MANAGING INTERGOVERNMENTAL INFORMATION NETWORKS, THE QUEST FOR A SUITABLE FRAMEWORK.

Lies Van Cauter, University of Leuven, Public Management Institute, Belgium.

Prof. Dr. Monique Snoeck, University of Leuven, Research Centre for Management Informatics, Belgium.

Prof. Dr. Joep Crompvoets, University of Leuven, Public Management Institute, Belgium.

Prof. Dr. Joris Voets, University of Ghent, Management, Innovation and Entrepreneurship, Belgium.

EGPA conference 2013, Edinburgh

Permanent study group XIX

KEYWORDS

Management intergovernmental information networks, road sign database, Inter-Organisational Systems Integration Framework, Information System Success Model.

ABSTRACT

The environment in which governments operate changes. They cannot face societal problems on their own and seek new forms of intergovernmental cooperation. The current call for integrated transboundary services points to a coordination problem of the public sector. Information can be a valuable resource to support intergovernmental cooperation but is often fragmented too. Governments who want to link their information flows have to make choices, each with its (dis)advantages. The Inter-Organisational Systems Integration Framework of Goethals (2006) might be of use to get insight in these choices. Via the case of the road sign database we explore if the Goethals framework is suitable to picture how the management of intergovernmental information networks can be strengthened.

WORK IN PROGRESS!

PLEASE DO NOT QUOTE

MANAGING INTERGOVERNMENTAL INFORMATION NETWORKS, THE QUEST FOR A SUITABLE FRAMEWORK.

Van Cauter Lies, Snoeck Monique, Crompvoets Joep and Voets Joris

1. INTRODUCTION

The environment in which governments operate changes as they face times of globalization, specialization, savings and declining legitimacy (Minnaar, 2012; Castells, 2000). Governments must act faster and more qualitatively, and be more innovative and pro-active in a more complicated and insecure environment where borders between market and state blur (Homburg, 2008; MBZK, 2005; Van der Aa et al, 2004). Governments cannot face the current **societal problems** that arise from these changes on their own: administrations only hold a part of the key solution and seek for partnerships, new forms of **intergovernmental cooperation**. (Voets, 2011; De Rynck, 2008; Snijkers, 2004). Forces are joined in networks, the era of collaboration has arrived (Agranoff & Mc Guire, 2003). Intergovernmental ties are the most common form of network connections in public programs (Voets, 2008).

The current call for integrated transboundary services points to a coordination problem of the public sector (Bouckaert et al, 2010). Along Ring and Perry (1985) a unique set of managerial constraints arises with changes in the societal context. There is a **need for coordination beyond the borders of public organisations** (Groeneveld & Van de Walle, 2011; Van der Aa et al, 2004; Teisman and Klijn, 2002; Jackson & Stainsby, 2000).

Information can be a valuable resource to support intergovernmental cooperation (Pardo et al 2008, White 2007, Deprest et al 2003). Public administration and public policy increasingly require connective capacities and inter-organisational/governmental strategies (among public actors and between public-private actors), supported by or shaped around coupled databases and information chains (Bouckaert, 2011). **But information is often fragmented** and spread over several databases and governmental levels (Knottnerus et al, 2011; Bouckaert et al, 2010; Snijkers, 2004; BMC, 2002). A main **challenge** is to **link information flows** of separate governments and to **manage interdependencies** and information networks that cut across governmental boundaries (Bouckaert et al, 2010: Snijkers, 2004; BMC, 2002). It is very likely that more and better information from numerous sources are needed in order to fulfil the demands to improve policy and service delivery (Klijn, 2003). **Information management** is therefore essential for public sector innovation. (Homburg, 2008; Voets, 2008; Mayer-Schönberger, 2007; European Commission, 1999). There is no magic, it is clear that information sharing networks may suffer from coordination or management problems (Goethals, 2006).

Governments who **want to link their information flows have to make choices**. Every decision has its advantages and disadvantages (Lance et al 2009, Nedovic-Budic & Pinto, 1999 in Vancauwenberghe, 2013). In order to strengthen the management of intergovernmental information networks, we need to gain insight in

the options networks have to deal with a certain problem. **According to the situation**, a certain data and process architecture and management style may be **more fruitful than another.**

As data and process architecture are a matter of developing an enterprise architecture, a relevant question is in **how far existing enterprise architecture** (EA) **frameworks** may **help** in developing the right data and process architecture. In particular, we need a framework that helps to assess the as-is situation and provides advices for the improvement of the architecture from a management perspective. Although the general focus of EA frameworks is both on the descriptive aspects of systems as on offering guidance and support for directions and decisions (Op 't Land et al, 2009). A specific guidance for managing data and process architecture in an intergovernmental network is lacking. In particular, the fragmentation of data across databases and governmental levels raises questions in terms of **where to manage which data ideally** (Pardo et al, 2009). On the one hand there is a need for centralization in order to make information systems interoperable, on the other hand there is the decentral need for adaption. This paradox is a difficult puzzle for public network managers. This makes the problem of (de)centralisation particularly relevant for intergovernmental information networks

A possible framework to gain insight in the options networks have, is **the Inter-Organisational System Integration Framework (IOSIF) of Goethals (2006)** as this framework specifically focuses on centralisation and decentralisation decisions surrounding data and processes**.** It grasps the current information network configuration in terms of (de)centralisation and zooms into the (dis)advantages of the choice to (de)centralize data or process design, - execution and – storage by formulating eight generic problems that need attention. The framework might thus provide insights to improve intergovernmental information networks.

The Inter-Organisational Systems Integration Framework (IOSIF) of Goethals (2006), enables organisations to **think out-of-the-box in order to set up processes of information sharing**, rather than copying existing solutions. It provides a framework to grasp the diversity in the field. The Goethals framework studies if a certain problem desires centralization or decentralization of data and process characteristics. The centralization concept is repeatedly considered in intra-organizational studies but hardly investigated in IOSI research so far. This makes the study of this framework more relevant and interesting.

