Advances in Transportation Studies: an international Journal 58 (2022)

ISBN 979-12-218-0230-6 – ISSN 1824-5463 – DOI 10.53136/97912218023066 – pag. 89-104

Regional road safety observatories: benchmarking of information systems

Z. Abounoas*[1] M.S. Gomez[2] W. Raphael[1] Y. Badr[1,3]
R. Faddoul[1] A. Guillaum[4]

[1]*University-Saint Joseph (USJ), Faculty of engineering (ESIB), Department of civil engineering, Beirut, Lebanon*
**corresponding author, email: Zahira.Abounoas@gmail.com*
[2]*International Federation of automobile, Paris, France (FIA)*
[3]*The United Nations Economic and Social Commission for West Asia (ESCWA), Beirut, Lebanon*
[4]*Renault, Paris, France*

subm. 19th December 2021 *approv. after rev. 6th June 2022*

Abstract

Road traffic deaths and serious injuries are a global public health issue, particularly in the Arab region, where the mortality rate from road crashes surpasses the global average and is more than three times higher than the European region's average. In this regard, an Arab Integrated Road Safety Observatory is being developed to help Arab countries execute evidence-based policies, strategies, and action plans, as well as meet the global targets of the second decade of action (2021–2030). Because numerous experiences exist at the worldwide level, the current paper aims to serve as a platform and reference for the Arab Observatory's development of an integrated Regional Road Safety Information System (RRSIS). In this regard, current RRSISs in various parts of the world were extensively examined and compared using literature and semi-structured interviews with international specialists. Six RRSIS from regional observatories or RRSISs with regional data sets were included in the benchmarking. As a result, various parallels and contrasts were found: a) at the technical level, each RRSIS has its own areas of interest (data, policy, or both), scope (aggregated or disaggregated data), and thus different sets of collected variables and values; b) at the organizational level, several similarities are identified, particularly with regard to the organizational structure; c) at the financial level, multiple differences are revealed, either for financial resources or scale expenditure. On the one hand, benchmarking is required to learn from prior experiences and current models as a source of inspiration. On the other hand, harmonization and coordination assure and guarantee consistency, integrity, and communication between the future Arab RRSIS and the existing regional RRSIS.

Keywords – Road Safety Observatory, Safety Information System, Regional Safety Database, Road Safety Data, Road Traffic Crashes, Regional Observatory

1. Introduction

Road safety is a long-standing public health problem that all nations face, despite their different socioeconomic structure. During the last century, motorization has increased significantly in three waves, the first in the United States (1910-1950), the second in Europe (1950-1975), and in the rest of the world (since 1965), and this increase in cars has been accompanied by an increase in the burden of road traffic crashes [1]. This period, especially after the World War II, was also characterized by a wave of information that flooded society in all areas [2], creating the need to use this amount of information in a logical and structured way, making "information systems" indispensable for planning and managing the complexity of decision making, especially to cope with heavy loads such as road traffic crashes. Therefore, information systems are used as socio-technical and organizational systems to collect, process, store, and disseminate information [3]. The creation of information systems for road safety is even more urgent today because road traffic crashes are the eighth leading cause of death worldwide for people of all ages and the leading cause of death for children and young adults aged 5 to 29 years [4]. However, information systems are often confused with observatories and sometimes with databases, so it is important to distinguish these terms at the outset. As illustrated by the authors in Fig. 1, an observatory consists primarily of an invisible part, the "information system". The latter includes a set of actors (information producers), a set of rules and organizational structures (organizing work and relationships between these actors), and a technical set related to the way information is produced (data set, database, methods, materials, etc.) [5]. Since data should not be the end, the observatory also consists of a visible part, the "dashboard", which attracts the attention of decision makers and contains indicators and indices that contribute to the management of the actions.

In practice, however, information systems in public policy have been developed relatively independently, as they tend to be focused on either the national level or the detailed local level [2]. There are a large number of documents that have implemented a road safety information system at the country level. In France, the Inter-ministerial Observatory of Road Safety (ONSIR) is one of the oldest entities responsible for collecting, processing, interpreting, and disseminating national statistical data, monitoring studies, and evaluating new safety measures taken or planned [6–8]. In Sweden, the Swedish Transport Agency is the competent authority for the Swedish Road Traffic Accident Data Collection (STRADA), the national information system containing data on road traffic crashes and resulting injuries. The system is fed by police crash reports and medical reports [9, 10]. In Canada, since the 1970s, provinces and territories have collected and processed information on police-reported traffic accidents and forwarded it to Transport Canada for final processing and compilation. The National Collision Database Online Web Application is a research tool that contains national statistics on traffic crashes on public roads [6, 11]. In the Netherlands, all road traffic crashes which are recorded by the police are registered in the National Traffic Accident Register BRON. The registration is done by the Center for Transport and Navigation (DVS), while the Institute for road safety research SWOV supplements the BRON data with data from the National Basic Hospital Care Register (LBZ), formerly known as the National Medical Register (LMR) [12]. Recently, the Polish Institute for Road Safety was established to support the road safety management system by providing a platform for analyzing road safety data, disseminating information, and providing knowledge on effective interventions based on national and international research and best practices [13]. On the other hand, global and regional information systems could play a fundamental role when national road safety information systems are weak or non-existent.

