1.a provides two examples for a multiple-effect tree. In the right-hand tree, organization *n* is composed of two administrative divisions, *na* and *nb*. Division *na* constantly strives to perform its road safety tasks, i.e. *na*.1 and *nb*.1. Because of these tasks, some positive effects arise, i.e. *x*, *y*, *z*, *s*, and *t*. The nodes in our tree structure are composed of organs (evaluation alternatives), tasks, and effects. The first node in the tree (parent node) are organs and the last nodes (the terminal children) are effects. To draw a multiple-effect tree, one can follow a procedure nearly identical to the general steps of the cognitive mapping [39].

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