Several **typologies** exist that look at inter-organizational information structures. Some authors that developed such a typology are Goethals (2011), Grijpink (2010), Österle et al (2001), De Wit & Meier (2000), Kumar & Van Dissel (1996) and Robey & Sales (1994). Only the model of Goethals and that of De Wit & Meier look at (de)centralization explicitly. As the model of De Wit & Meier is less sophisticated than that of Goethals et al, we aim to start from the latter.

This brings us to the research question:

RQ. Is the Inter-Organisational System Integration Framework (IOSIF) of Goethals, consisting of an architecture description framework and eight generic

problems, a suitable framework to research how the management of intergovernmental information networks can be strengthened?

We will first discuss the methodology used for our research. In part three the theoretical frameworks are sketched: the architecture description framework and the eight generic problems of IOSIF. Part 4 puts the frameworks to a test: are they suitable to research how the road sign database can be strengthened. We dig deeper in this 'suitability' question via a discussion (part 5). Conclusions and limitations are formulated in the final part 6.

2. METHODOLOGY

This paper is written in the frame of a project concerning '*strengthening management of intergovernmental information networks – the case of Flanders'*. It aims to find a suitable framework to strengthen the management of intergovernmental information networks. This will be done via case studies and a survey of 122 Flemish intergovernmental information networks. This research presented in this article threats a first case study, the goal of which is to **test** if the architecture description framework and the eight problems of the Goethals framework are suitable **instruments to develop advice**. Our article is the first tentative attempt to use and test the Inter-Organisational System Integration Framework in a public sector context.

The Goethals framework will be assessed via a **case study** of the **road sign information network.** The road sign database contains all road signs, their main characteristics and positions on the Flemish roads. As the information flows within this network are not smoothly linked, there is room for improvement and the Goethals framework should therefore be able to pinpoint the problems and formulate advice on how to strengthen the road sign information network. To assess the architecture description framework, information on the current data an process architecture of the road sign database was collected by means of interviews with the designers of this database. As we need to **evaluate the frameworks** capability to help in formulating advice on how to strengthen the management of a network, also information on the experienced strong and weak points of the current data and process architecture needed to be collected. To this end, we interviewed a subset of the users. **Twenty-three municipalities volunteered** to test the road sign database in its start-up phase. Their road sign information was already mapped by June 2009 (Verbiest, 2009b). We interviewed these twenty-three municipalities by telephone to evaluate the functioning of the road sign information network. At Flemish level the Department of Mobility and Public Works, the Agency for Roads and Traffic and the Agency for Geographic Information were interviewed face-to-face. Policy documents were researched too.

As it soon became clear that 18 of the 23 pioneering municipalities did not use the road sign database at all, we wondered if this low adoption rate counted for the other Flemish municipalities and cities. Additionally 85 telephone interviews with 85 municipalities and cities were completed. **In total 108 of the 308 Flemish municipalities and cities were questioned**. As the road sign database is only used by the police force in some municipalities, we made sure that at least one municipality per police zone was questioned. Some municipalities ask their police force for road

sign information and may as such use the road sign database indirectly. The municipalities were chosen at random per police zone.

During the telephone interviews municipalities and cities were asked how frequently the road sign database was used. If they did not (often) use this database they were asked why this was the case and if they employed any alternatives concerning their road sign policy. The non-users were asked if they desired to get back on board in the future. Municipalities and cities who did use the system were asked for what purpose they utilized the database and if they kept the database consequently up-to-date.

The next part digs into the theoretical frameworks of this paper.

3. THEORETICAL FRAMEWORKS

In the next paragraphs the position of the Goethals framework in the field (3.1.) is explored. Further the architecture description framework (3.2.) and the eight generic problems (3.3.) of Goethals' Inter-Organisational Information Integration Framework (2006) are scrutinized.

3.1 THE POSITION OF THE GOETHALS MODEL

Goethals, Snoeck & Lemahieu (2011) state the configuration of inter-organisation system integration solutions and the **role of centralization** in those **configurations** is neglected by scholars so far. Cross-enterprise collaboration requires companies to remodel the organizational structures (Bowersox et al, 2003 in Goethals, 2006). The configuration choices of organisations in an information network can be visualised in the Inter-Organisational Systems Integration Framework (IOSIF) of Goethals (2006).

The IOSI Goethals framework is designed for the private sector. As the aim is to strengthen public sector information networks, it will have to be adapted. Along White (2007) **managing** information in the **public sector** is significantly **different from** managing information in **private sector**, e.g. technically, politically, bureaucratically or financially. Many public agencies have to deal with less than state-of-the art technologies. Sometimes budgets and revenues are low (White, 2007). Public sector needs of constituent groups are more diverse and politicized (Provan & Milward, 2001). Collaborating parties in public sector networks are often known in advance and fixed, the chance for more incidental partnerships is higher in private sector information networks (Landsbergen & Wolken, 2001). On the other hand, private conglomerates are controlled by the parent corporation while each member of the public sector network can act independently of all other members (Mandell, 1990).

Although one cannot deny differences between the management of **public and private** sector information and information networks, some **parallels exist too**. Both private and public organisations strive to automate existing business practices to a certain extent and to request information only once, considering values as client orientation and efficiency. Both see virtue in common standards and the use of web services to ease information sharing. Cross-enterprise as well as cross-governmental collaboration cannot rely on leadership by one party. Both are confronted with cultural differences and different legislation when trying to share information etc.

(Van Breemen, 2011; De Rynck, 2008; Goethals, 2006; Snijkers, 2004). Institutions developed to govern inter-firm relations may also work for the governance of inter-organizational relations in the public sector, etc. (Keersbergen & Van Waarden, 2004).