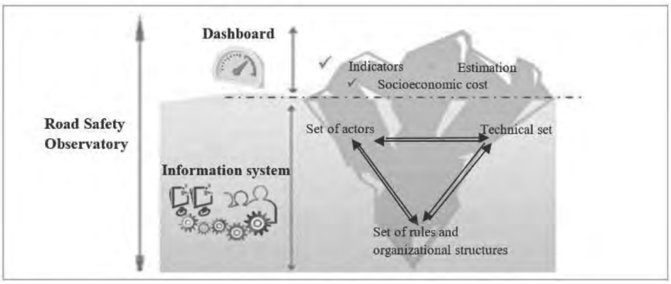

Fig. 1 - Components of a road safety observatory

Therefore, the main objective is to ensure compliance with Recommendation No. 36 of United Nations Resolution A/ RES /74/29, which calls for "making appropriate use of existing efforts, including those of regional road safety observatories, to harmonize road safety data and make them available and comparable" [14]. RRSIS can integrate data from different countries into a unified and harmonized framework for planning and policy making. This integrated information system should be considered as a "common resource" that can be accessed by different decision makers. Within the global framework, the World Health Organization (WHO) is the institution responsible for monitoring the state of road safety in the world during the first Decade of Action 2011-2020, the second Decade of Action 2021-2030, and thereafter the Sustainable Development Goal 3.6 by 2030. It produced the Global Status Report on Road Safety in 2009, which was the first modeled regional estimate of road fatality rates [15], and was followed by other global reports (2013, 2015, and 2018). In addition, the Institute for Health Metrics and Evaluation (IHME), as an independent global health research center at the College of Washington, also provides estimated and comparable data on the world's major health problems, including road crashes, and evaluates the corresponding countermeasures using the Global Burden of Disease tool [16].

In Europe, the European Union's Community Road Accident Database (CARE) was first created (1993) on the basis of Council Decision 93/704, long before the establishment of the European Road Safety Observatory (ERSO). The philosophy behind the creation of CARE was to identify and quantify road safety problems in Europe, evaluate measures, and facilitate knowledge exchange [17]. Later, in 2004, a new project called "SafetyNet" was launched to extend the scope of CARE to include data from the 10 new Member States that joined the EU in 2004 and to shape the ERSO dashboard by developing protocols, recommendations for exposure data collection, safety performance indicators, and In-Depth data [18, 19]. “ERSO is the gateway into a central resource of European road safety data, knowledge and links” [20]. In 2010, the Dacota project was launched to further improve ERSO by "extending, structuring and applying the data and information it contains" [21]. On the other hand, there is a road safety database that provides "aggregated data" mainly for European countries as well as some non-European countries (32 countries in total) on road traffic crashes and exposure data, the Database of the International Traffic Safety Data and Analysis Group IRTAD database [22].

In the United States, the Fatality Analysis Reporting System (FARS) is a census that provides the National Highway Traffic Safety Administration (NHTSA), congress, and the public with disaggregated data on fatal injuries resulting from highway crashes [23]. In addition to FARS, the system we will focus on at the U.S. level in this paper, other information systems include the National Automotive Sampling System-Crashworthiness Data System (NASS-CDS), which is a representative sample of crashes of all severities, detailed crash data systems such as the Crash Injury Research and Engineering Network (CIREN), and the recent Safety Data Initiative [24]. In the United States, information on nonfatal crashes is also collected using the Abbreviated Injury Scale. However, data on this category of causalities is not properly disseminated, are not collected on an annual basis, and are often used by manufacturers to improve their products rather than by policy makers.

In Latin America, the Ibero-American Road Safety Observatory (OISEVI) is an international collaborative instrument that brings together the top road safety authorities of the Ibero-American member countries. Its main objective is to coordinate road safety strategies and initiatives at the regional level, based on the generation of timely, objective and reliable information, in order to contribute effectively to reducing crash rates in Ibero-America. The actions aim to strengthen the technical capacity in each member country, respecting the principles of autonomy and democracy.

The aim of these strategies is to give greater importance to road safety by strengthening the technical capabilities of national authorities, experts in the field and members of non-governmental organizations. In addition, these initiatives aim to learn about and address the different causes and intervention options and help obtain resources to finance the necessary activities [25]. The Ibero-American Road Safety Observatory is an institutional development program that aims to address the need for accurate data and information to influence and technically evaluate the main actors responsible for traffic and road safety in the member countries of the Comunidad Ibero-Americana de Naciones (Ibero-American Community of Nations - CIN), in order to significantly reduce the number of road traffic crashes, and their consequences [26].

In Africa, the African Road Safety Observatory (ARSO) was created as a space for interaction to present the relevant road safety needs of African countries. This observatory has started its work in parallel with a project funded by EC called Safer-Africa. It integrates various knowledge and tools, such as reports, fact sheets, knowledge resources, and links, and it integrates public support (crowdsourcing) to promote collaboration among specialists and end users. In addition, the Observatory is intended as a management tool for all activities of the Safer Africa Project's Dialog Platform, more specifically for advising a Board of Directors as well as a stakeholder group.

In the Asia-Pacific region, concerted efforts by the development community to help countries improve road safety led to the establishment of the Asia-Pacific Road Safety Observatory (APRSO), modeled after observatories in Latin America and Africa. It was officially established in 2020 through the Asian Development Bank (ADB) technical assistance program to support the first 3 years of operation.

In the Arab region (Arab region includes 20 Arab speaking countries members of UN-ESCWA, namely: Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Mauritania, Oman, State of Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates and Yemen), the number of traffic fatalities in 2016 was estimated at 18.9 fatalities per 100,000 people. This is more than the global average of 18.2 fatalities per 100,000 people and more than three times the average recorded for the European region, which is 5.9 fatalities per 100,000 people [4]. Several papers have explained the current state of road safety in this region by the fact that there are fundamental dysfunctions at the level of management and data collection that affect the reliability, accuracy, and comparability of data in this region [27, 28]. In order to address these road safety issues in a systematic and sustainable manner, as is the case in other regions of the world, UN-ESCWA has advocated for the Arab Integrated Road Safety Observatory (AIRSO), which is currently under development. The main objective of AIRSO is to assist member states in developing and implementing evidence-based road safety policies, strategies and action plans based on reliable, accurate and standardized data.