Management of networks covers multiple issues from different disciplines. But research is still quite mono-disciplinary and it seems unclear how disciplines relate (Van Breemen, 2011). Different subdisciplines in science use their own terminology. This can hamper comparing and combining of these subdisciplines. Building bridges is nevertheless valuable (Provan & Kenis, 2008). Using the Goethals IOSI framework, created in the inter-organisational theories perspective from a Business to Business integration point of view, in a public sector context, might provide new insights on the management of intergovernmental information networks. Lips et al (2005) believe that the **coupling of public management and inter-organisational information system studies**, will make these domains grow strong together. In this case looking to the private sector is quite logic as most of the current knowledge on inter-organisational information systems is based on private logistics chains (Van Breemen, 2011). Taking inter-organisational studies as a starting point makes sense as these studies inspired the public management network research (Klijn, 2008).

3.2 THE ARCHITECTURE DESCRIPTION FRAMEWORK

Goethals created a framework specifically concerning Inter-Organizational Systems Integration (IOSI). The framework aims to define a business to business solution space and tries to illustrate the relevance of choosing an appropriate solution by showing that different solutions have different properties. The framework inventories solutions for data sharing problems and process integration problems. The competitive environment requires organisations to integrate and coordinate their systems efficiently and effectively (and thus to pursue alignment of inter-organisational systems) (Smith and Fingar, 2003 in Goethals, 2006). There is an increasing need to **understand options in inter-organisational systems integration**. According to the situation a solution may be more fruitful than another considering different properties in terms of variables such as business continuity, ownership, flexibility… The architectural knowledge that the framework provides, is important in order to be able to choose from different integration solutions. Along Markus and Robey (1988) no single measure is intrinsically better than another, so the choice of a success variable is often a function of the objective of the study, the organizational context, the aspect of the information system which is addressed, the independent variables under investigation, the research method and the level of analysis (in DeLone & McLean, 1992).

As shown in table 1, Goethals distinguishes data - and process control and design- and execution control. The division between process (task through which things are made/ changed/destroyed) and data (things that are) arose from case studies and a number of standards. This distinction fits the distinction made by Clergeau and Rowe (2005), Simon (1994) and Hirscheim et al (1994) (in Goethals, 2006). Another distinction is that of design control versus execution control. This division rose from the observation that organisations try to deal with similar problems in different ways. Organisations may enable conversations by designing a common language. When they do not develop a common language, additional tasks demand extra execution time to deal with incompatible data formats. The distinction between design/ structure

and execution is also made by Maes (2007) whose model is based on insights of Henderson & Venkatraman (1993).

	Process control related	Data control related
Design control	Process design	Data design
Execution Control	Process execution control	Data execution transmission
	Task execution	Data execution storage

TABLE 1 B2BI (DE)CENTRALIZATION DIMENSIONS OF THE IOSIF (GOETHALS ET AL, 2011)

The right column of table 1 is about data control. Goethals makes the distinction between data design, data transmission and data storage. Data control related issues focus on deciding about the what, where, why, how and who of data sharing. It is about the *way* decisions are made with respect to data sharing.

Mintzberg (1993) states that the control over execution and over decision taking can be (de)centralized. When data are centrally controlled, they may be kept at the level of one organisation, or even an industry. Information will not be adapted to specific needs of partners and what can be shared is centrally regulated. Often there is one strong party, the rest follows. When data are controlled decentrally parties bilaterally agree on the content to be shared, the data formats…

In the first row of the data control column one can see **'data design'**. The design can be a global data model. The boundary objects theory states that it is important to ensure semantic interoperability when sharing information. Boundary objects are objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity (Marriott School for Management, 2013). Organisations are free to decide if they adopt a certain standard. The second row of the data control column deals with **'data transmission'**. Data transmission can happen directly from data provider to data receiver or via an intermediate central system. The last row in the data control column focusses on **'data storage'**. Data can be stored in a central repository that is shared by all partners or in different locations.

The middle column of table 1 deals with process control. These three dimensions form the inter-organisational process-specific integration solution space.
The first row of this column deals with **'process design'**. Decisions with respect to how processes will be realized can be made (de)centrally. If decisions are made centrally, an overall picture of what the entire process looks like will be available and managed. If decisions are made decentrally there is no overall process picture that is managed. The second row of the middle column is about '**process control'.** Process execution can be controlled centrally, by a single controller: this controller interprets the process definition and is responsible for starting, suspending, resuming and stopping of the process execution. Several parties can control a fragment of the process. In real life, process control often follows a hybrid model. A last cell of table 1 is **'task execution'**. Tasks can be executed by a central party that acts as a communal service provider or can be executed decentrally in which case different organisations locally execute tasks.

Each dimension refers to an important aspect and encompasses a **continuum** from an entirely centralized to an entirely decentralized setup. Depending on the (de)centralization choices a system will possess or lack certain characteristics concerning flexibility, safety, ownership, service delivery etc. Several authors researched the (dis)advantages of certain (de)centralization choices e.g. Asheley (2006), Kotelnikov (2006), Scheiber (2004), Bauer (2003), Iamnitchi (2000), Sastry (1998), Mintzberg (1992), Streeter (1973) etc. (in Goethals, 2006). Each process-specific integration solution can be combined with each data integration solution.

The construction of a data and process configuration in order to share information, can be hampered by several problems. Goethals identified eight generic problems that explored in the next section and that complement the architecture description framework described in this section.

3.3 THE EIGHT GENERIC PROBLEMS OF INTER-ORGANISATIONAL INFORMATION SHARING

When organizations decide to **share data** or to create inter-organizational processes, they are likely to be confronted with a **number of problems** (Tang et al, 2006; Sheu et al, 2001 in Goethals, 2006). Depending on the situation, these problems may be considered more or less important, and may thus have a bigger or a smaller influence on the chosen solution. Goethals (2006) distinguishes **eight generic problems**. The problems can surface at the data as well as at the process side. The list of problems is the result of a **literature study** in the frame of his PhD research concerning Extended Enterprise Integration Approaches. The table is deduced from research of Asheley, 2006; Kotelnovik, 2006; Robb, 2005; Radding, 2005; Wood, 2004; Bauer, 2003; Zrimsek & Prior, 2003; Jordan, 2002; Merrill Lynch & Co, 2001;Yu, 2000; Iamnitchi, 2000; Nygaard-Andersen et al, 1994; Streeter, 1993; Mintzberg, 1992 etc. (in Goethals, 2006).

Discussing these problems (table 2) is a valuable basis for evaluating the road sign database configuration.

P1	Agreement is needed about what should happen and when
P2	Companies have a different viewpoint
P3	Partners need to agree on how they can take care of the execution
P4	Investments are needed
P5	Service levels should be appropriate
P6	Companies should preserve the function of the practice
P7	Ownership may not be well arranged
P8	Parties change over time

TABLE 2 EIGHT GENERIC PROBLEMS (GOETHALS, 2006)

A first problem that Goethals (2006) distinguishes in table 2 is the **need** for **agreement** on what should **happen** and when. Identifying what data should be transmitted electronically when to who is difficult. This is more so if the information

flows were not yet existent at organizational level before. A challenge is to determine who should be expected to have access to what data when.

Secondly, organisations have **different viewpoints**. Knowledge is localized and embedded (Carlile, 2002 in Goethals, 2006). Integrating the data about an object is problematic as different user groups have a different perception of the object and are thus interested in partly the same and partly different data.

Thirdly, partners need to agree on how they can **take care of the execution**. From a data perspective, this implies that an appropriate data format has to be defined such that data can easily be shared and exchanged. As data serves as input for tasks, on the process side, partners need to agree how one will be informed that data is ready for processing and how one will know when tasks can/should start.

A fourth problem is that **investments** are needed. Investments can be left primarily to one partner or can be split among the partners and/or third parties. If one party makes changes to (or withdraws) the systems he possesses, other parties may need to make additional investments.

A fifth challenge is that **service level agreements** should be available. The most important service level requirement concerns 'availability'. Partners need data to execute desired tasks, but there is a chance that at some point in time the data will be unavailable, hampering the internal functioning of one or more organisations and/or the functioning of the entire network.

Another problem is that the **function of practice** must be preserved. Organisations have to trust each other: the receiver has faith in the quality of data, and the sender has faith in the receiver preserving the confidentiality of data.

On the one hand, several parties may want to decide what can/must happen with the data. On the other hand, no party may be designated as data owner or may feel responsible. As such a seventh problem may be that **data ownership** is not well arranged.

Finally parties that provide the data, and/or the **parties** that use the data may **change**. There is a risk that partners use old, invalid data and that former partners still get access to data present in the network.

Now the content of the IOSI and eight generic problems frameworks is explained, we will explore the case of the road sign information network (4.1.) before testing the frameworks via this case (4.2, 4.3).

4. TESTING THE FRAMEWORKS ON THE ROAD SIGN INFORMATION CASE

A short historic overview of the road sign information network is given, before analysing the road sign information network via the architecture description framework and the eight generic problems framework of Goethals.

4.1 HISTORY OF THE ROAD SIGN INFORMATION NETWORK

The road sign information network is built around the road sign database. This **online database** contains every road sign on the Flemish[1] roads. The creation of the database was triggered by the European Rosatte project, by a proliferation of road signs and by the need for policy information (Verbiest, 2009a). A central up-to-date overview of road signs was lacking. The window of opportunity to launch this database politically was a huge traffic obstruction in Bruges. A bridge was hit by a truck because there was no road sign about the bridge's height (MOW, 2010).

Data were inventoried by means of mobile mapping: 54.000 kilometres of municipal roads and 6.500 kilometres regional roads were inventoried in one application. The online application consists of two elements. On the one hand one can see the **location and characteristics** of **every road sign in Flanders** on a road map. On the other hand **360 degree panoramic pictures** can be used. These panoramic pictures are reused in other geographic databases. The total cost of the project is 19.2 million euros (Flemish Parliament, 21th of June 2012).

The Flemish minister for Roads **initiated** the creation of the road sign database **in 2008**. Because of the division of powers in Belgium, two public organisations were responsible for the creation of the inventory and database. The Flemish Agency for Roads and Traffic took care of the regional roads, while the Flemish Department of Mobility and Public Works mapped the other roads (Boterbergh et al, 2008). Once the inventory was completed, the 308 Flemish **municipalities were requested to keep the road sign database up-to-date** for their territory. The Agency for Roads and Traffic was asked to keep data about the Flemish regional roads up-to-date. Municipalities were advised to make these updates part of their internal processes. The Flemish government argued that up-to-date road sign information could be useful for fire workers, police men and municipal civil servants (Cabinet of minister Crevits, 2010). The database did not only have potential for municipalities, external partners such as cartographers and gps firms showed interest too. The database was **fully operational in 2011**.

Never started with the database	Non use	Use it a once/ a few times a year	Monthly use
20	64	21	3

TABLE 3 ROAD SIGN DATABASE: FREQUENCY OF USE (N= 108)

When we look at the frequency of use pictured in table 3, **four groups** could be distinguished. A first group consists of municipalities that never even tried to use the road sign database. Five **never started with the database** because they possess their own database. The other fifteen municipalities and cities in this group did not have the time or personnel to start with the database or categorize it as 'not useful'.
Secondly, we can distinguish municipalities and cities that **enrolled but** currently **do not use** the road sign database at all. This is the case for 63 of the 108 interviewed municipalities or cities.

[1] Flanders is the most Nordic region of the three regions in Belgium.

Twenty one municipalities/cities use the database **once or a few times a year** and another three municipalities utilize it **at least once a month**. During an interview the Flemish government confirmed that the results of our sample corresponded to the situation of other Flemish municipalities and cities. Municipalities and cities **do not feel the need to keep their road sign information up-to-date**. The Agency for Roads and Traffic does not manage to keep its data up-to-date either. Because of this behaviour **the road sign database got spoiled**. What went wrong?

The study of the current inter-organisational system integration configuration (4.2) and problems (4.3) might provide an answer.