To date, the regional dimension of road safety information system development has not been presented in sufficient detail and holistically in the literature. In this paper, we focus on regional information systems. In particular, this paper is the result of an attempt to fill the gap by benchmarking the potential RRSIS in the world. The main objective is to provide a solid baseline and reference that can later be used to design an integrated Regional Road Safety Information System (RRSIS) for the Arab Observatory under development.

2. Methodology

A systematic review of technical documents was conducted to review six RRSIS of existing road safety observatories using available information at the organizational, financial, and technical levels (Fig.2).

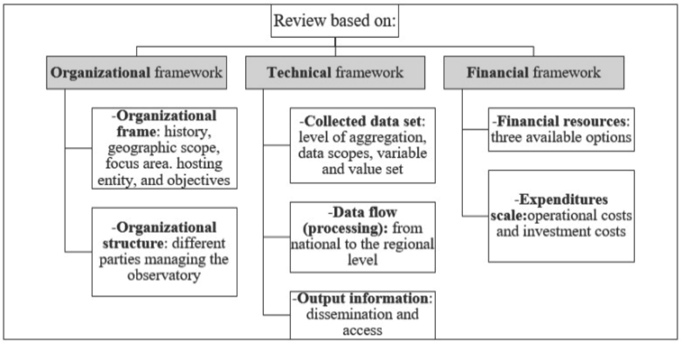

Fig. 2 - Review structure

Tab. 1 - Data availability on the existing RRSIS

	Organizational aspects	Financial aspects	Technical aspects	Sources
ERSO/ CARE/	☑	☑	☑	Review of technical documents (mentioned in the following sections) and interviews with international experts.
IRTAD		☑	☑	
FARS		☑	☑	
OISEVI	☑	☑	☑	
ARSO	☑	☑	☑	
APRSO	☑	☑		

In addition to the literature review, to collect unpublished information, semi-structured interviews were conducted with road safety specialists from the International Automobile Federation (FIA), the Database of the International Traffic Safety Data and Analysis Group (IRTAD), the World Bank (WB), the European Commission (EC), the Belgian Institute for Road Safety (VIAS), and WHO. The data available for each RRSIS are listed in the matrix below (Table. 1).

3. Results and discussion

3.1. Organizational and institutional framework

3.1.1. Organizational frame

Every entity discussed has its own organizational framework. First, the in-service date, as illustrated below, FARS is the first regional initiative that started collecting data on road traffic crashes (Table 2). Second, in terms of geographic scope, it's interesting that some countries belong to more than RRIRS without any conflicting effects. For example, Spain is part of ERSO, IRTAD and OISEVI at the same time. Third, the type of the responsible authority, all RRSIS have a permanent responsible authority. The only exception is the OISEVI, for which the responsible country is defined by rotation. It is based in the country in charge of chairing the steering committee. In addition, the objectives that are explicitly expressed by the RRIRS are listed below (Table.3), we note that some of the objectives are shared by multiple RRSIS.

Tab. 2 - Scope of the RRSIS studied

	CARE/ERSO	IRTAD	FARS	OISEVI	ARSO	APRSO
Established in:	Care (1993) ERSO (2009)	1988	1975	2011	2018	2020
Member countries:	33 (EU+EFTA[1])	32[2]	52[3]	15 out of 22[4]	38 out of 55[5]	22[6] out of 56
Focus area:	Data only	Data only	Data only	Data and policy	Data and policy	Not yet decided
Hosted by:	Eurostat/ European Commission	Joint Transport Research Committee of OECD and ITF[7]	National Center for Statistics and Analysis	Member country by rotation	African Union	Asian Development Bank (ADB)

Note:

[1] EFTA: European Free Trade Association
[2] 9 additional countries also provide data and the validation process by the IRTAD Group is on-going
[3] 50 states, plus Columbia, and Puerto Rico
[4] The eligible countries are 19 Latin American countries and three European countries (Spain, Portugal and Andorra), 7 countries are not officially committed (Bolivia, Brazil, Cuba, Peru, Nicaragua, El Salvador and Venezuela)
[5] 38 out the 55 members of the African union designated their data coordinators
[6] Currently, Australia, Afghanistan, Armenia, Azerbaijan, Bangladesh, Bhutan, Cambodia, Cook Islands, Fiji, Kazakhstan, Kyrgyz Republic, Lao PDR, Maldives, Marshall Islands, Mongolia, Nepal, New Zealand, Pakistan, Philippines, Solomon Islands, Sri Lanka, Turkmenistan
[7] OECD: The organization for Economic Co-operation and Development; ITF: International Transport Forum

Tab. 3 - Objectives and missions of the RRSIS studied

	CARE/ ERSO	IRTAD	FARS	OISEVI	ARSO	APRSO
1. Monitor Road safety	☑				☑	☑
2. Identify RS problems	☑		☑		☑	☑
3. Develop and implement countermeasures	☑		☑		☑	☑
4. Evaluate the efficiency of the initiatives/ countermeasures		☑	☑			
5. Contribute to the Regional/ International Cooperation/ twining		☑		☑	☑	☑
6. Make comparisons		☑		☑		
7. Facilitate the exchange of the best practices/ experiences	☑				☑	☑
8. Provide logistical support to projects of common interest				☑		
9. Provide technical assistance					☑	☑
10. Present a Repository of databases	☑	☑	☑	☑	☑	☑
11. Conduct regular advanced research		☑		☑		☑
12. Foster the establishment of national road safety observatories/ lead agencies		☑		☑	☑	☑