4.2 ANALYSIS OF THE ARCHITECTURE OF THE ROAD SIGN INFORMATION NETWORK

In order to discover whether the Goethals framework is a suitable framework to research how intergovernmental information networks - and more specifically the management of the road signs information network - can be strengthened, the **configuration structure** should be clear. A picture of this structure will provide insights in choices the network partners made in order to create the road sign database. These understandings can enable network partners to discover what went wrong and in a second stage to install improved solutions.

When governments want to share information, they have to take a position on the six (de)centralization dimensions of architecture description of the Inter-Organisational Systems Integration Framework. Choosing a good data integration solution (and thus having knowledge about the solution space) seems important as it has been shown that skills in managing inter-organisational knowledge flows are a source of competitive advantage (Dunning, 1988; Levy et al, 2003 in Goethals, 2006). Table 4 shows the positions that were taken in this case.

	Process control related	Data control related
Design control	Process design ➔ centralized	Data design ➔ centralized
Execution Control	Process execution control ➔ quite decentralized	Data execution transmission ➔ centralized
	Task execution ➔ decentralized	Data execution storage ➔ centralized

TABLE 4 (DE)CENTRALIZATION DIMENSIONS IOSIF CONCERNING THE ROAD SIGN INFORMATION NETWORK (GOETHALS ET AL, 2011)

The **data design** of the road sign database is centralized. Municipalities and the Agency for Roads and Traffic were consulted before the database was shaped. Nevertheless most of the choices were already made beforehand by the Flemish government. The Flemish government created the database and gave it to its 308 municipalities and the Agency for Roads and Traffic. These were asked to keep the system up-to-date. Municipalities could not decide individually *what* information they shared via the system, this is regulated centrally at Flemish governmental level.

Concerning the **data transmission**, there is a shared storage space where data are permanently stored. Data is transmitted from the municipality or the Agency of Roads and Traffic to the central controller (the Flemish government) and vice versa. There

are no direct application data transmissions between municipalities. Municipalities can see - but not adapt - each other's road sign information via the central database. When a municipality A is data provider and municipality B data receiver, e.g. because B needs road sign information just beyond the municipal border, then this data need to be transmitted via the central system.

Data storage dimension of the road sign database is central. All information is stored in the central database on the Flemish level. If the Flemish system is offline, municipalities do not have road sign information. Officially this is the case, but in the meantime, several municipalities possess data copies or parallel databases. Two years after the creation of the road sign database, the Agency of Roads and Traffic created its own parallel database for regional roads information.

Process design, the Flemish government made unilateral and central decisions how the process should be realized: it decided *how* information should be updated: via a web application. If a municipality or the Agency for Roads and Traffic adds a road sign, this is automatically updated in the central program. *Who* makes the updates differs per municipality: it can be a police man, a technical road sign civil servant, … As a result, there is an overall picture of the process. Although the process model was defined centrally, municipalities could still freely decide whether they adopted the standard or not (see process control).

Concerning the **process control** is in practice decentral. Although the Flemish government urged municipalities to cooperate, no legal demand or financial pressure was used. Each municipality decides for its own whether and when they kept the database up-to-date. So they each control their distinct part and are responsible for the starting, suspending, resuming and stopping the process control. The Agency for Roads and Traffic controls its own database. The Flemish government desired to control the entire process by collecting data in one central database.

The **task execution** happens decentralized: several parties execute a specific task, all municipalities should execute their tasks using the same system.

4.3 THE EIGHT GENERIC PROBLEMS OF INTER-ORGANISATIONAL INFORMATION SHARING AND THE ROAD SIGN INFORMATION NETWORK

In order to grasp why most municipalities and cities in our sample do not use the road sign database (often), the table of **eight generic problems of inter-organisational information sharing** will be used (Goethals, 2006). Table 5 summarizes the eight generic problems.

Problem 1 concerns the need for agreement on what should happen and when. The Flemish government launched the idea of a road sign database, municipalities were informed and could give small remarks. As designer of the road sign database the Flemish government decided who had access to the data. It asked municipalities to make data updates. These updates would be automatically transmitted to the central database. Many municipalities were enthusiastic at the start of the project. Although there seemed to be agreement at the start of the project, this initial enthusiasm dropped because the **database suffered severe technical teething problems**. System

quality appeared to be low as it did not function well. Therefore municipalities did not agree any more to keep the database up to date.

P1	Agreement is needed about what should happen and when
P2	Companies have a different viewpoint
P3	Partners need to agree on how they can take care of the execution
P4	Investments are needed
P5	Service levels should be appropriate
P6	Companies should preserve the function of the practice
P7	Ownership may not be well arranged
P8	Parties change over time

TABLE 5 EIGHT GENERIC PROBLEMS OF IOIS (GOETHALS, 2006)

P2. Organisations have different viewpoints. The technological frames theory acknowledges that different groups have different perspectives of usefulness, importance and significance of technological artefacts (Orlikowski & Gash, 1994). The Flemish government and municipalities have only partly the same data interest. The municipalities and the Agency for Roads and Traffic can be divided in different groups. First, municipalities who do use the database, secondly municipalities who do not and never did, thirdly municipalities and the Agency for Roads and Traffic who did but do not use the database any more. The user satisfaction of the municipalities who do not use the database any more seems low. One could expect that the 24 municipalities who use the road sign database are satisfied with it. Strangely enough we see that only 6 of the 24 users keep their data up-to-date.

P3. Agreement on how to take care of the execution. On the data side, the data exchange issues where naturally solved by imposing a single database with a unified format on all partners. In terms of task initiation, it seems that there was no agreement ever made on this point. The Flemish government encouraged municipalities and the Agency for Roads and Traffic to use the road sign database, but it did not have any encouraging or discouraging tools to stimulate the usage and updating by municipalities. This does not have to be detrimental, if municipalities are motivated. Motivation appears to be a problem nowadays, many municipalities are **not triggered to execute** their updating task. No encouraging tools like legal obligation were used.