3.1.2. Organizational structure

IRTAD, as a permanent working group of the Joint Transport Research Centre of the OECD and the ITF, has a unique organizational structure [29, 30] :

- The Joint Research Centre: unites analysts from transport ministries and transport research entities from 57-member states to conduct joint work on transport issues. The main mission of the Center is to promote economic development and to contribute to cooperative research programs on transport covering all modes of transport within a broader financial, social, ecological and institutional framework. The Centre is supported by a Secretariat located at the OECD in Paris.
- The Joint Transport Research Committee: oversees the work of the Center by establishing a work program reflecting the interests of all members and monitoring its execution.
- The Transport Management Board of the International Transport Forum, which provides political oversight and reports to transport ministers at ministerial sessions of the annual Summit.

Conversely, based on their internal bylaws to fulfil its objectives, the OISEVI, ARSO and APRSO share similar structures, which consists mainly of the following entities:

- General Assembly (GA): It comprises the leading road safety authorities of each member country. It is the highest-ranking body, charged with outlining the overall policies.
- Steering Committee (SC): It comprises some member countries, proposed and approved by the GA; one is elected as Chair. The committee's main functions are to approve the action plan and ensure its implementation.
- Technical Secretariat (TS): It is in charge of implementing GA agreements and guidelines adopted by the SC. It has the technical and operational functions, including outlining the Annual Work Plan, coordinating technical assistance to member countries, and proposing methodological improvements for collecting road safety data.
- Cooperation Committee: This committee is a multi-stakeholder advisory body comprising organizations, institutions, and/or professionals linked to road safety.
- In addition to Data Coordinators (DCs): are the primary link between the observatories and each member country and are responsible for the gathering and systematizing of country-level data on road safety. In addition to the policy coordinators if the entity aims to produce guidance for designing, implementing and evaluating regional road safety policies (for example ARSO have both data and policy working groups).

3.1.3. AIRSO organizational framework

As mentioned in the section above, there are three options for the hosting organization:

- ✓ Option-1: hosted by a regional entity
- ✓ Option-2: hosted by a research department/institute
- ✓ Option-3: hosted by one of the Member States on a rotating basis

Under option 2, the responsible entity will have fewer powers vis-à-vis the Member States. Option 3 should preferably be avoided since it has created coordination problems in the OISEVI experiment. For this reason, we recommend option 1 for AIRSO. For the kick-off phase, ESCWA could provide the transitional technical secretariat of the Arab RRSIS in accordance with United Nations procedures. The field of interest could cover both data and policy for a more comprehensive vision and direction.

As for the organizational structure, the most recent RRSISs share a similar organizational structure, which is practical, tested and approved. This structure is made up of the General Assembly, the Steering Committee, the Technical Secretariat and the Working Groups (data and policy coordinators). We recommend that a similar structure be adopted for AIRSO.

3.2. Technical framework

3.2.1. Collected data set

As shown in Table 4, the data collected in each of the discussed RRSISs have a different level of aggregation (aggregate or disaggregate). It covers different scopes either deaths, injuries or both. It captures different levels of baseline information (collision, road, vehicle and person) [31] or advanced information (in-depth data, exposure data and performance data).

In addition, Table 5 summarizes the number of variables collected and their corresponding values in each of the RRSIS under discussion. With the exception of APRSO where this information is not yet available. FARS uses the Model Minimum Uniform Crash Criteria (MMUCC) developed in the United States, which contains a large set of variables [32]. In the FARS, particular attention is given to vehicle information. The European Union's Common Accident Data Set (CADaS) [33] was reduced (Mini-CADaS) and used in newest observatories like ARSO. Noting that certain variables are categorized as High Importance (HI).

The focus and scope are not the same for all RRSIS. Some focus more on collecting data on a particular category than others:

- ERSO/CARE with CADaS focuses more on "road data" as this category represents 32% of the total variables collected.
- IRTAD and OISEVI focus more on "vehicle data" as this category represents 48% of the total variables collected. However, in addition to baseline data, IRTAD also collects exposure data (19) and performance data (5).
- FARS also focuses on "vehicle data" as this category accounts for 51% of the total variables collected.
- ARSO with the mini-CADaS focuses more on "road user data" as this category accounts for 35% of the total variables collected.

Tab. 4 - Data coverage

	CARE/ CADaS	IRTAD& OISEVI	FARS	ARSO
Disaggregate data	☑		☑	☑
Aggregate data		☑		
Injuries	☑	☑		
Deaths	☑	☑	☑	☑
Exposure data		☑		

Tab. 5 - Number of collected variables and values by category

	ERSO/CARE		IRTAD&OISEVI		FARS		ARSO	
Category	**Variables**	**Values**	**Variables**	**Values**	**Variables**	**Values**	**Variables**	**Values**
Crash	13 (7 HI)	104	None	None	51	506	10 (9 HI)	40
Road	25 (12 HI)	105	7	7			9 (3 HI)	48
Traffic Vehicle	18 (8 HI)	196	11	7	98	1213	8 (6 HI)	37
Person	21 (13 HI)	102	5	30	39	328	15 (7 HI)	68
Total	**77**	**507**	**23**	**44**	**188**	**2047**	**42**	**193**

Essentially, all RRSISs studied collect data on "crash", "road user", "vehicle" and "road". FARS is the most detailed RRSIS, it collects 188 variables (e.g. location, vehicle identification number, first point of impact, first object hit in a carriageway, and number of occupants). However, we note that the potential dynamism of road transport is not considered in the above-mentioned variables. As predicted by [34], the expected invasion of roads by fully automatic vehicles in the future will generate new behaviors among vehicle occupants, so that new types of road traffic crashes and injury outcomes may emerge. Therefore, the set of variables must leave room for new explanatory variables and their potential values that might appear in the future, such as "the activities during the road trip", "position preferences" and "seat belt configurations". Similar observation for the variables of all the RRSISs examined.