P4. Investments are needed. As the Flemish government paid for the database, municipalities/cities and the Agency for Traffic and Roads did not have financial objections. The Flemish government paid the whole database, municipalities and cities could freely benefit from it. However, municipalities that already had an own road sign database were asked to invest time and re-enter their data in the Flemish system, as a common data format was lacking.
Non updating municipalities and cities nowadays claim that **updating** the database **is a too time consuming investment**. The net benefits seem not to outweigh the investments. A mobility civil servant remarked that the deduction of a report could take more than 20 minutes and the entering of ten road signs, a day. One municipality A still has no benefit in knowing the road sign data of municipality B. There should be a cultural fit between the technical and social subsystem of a municipality. Cheap and easy alternatives further discourage municipal investments. The Agency Roads and Traffic decided to stop updating the road sign database and created a database of

its own. The Flemish government had the idea to sell the road sign information later on to map makers like Tom Tom and Nokia, but map makers do not desire to buy the road sign information as they cannot afford it to be outdated.

P5. Service levels should be appropriate. Each municipality has to make updates of its own road sign data, but there are no service level agreements. Currently when a specific party **fails to execute** its task, data are simply not updated.

P6. Organisations must preserve the function of practice. The level of trust in the Flemish government by municipalities dropped. The database did not function as it was pictured and the Flemish government was difficult to reach for questions. As a result of this, the information quality fell short as quite a big amount of data was outdated, it could not be sold to gps firms. The Flemish government takes care of the security of the whole system. 27% of the questioned municipalities and cities complain about a tough log in procedure and experience difficulties to get an entrance permission.

P7. *Ownership may not be well-arranged.* The last-but-one generic problem that Goethals distinguishes is not well arranged data **ownership**. The Flemish government owns the entire database and decides how tasks are brought together. Municipalities should have a feeling of data ownership for municipal roads data. Most municipalities only care for their own data in- or outside the database. It seems important to recognize that individual agencies and managers are still motivated partly by self-interest (Provan & Milward, 2001). Road signs at the border with neighbouring municipalities may also be considered useful.

P8. Parties change over time. Political as well as civil servant leaders have an opinion on the road sign database. The project leader, the Flemish government, is criticized for not communicating often, municipalities do not feel encouraged. In 2012 new municipal councils were elected. Some new local political leaders encourage or discourage the use of the road sign database. Local civil servants play a role in keeping the database up to date. In three cases municipalities began to use the database after the retirement of the mobility civil servant.

When evaluating the eight possible generic problems that organisations might face when trying to share information, it becomes clear that the road sign information network suffers to a certain extent from all eight generic problems. Moreover, it becomes clear that certain problems were not sufficiently addressed before implementing the database. As an example, agreement (P1) on what should happen and when seemed to be present at the start but this agreement was superficial as the different viewpoints (P2) on key aspects that would ensure usefulness of the database were not investigated with sufficient depth. Other problems were simply not dealt with: e.g. no service level agreements were made (P5). Moreover, the 8 problems seem to be interrelated as well; The low service quality level provided by the Flemish government (P5) entailed negative effects on the preservation of the function of practice (P6), the willingness to use the database (P1) and investment decisions (P4). Most of the **problems arose** only **after** municipalities experienced the numerous **teething problems** of the database. It must be remarked that the causes of non-execution were not always technical teething problems. Some causes could be found

within municipalities e.g. a shortage of personnel, means or time and internal disputes.

The Flemish department for Roads and Public Works was aware of the problems and searched for solutions. The road sign database has reached a critical point. By April 2013 IT updates and adaptions were made. Logging in the system should go four times faster, demonstration movies should guide users, it should be possible not only to export but also to import information in the database due to xml and an open source web application, etc.

The negative perception about the database seems strong. One could raise the question if these adaptions will be enough to revive the troubled road sign database.

5. DISCUSSION

RQ. Is the Inter-Organisational System Integration Framework (IOSIF) of Goethals, consisting of an architecture description framework and eight generic problems, a suitable framework to research how the management of intergovernmental information networks can be strengthened?

The **Inter-Organisational System Integration Framework** pictures the configuration of the road sign information database. It seems that not all configuration choices were the most suitable ones in the past. There is a discrepancy between the original choices and the current factual structure. Data storage was meant to be central but in practice several municipalities possess decentral copies. Process design is central but municipalities still have to choice to adopt the standard or not. Process and task execution are decentral but the majority of municipalities do not take up their part etc. Although discrepancies between the intended architecture and the factual structure points to suboptimal decisions on (de)centralization, it does not yield concrete advice as to how to improve the information management. The fact that decentral copies of the central data are in use and that municipalities do not execute their tasks does not make us any wiser how the management of the road sign database can be strengthened. As such, the architectural description framework of the IOSI framework provides insight in a number of elements, but does not seem sufficient on its own to formulate advice.

The **eight generic problems framework** uncovers a series of troubles of the road signs information network. The analysis along these problems pictures more than the description of the configuration. It takes the need for agreements and investments into account, it recognizes that parties may have different viewpoints, that they can change over time and ownership may not be well arranged. It acknowledges that service levels must be appropriate and the function of practice must be preserved. Because the eight generic problems framework looks further than configuration, it might be of greater use to evaluate how the management of intergovernmental information networks can be strengthened.

When we use the eight generic problems framework, **forces that influence management choices** can be detected. These forces led to an unsuccessful implementation of this information sharing initiative (Howlett & Ramesh, 1995).

Forces define why a certain problem is hard and why the obvious solution(s) would not work. Forces influence human behaviour (Appleton, 1999 in De Rore, 2009; Geyer & Van der Zouwen, 1978). The fact that the eight problems are interconnected, points to a number of common underlying forces that drive decision. In particular, the expected benefit can be assumed a driver for the willingness to invest, to make agreements on what part of the process one is willing to take care of and to engage in service level agreements. We seem to recognize elements of the DeLone & McLean's (1992, 2003) information system success model while discussing the generic problems of the road sign information database.