3.2.2. Data flow (processing)

Figure 3 is created by the authors to illustrate the two possible data flows, each of the RRISIS studied adopting one of the flows described below.

The IRTAD aggregate data is collected straightforwardly from national data providers in the IRTAD countries, which is provided in a common and harmonized format. In the OISEVI (IRTAD-Lac Operation) the procedure is similar to the IRTAD. The OISEVI secretariat sends Member States an Excel questionnaire to fill in the data. Then, the secretariat checks the data once received, before disseminating data through ITRAD-Lac database to all OISEVI members. However, it is possible to develop a program to directly import data from the databases of each country.

With regard to the FARS data collection process, the NHTSA has signed a cooperation agreement with one agency of each state government. The agencies provide upstream data in a standardized format on fatal road accidents in the state (data flow-2), as shown in Figure 3. At that time, the information is collected, encrypted, and submitted to a microcomputer framework and sent to Washington. This information is organized and provided to the general population through the FARS interface to the public fully compliant with the protection law, with confidential data blanked out, for example, names, locations, or social security numbers [35]. FARS data is obtained solely from the States' existing documents, namely, "Police Crash Reports, State Vehicle Registration Files, State Driver Licensing Files, State Highway Department Data, Vital Statistics, Death Certificates, Medical Examiner Reports, and Emergency Medical Service Reports" [35–38]. FARS analysts, whose numbers vary from state to state, are responsible for collecting, interpreting and reporting their state's data to NCSA. [39].

In terms of the CARE disaggregate data collection process, each member state produces its own data, following its procedures and using national protocols and formats (Data flow 1). This data is thusly sent to the European Commission in the form of a report after exclusion of confidential data) via the web portal of Electronic Dataflow Administration and Management Information System (EDAMIS). CARE provides a protocol framework of transformation rules from the original structure and definitions to guarantee comparability of variables and values. Instead of harmonizing data downstream, CARE began to gradually collect common and harmonized data upstream through the Common Accident Data Set (CADaS). CADaS is a standard model for reporting road traffic crash data for each crash in a common way ensuring high quality and consistency of input data, and which is implemented on a voluntary basis in national systems of collection of data on traffic collisions. As illustrated in Figure 3, there are two possible types of data streams to collect and transfer data from the national to the regional level.

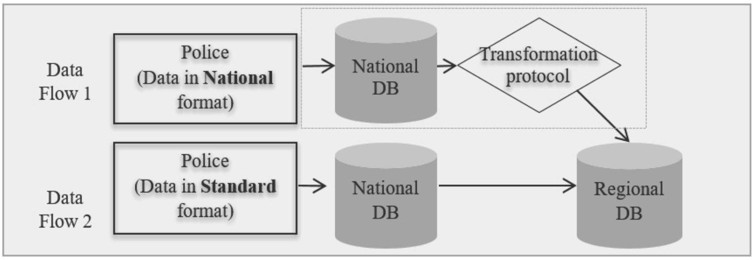

Fig. 3 - Crash data collection and transformation processes (Note: DB=DataBase)

We found it interesting to mention that there are different bases for data transfer:

- EU countries transfer data to the CARE on a mandatory basis
- FARS data collection process is based on a cooperative agreement
- Data is transferred to IRTAD on a voluntary basis once the country became a member

3.2.3. Output information: dissemination and access

The CARE database can be accessed either via a dial-up router link or through secure networks. The Internet front-end was configured by the Info-View and Web-Intelligence engines. Info-View gives an immediate summary of all the documents in the corporate database that are available and helps to view, refresh and share these documents, while Web-Intelligence allows to create, edit and analyze documents. The European Commission controls access to the CARE database, presently two or three accesses are available for each Member State. The final users are DG TREN (Directorate-General for Transport and Energy) and few selected bodies in each Member State [40, 41]. In addition, ERSO has a separate website (www.erso.eu), which was developed by the SafetyNet project.

IRTAD is part of the OECD-Stat, which is the OECD's online statistical platform/portal where users can access OECD statistical databases. It makes it possible to: a). Create tables by selecting variables and customizing the table layout. b). Extract and download large volumes of data. c) Display detailed metadata on methodology and sources [42].

Thanks to its public access capacity, FARS enables the display of data online using the FARS query system. In addition to other methods for accessing data, notably, a). Solicitations for specific data will be answered free of charge by NCSA within fourteen days, depending on the nature and complexity of the information requested. b) Computer compact discs can be purchased in one of a few easy-to-scan configurations, which allow to manage the information using any specific computer system. c) FARS information can be obtained by downloading one of the files distributed over the official website in different formats [43].

3.2.4. AIRSO technical framework:

We recommend the following for AIRSO:

- Collect disaggregate data to meet the objective of assisting Arab countries in implementing evidence-based policies, strategies, action plans, and achieving the global targets of the second decade of action 2021-2030;
- Adopt data flow 2 in Fig.3 to avoid the burden of the transformation protocol. This could also improve national data collection;

- Define a minimum set of variables and values, by identifying the relevant ones from desegregated RRSISs (CADaS from CARE and FARS). Data mining technics can be very useful (e.g. identifying severity explanatory variables);
- Build a standardized e-form, no big investments are needed. Customization of existing tools like CyberTracker would be practical instead of starting from scratch.

3.3. Financial framework

3.3.1. Financial resources

In relation to funding resources, there are three funding options. First, through self-financing by the Member States. For instance, the European Commission funded ERSO/CARE, while IRTAD members pay an annual fee of €5,000 to help maintain the organization's technical secretariat.

Second, by seeking external financing from international organizations such as the FIA, the ITF or development banks. APRSO received a $540,000 UKaid grant through the Global Road Safety Facility (GRSF) and received $160,000 from the world bank [44].

Third, a hybrid option such as OISEVI, which was mainly financed by the Member States, as staff and travel expenses were offered when possible. Later, OISEVI obtained USD 663,900 from the World Bank to finance institutional capacity development [45].

3.3.2. Expenditure scale

Pooled resources are used either to cover operational costs incurred in day-to-day operations or to cover start-up costs associated with one-time expenses during the implementation of the RRSIS. The total generated cost differs from an RRSIS to another, mainly depending on:

- The geographical scope: RRSIS that covers more countries will obviously consume additional resources;
- The date of establishment: as the oldest RRSIS played for the conceptual basics (variables, indicators, and protocols etc.), for example EC payed for two separate projects, which are Safety-net and Dacota;
- Level of detail of data collected: the collection of disaggregated data is more expensive, especially for in-depth analysis. Some RRSISs use internal resources, while others use outsourcing to improve their economic efficiency. However, recourse to outsourcing means that these skills disappear as soon as the contract ends;
- Existence of solid basis/ core before starting the establishment: mainly the existence of common regional database. Design and implementation from scratch costs more than an RRSIS for which the database and data collection protocols are already in place.

However, the most striking thing is that the availability of large economic resources does not guarantee the good quality of the data collected. For example, the gap between reported and estimated deaths in the United States in 2016 is about 5,000 deaths, despite spending $12 million annually on FARS and NASS alone. The authors have expanded Figure 4 below to illustrate some examples of the financial resources and scale of expenditures of the RRSIS under study.

ERSO/CARE

Safetynet Project (ERSO)

- Funding: European (6th RTD framework program)
- Duration: 05/04-04/08
- Total project cost: 12,815,778 euros
- Eu contribution: 90,000 euros

Dacota project: Road safety data collection, transfer and analysis

- Funding: European (7th RTD framework program)
- Duration: 01/10-12/12
- Total project cost: 7,310,655 euros
- EU contribution: 5,500,012 euros

Other Examples of the operational cost for CARE

- Work in house: 2-3 full job ITs are affected to do data processing, managing user platform, providing training, making queries, publishing basic data, some limited analysis
- Outsource some work through public tendering. Last contract 2020-2023 with VIAS and SWOV for 500,000 euros).
- 3 million euros to support countries to Key Performance Indicators (KPIs)

ARSO

Estimated Budget including the establishment and the operational cost for 2019-2020 (**2 years**)

World Bank	USD 780,000
FIA	USD 100,000
SSATP	USD 120,000
Total:	USD 1,000,000

IRTAD

IRTAD members pay a yearly **5000 euros** to contribute to the maintenance of the Technical Secretariat of the organization.

OISEVI

Category	Estimate at approval (USD)
Goods and non-consulting services	61,512.81
Consultants' services (including audits)	403,217.19
Training and workshops	199,170.00

Cost for 2013-2016: 663 900 USD

APRSO

Items	Budget (Two years) in K.USD	Available/ committed in K.USD		
		GRSFA/ UKaid	ADB	WB
Secretariat technical staff (consultants)	384	384	189.11	
Events/ meetings	300	129	34.81	
Travel	60	60		
Secretariat (International ADB staff)	625.5		625.5	
Secretariat (national ADB staff)	116.1		116 .1	
Office space and operations	600		600	
Int'l Technical experts	160			
Miscellaneous administration/ support cost	27	27		
Total	**2,772.6**	**600**	**1,565.52**	**160**

FARS/ NASS CDS

Cost about 12 million USD a year

Fig. 4 - Illustrations of financial resources and expenditure scale of different RRSIS

3.3.3. AIRSO financial formwork

At this stage, AIRSO opted for the hybrid financing option, it received a first external grant from the United Nations Road Safety Fund to start the pilot in Tunisia and Lebanon, besides self-financing from Qatar.

The oldest RRISSs, those established before 2011, have invested a lot of resources compared to the youngest, especially because they had to conduct research and set up pilot projects. These RRSISs were introduced in high-income countries (EU and US), where the cost of operation is higher. However, because the newer RRSIS do not have to reinvent the wheel, their allocated resources. ARSO is a good example. Its start-up and operating costs were $1 million for two years. We might consider this a reasonable reference figure for AIRSO's establishment.