Delone & McLean launched in 1992 a framework and model for measuring the complex dependent variable in IS research. The model is originally based on research of Shannon & Weaver (1949), Mason (1978), Zmud (1978) and Ives et al (1984). The model was revised in 2003, by then more than 300 scholars referred to, validated or challenged this model. Figure 1 pictures the adapted **information system success model.**

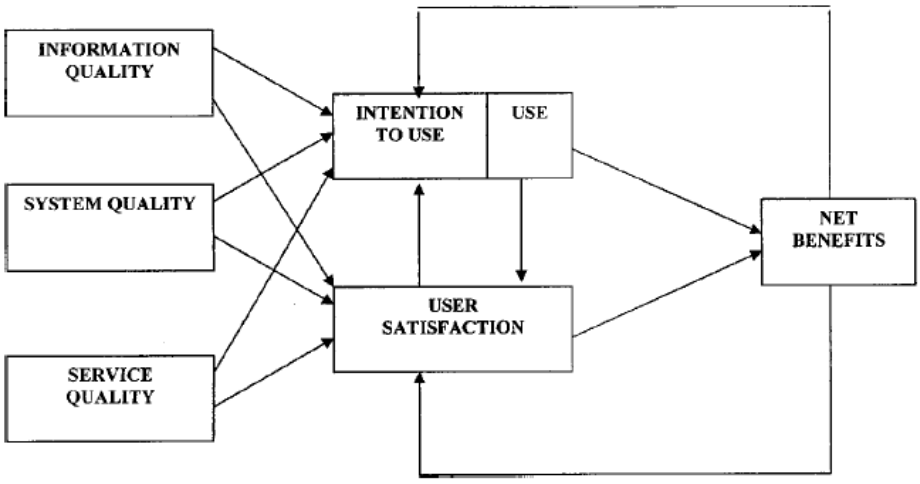

FIGURE 1 UPDATED D&M IS SUCCESS MODEL (DELONE & MCLEAN, 2003)

The *information quality* of the road sign database appears to be low as information is outdated. The *system quality* is low because of technical teething problems. The *service quality* looks at the overall support delivered by the service provider. The department Mobility and Public Works did not have legal resources to encourage the updating of the database. Municipalities complained that the leading department Mobility and Public Works was difficult to reach when they experienced problems. The *use* of the database severely dropped because of a low *user satisfaction* caused by technical teething problems. 64 of the 108 questioned municipalities quitted. 20 of the examined municipalities did not have the *intention to use* the database from the start. Some made this decision because they heard of the low user satisfaction. 24 of the 108 municipalities use the database but only 6 keep it up-to-date. The needed time investments appear to outweigh the net benefits. It seems important to recognize that organizations and managers are still motivated partly by self-interest (Klijn, 2008; Domisse et al, 2007; Agranoff & McGuire 2001/2004; Provan & Milward, 2001).

The Goethals framework and the eight generic problems frameworks can therefor only form the start of our framework to analyse the strengthening of management of intergovernmental information networks. It will have to be adapted and

complemented. The information system success model of Delone & McLean can be an interesting addition to this framework.

6. Conclusion and Limitations

6.1 Conclusion

The Inter-Organisational System Integration Framework pictures the configuration of information sharing initiatives. It tries to illustrate the relevance of choosing an appropriate (de)central solution by showing that different solutions have different properties. An appropriate configuration is important to create strong intergovernmental information networks. It seems that not all configuration choices were the most suitable ones for the road sign information network. There is a discrepancy between the original choices and the current factual structure.

A manager of intergovernmental information networks like the road sign database should keep the eight generic problems framework in mind. An appropriate configuration is not enough to ensure successful intergovernmental information sharing. The framework of DeLone & McLean can be a useful addition to the IOSIF, many forces can influence the success of intergovernmental information networks. Information, system and service quality, the perceived usefulness, use and user satisfaction and the net benefits count, these interrelated forces are sore points for the road sign information network.

In our quest for a suitable model to research the management of intergovernmental information networks, we find inspiration in the Goethals framework and its eight generic problems. These nevertheless have to be expanded and adapted, the Delone & McLean can be of great use to do so.

6.2 Limitations

This article was the first test of the IOSI framework applied to analyse a public management case in order to formulate management advice on strengthening information management. Much remains to be refined but writing this article was an enriching experience for the authors.

First of all different appropriate ways to strengthen an information network exist, much depends from which actor's perspective and goals one looks. Secondly situational factors play a major role. Looking at the configuration of a network is an important basis to picture the relations between actors. Nevertheless many forces are not (fully) grasped by the architecture description in the Goethals Inter-Organisational System Integration framework. The eight generic problems framework partly fills in this gap. In further research we plan to look both at the inter-organisational system integration choices and at forces that influence these. The DeLone and McLean information success framework can be of great use to do so. Some forces might be specific to a public sector context. As the IOSI, the eight generic problems and the D&M framework are created for a business context, these forces are very relevant to adapt the frameworks to public sector research.

7. REFERENCES

7.1 SCIENTIFIC LITERATURE

Agranoff, R. (2003), Leveraging Networks: A Guide for Public Managers Working across Organizations. Washington, DC: IBM Endowment for the Business of Government, 44 pgs.

Agranoff, R. & McGuire, M. (2004), Another look at Bargaining and Negotiating in Intergovernmental management. Journal of Public Administration Research and theory 14 (4): 495-512.

Agranoff, R. & McGuire, M. (2001), Big questions in public network management research, Journal of Public Administrtion Research and theory 11:03, 295-326.

Bestuur & Management Consultants (BMC). (2002), De Verbinding & Berenschot Procesmanagement: Naar een methodisch kader voor ketenregie in het openbaar bestuur, 78 pgs.