4. Conclusions

Our research has led us to draw conclusions about the main similarities and differences between existing RRSISs, such as ERSO/CARE, FARS, IRTAD, OISEVI, ARSO, and APRSO, which are either part of regional observatories or incorporate regional databases. The comparison was made on three levels, with some of the most important findings at each level serving as an inspiration for the AIRSO's design and as a benchmark for future forthcoming observatories in the Western Balkans and Eastern Partner countries:

a) Organizational and institutional level: recent RRSISs all have a similar, tested, and well-established organizational structure. The General Assembly, the Steering Committee, the Technical Secretariat, the Cooperation Committee, and the Data and Policy Coordinators make up this structure. For AIRSO, we recommend that a similar structure be used;
b) Technical level: It is worth noting that the data transfer base for the RRSIS under discussion is different. Data is transferred either on a mandatory basis, in accordance with a cooperation agreement, or on a voluntary basis, once the country has joined. Only two of the six RRSIS (CARE / ERSO and FARS) do collect disaggregated data in terms of data collection. For AIRSO, the two systems listed below were employed for specific objectives in subsequent steps to determine the best data set for the Arab RRSIS;
c) Financial level: A financial comparison was conducted at this level in order to acquire estimated numbers for the cost of establishing and operating an RRSIS. Each entity has pooled its financial resources, either through self-financing, external money, or a hybrid of the two. However, the size of the expenditure, whether to cover operational or investment costs, is dependent on a number of factors, including geographic scope, date of establishment, level of detail, and the existence of a solid / basic foundation prior to the establishment (most notably, the existence of a common regional database). For AIRSO, the hybrid financing option of external subsidy and self-funding was chosen. As stated in Section 3.3.3, the expenditure baseline is $1 million.

This paper serves as a platform and reference for practitioners and researchers seeking to develop a future RRSIS anywhere in the world, not just at AIRSO. The scope of this paper is limited to the RRSIS; the next step is to recommend the AIRSO dashboard. In today's data-driven environment, dashboards are both omnipresent and crucial. RRSISs are constantly changing. For example, new countries can join or leave the RRSIS under study at any time, affecting the results.

Funding

Renault Foundation provided financial support to perform this research work.

Acknowledgement

This research was performed as part of the development of the Integrated Arab Road Safety Observatory, which will be implemented by UN-ESCWA. The Renault Foundation provided funding for this research; we are grateful for their generosity. Thanks also to the foreign specialists, Mara Teresa Sanz Villegas (EC), Véronique Feypell (OECD), and Vironica Raffo (WB), who provided us with a wealth of information about the RRSIS. The anonymous reviewers' constructive remarks and recommendations are sincerely acknowledged.

References

1. Borowy, I. (2013). Road Traffic Injuries: Social Change and Development. *Medical History*, *57*(1), 108. https://doi.org/10.1017/mdh.2012.83
2. Nijkamp, P., & Rietveld, P. (1983). *Information Systems for Integrated Regional Planning*. Amsterdam: North Holland Publishing Co. Retrieved from http://pure.iiasa.ac.at/id/eprint/2146/
3. Piccoli, G., & Pigni, F. (2018). Information Systems for Managers with Cases 4.0. Prospect Press.
4. WHO. (2018). *Global status report on road safety 2018*. Retrieved from https://ebookcentral.proquest.com/lib/qut/detail.action?docID=5910092
5. Giry, A. (2003). *Le Systeme D'information Environnementale Français*. ministere de l'ecologie du developpement durable. Retrieved from http://temis.documentation.developpement-durable.gouv.fr/docs/Temis/0063/Temis-0063188/18090.pdf
6. IRTAD. (2017). *Road Safety Annual Report*. Retrieved from https://www.oecd-ilibrary.org/docserver/irtad-2017-en.pdf?expires=1606814282&id=id&accname=ocid195767&checksum=1899D66853CE36B83CB14AF950A51352
7. ONISR. (2020). Retrieved November 30, 2020, from https://www.onisr.securite-routiere.gouv.fr/
8. Żukowska, J., & Krystek, R. (2012). The role of observatories in the integrated transport safety systems.
9. ETSC. (2018). *An Overview of Road Death Data Collection in the EU*. Retrieved from https://etsc.eu/wp-content/uploads/PIN-FLASH-35-final.pdf
10. Trafikverket. (2020). Data Collection. *Trafikverket*. text, trafikverket@trafikverket.se. Retrieved December 3, 2020, from https://bransch.trafikverket.se/en/startpage/operations/Operations-road/vision-zero-academy/Vision-Zero-and-ways-to-work/data-collection/
11. Government of Canada, T. C. (2019, November 7). National Collisions Database Online, National Collision Database Online 1.0 - Transport Canada. Retrieved December 3, 2020, from https://wwwapps2.tc.gc.ca/saf-sec-sur/7/ncdb-bndc/p.aspx?l=en
12. SWOV, I. for R. S. R. (2016). *Data Sources Comprehensive Overview*. Retrieved from https://www.swov.nl/sites/default/files/bestanden/wegwijzer/data_sources.pdf
13. Żukowska, J. (2015). Regional implementation of a road safety observatory in Poland. *Archives of Transport*, *Vol. 36, iss. 4*. Retrieved from http://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-b197b3d7-5436-479b-be5f-da6922ee1122
14. UN General Assembly. (2020). *Resolution adopted by the General Assembly, 74/299. Improving global road safety*. Retrieved from https://undocs.org/pdf?symbol=en/A/RES/74/299
15. Adeloye, D., Thompson, J. Y., Akanbi, M. A., Azuh, D., Samuel, V., Omoregbe, N., & Ayo, C. K. (2016). The burden of road traffic crashes, injuries and deaths in Africa: a systematic review and meta-analysis. *Bulletin of the World Health Organization*, *94*(7), 510-521A. https://doi.org/10.2471/BLT.15.163121
16. Institute for Health Metrics and Evaluation. (2014, April 18). About GBD. *Institute for Health Metrics and Evaluation*. Retrieved April 7, 2021, from http://www.healthdata.org/gbd/about
17. Database - Eurostat. (2020). Retrieved December 10, 2020, from https://ec.europa.eu/eurostat/data/database?node_code=tran_sf_roadus
18. Saftynet. (2009). SafetyNet Final Activity Report. Retrieved March 4, 2021, from https://trimis.ec.europa.eu/sites/default/files/project/documents/20090206_184410_45024_SafetyNet_Final_Activity_Report_V3_Final.pdf
19. TRRIMIS - Europran Commission. (2015, May 21). European Road Safety Observatory (Safetynet). *TRIMIS*. Retrieved February 23, 2021, from https://trimis.ec.europa.eu/project/european-road-safety-observatory

20. Safetynet. (2007). ERSO website. Retrieved February 23, 2021, from http://www.dacota-project.eu/Links/erso/index-2.html
21. TRIMIS - European Commission. (2013, September 11). Road safety Data Collection, Transfer and Analysis. *TRIMIS*. Retrieved February 23, 2021, from https://trimis.ec.europa.eu/project/road-safety-data-collection-transfer-and-analysis
22. IRTAD. (2015, December 7). Road Safety Database. *ITF*. Text. Retrieved December 14, 2020, from https://www.itf-oecd.org/irtad-road-safety-database
23. NHTSA. (2016, November 14). FARS. *NHTSA*. Text. Retrieved February 23, 2021, from https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars
24. US.DOT. (2020). Background on Safety Data Initiative Office of the Under Secretary for Policy United States Department of Transportation.
25. OISEVI. (2012). OISEVI Observatorio Iberoamericano de Seguridad Vial. Retrieved December 11, 2020, from https://www.oisevi.org/archivos/documento_conceptual_oisevi_070312.pdf
26. OISEVI. (2017). Organic Statute Of The Ibero-American Road Safety Observatory.
27. Abounoas, Z., Raphael, W., Badr, Y., Faddoul, R., & Guillaume, A. (2020). Crash Data Reporting Systems In Fourteen Arab Countries: Challenges And Improvement. *Archives of Transport*, 16. https://doi.org/10.5604/01.3001.0014.5628
28. Jadaan, K. S., Bener, A., & Braizat, E. (2016). Formulation of road safety strategy for developing countries with special reference to Jordan. *Advances in Transportation Studies*, 11.
29. ITF. (2015). About the Joint Transport Research Centre of the OECD and the International Transport Forum. Retrieved February 23, 2021, from http://www.internationaltransportforum.org/jtrc/jtrcabout.htm
30. OECD. (2003). Resolution of the council on the establishment of a joint OECD/ECMT transport research centre. Retrieved February 23, 2021, from http://www.internationaltransportforum.org/jtrc/c-128-final.pdf
31. SafetyNet. (2008). *Common Accident Data Set reference guideline*. Retrieved from https://www.ssatp.org/sites/ssatp/files/publication/common_accident_data_set_cadas.pdf
32. Fatality Analysis Reporting System (FARS) Analytical User's Manual. (2015). *UserManual.wiki*. Retrieved April 30, 2022, from https://usermanual.wiki/Pdf/Fatality20Analysis20Reporting20System20FARS20Analytical20Users20Manual2019752015.1706426821/view
33. European Commission DG MOVE. (2018). CARE Dabase CADaS. Retrieved April 30, 2022, from https://www.ssatp.org/sites/ssatp/files/publication/common_accident_data_set_cadas.pdf
34. Koppel, S., Jiménez Octavio, J., Bohman, K., Logan, D., Raphael, W., Quintana Jimenez, L., & Lopez-Valdes, F. (2019). Seating configuration and position preferences in fully automated vehicles. *Traffic Injury Prevention*, *20*(sup2), S103–S109. https://doi.org/10.1080/15389588.2019.1625336
35. NHTSA. (2019, July 17). Fatality Analysis Reporting System. *NHTSA*. Text. Retrieved December 15, 2020, from https://www.nhtsa.gov/crash-data-systems/fatality-analysis-reporting-system
36. NHTSA. (2020). FARS Encyclopedia. Retrieved December 11, 2020, from https://www-fars.nhtsa.dot.gov/Main/index.aspx
37. Krishnaveni, S., & Hemalatha, M. (2011). A Perspective Analysis of Traffic Accident using Data Mining Techniques. *International Journal of Computer Applications*, *23*(7), 40–48. https://doi.org/10.5120/2896-3788
38. NHTSA. (2016). FARS/NASS GES Coding and Validation Manual. Retrieved December 15, 2020, from https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812216
39. Abdulhafedh, A. (2017). Road Traffic Crash Data: An Overview on Sources, Problems, and Collection Methods. *Journal of Transportation Technologies*, *7*(2), 206–219. https://doi.org/10.4236/jtts.2017.72015

40. European Commission. (2018). CARE Database. Retrieved December 21, 2020, from https://ec.europa.eu/transport/road_safety/system/files/2021-07/cadas_glossary_v_3_7.pdf
41. Villegas, M. T. (2011). CARE database. Retrieved December 21, 2020, from https://unece.org/DAM/trans/doc/2011/wp6/ECE-TRANS-WP6-2011-pres08e.pdf
42. OECD, S. (2013). Web Browser User Guide. Retrieved from https://stats.oecd.org/Content/themes/OECD/static/help/WBOS%20User%20Guide%20(EN).PDF
43. NHTSA. (2020). FARS Encyclopedia: Request Data. Retrieved March 14, 2021, from https://www-fars.nhtsa.dot.gov/Main/index.aspx
44. FIA. (2021). *Meeting Regional Road Safety Observatories of 10.12.2020*. Retrieved from https://www.youtube.com/watch?v=q_mcrlChOuE&feature=youtu.be&ab_channel=FIA
45. World Bank. (2016). IDF Grant TF-14563 for Institutional Capacity Building of OISEVI.

Copyright of Advances in Transportation Studies is the property of Advances in Transportation Studies and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.