Bouckaert, G. (2011), Foreword. In: Z. Nedović-Budić, J. Crompvoets & Y. Georgiadou (Eds.), (2011). Spatial Data Infrastructures in Context: North and South. Boca Raton, USA: CRC Press – Taylor & Francis, vii-viii.

Bouckaert, G., Peters, G. & Verhoest, K. (2010), The coordination of public sector organisations. Shifting patterns of public management. Palgrave Macmillan.

Castells, M. (2000), The Rise of the Network Society: The Information Age, Economy, Society and Culture Vol. I. Cambridge, MA; Oxford, UK: Blackwell.

Deprest J. & Robben F. (2003), E-government: the approach of the Belgian federal administration CBSS Brussels, 55 pgs.

DeLone, W. H. & McLean, E.R. (2003), The DeLone and McLean Model of Information Systems Success: A Ten-Year Update, Journal of Management Information Systems, Vol 19, nr. 4, 9-30

DeLone, W. H. & McLean, E.R. (1992), Information Systems Success: The Quest for the Dependent Variable, Information Systems Research 3: 1, 60-95.

De Rore, L. (2009), Phd: Measuring Productivity and Improving Efficiency in Software Development Environments, p94.

De Rynck, F. (1 June 2008), De gemeente als sturende eenheid is een illusie, Lokaal: 10, 11-13.

Dommisse, B. & Consultants P. (2007). Samenwerken in ketens in de publieke sector in Grijpink, J.H.A.M., 'Geboeid door ketens' , 1-10.

Geyer, R.F. & van der Zouwen, J. (eds.) (1978), Sociocybernetics (2 vols.). The Hague, Martinus Nijhoff Social Sciences Division, 312 pgs.

Goethals F.G., Snoeck, M. & Lemahieu W. (2011), Options in inter-organizational systems integration, Faculty of Business and Economics, KU Leuven, nr 3, vol 16.

Goethals, F. (december 2006), Proefschrift: Classifying and Assessing Extended Enterprise Integration Approaches, University of Leuven, 1-202.

Groeneveld S & Van de Walle S., (2011), New steering concepts in public management, Research in Public Policy Analysis and Management volume 21, Emerald Books, Bingley, 1-238.

Henderson J. C. & Venkatraman N. (1993) Strategic alignment: Leveraging information technology for transforming organizations, Volume 32, Number 1, 4.

Homburg, V. (2008), Understanding e-government. Information systems in public administration. New York. Routlegde, 131pgs.

Howlett, M. & Ramesh, M. (1995), Studying public policy. Policy cycles an policy subsystems, Chapter 8 Policy Implementation, policy design and the choice of policy instrument, Oxford University Press, Canada, 153-167.

Ives, B., Olsen, M. &Baroudi J.J. (October 1983), The Measurement of User Information Satisfaction,
Communications of the ACM, 26 IO, 785-793.

Jackson, P.M. & Stainsby L. (2000). Managing public sector networked organizations. Public Money & Management, Vol. 20, No. 1, 11-16.

Keersbergen, K. & Van Waarden, F. (2004). Governance' as a bridge between disciplines: cross-disciplinary inspiration regarding shifts in governance and problems of governability, accountability and legitimacy, European Journal of Political Research , 43, 143-171.

Klijn, E.H. (2008). Chapter 5: Policy and implementation networks: managing complex interactions.

Klijn, E.H. (2003). Networks and Governance: a perspective on public policy and public administration. In Salminen, A. (Ed.). Governing networks. IOS Press. Amsterdam, 29-38.

Knottnerus, J.A. et al. (maart 2011), iOverheid: synopsis van wrr-rapport 86, De Wetenschappelijke Raad voor het Regeringsbeleid, Den Haag, 1-54.

Landsbergen, D. Jr.; Wolken G. Jr. (maart/april 2001), Realizing the Promise: Government Information Systems and the Fourth Generation of Information Technology, Public Administration Review, volume 61, No 2, 206-220.

Lips, M., V. Bekkers & A. Zuurmond (red.) (2005), ICT en openbaar bestuur; Implicaties en uitdagingen van technologische toepassingen voor de overheid, Utrecht, Uitgeverij Lemma, 749 pgs.

Maes, R. (april 2007), An Integrative Perspective on Information Management , PrimaVera Working Paper Series, Amsterdam Business School, 22 pgs.

Mandell, M.P. (1990). Network Management: Strategic Behavior in the Public Sector. In Strategies for Managing Intergovernmental Policies and Networks, edited by Robert Gage and Myrna Mandell, 29-53.

Markus, L.M. & Robey D., (1988). Information Technology and Organizational Change: Causal Structure in Theory and Research, Management Science, , 34: 5, 583-598.

Marriott School for Management, (2013), 87 Information System Theories, http://en.wikipedia.org/wiki/Information_systems.

Mason, R. O. (October 1978), Measuring Information Output: A Communication Systems Approach., Information Management, 1, 5, 219-234.

Mayer-Schönberger, V. & Lazer, D. (2007), From Electronic Government to Information Government, MIT Press.

Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (MBZK). (2005), Doen of laten? De rol van het Rijk bij ketenvorming. Den Haag.

Minnaar F. & Bekker K. (2012), Public Management in the Information Age, Van Schaik Publishers, 177 pgs.

Mintzberg, H. (1993). Structure in Fives, Designing effective organizations.Prentice-Hall, Englewood Cliffs, New Jersey, 305 pgs.

Oliver R. L, 1977, "Effect of Expectation and Disconfirmation on Postexposure Product Evaluations - an Alternative Interpretation," Journal of Applied Psychology, 62(4), 480 pgs.

Op ’t Land, M., Proper, M., Waage, Cloo, J. & Steghuis C. (2009), Enterprise Architecture: Creating Value by Informed Governance, Springer, 145 pgs.

Orlikowski, W. J., & Gash, D. C. (1994). Technological frames - making sense of information technology in organizations. ACM Transactions on Information Systems, 12(2), 174-207.

Pardo T.A., Gil-García J.R. & Burke, G.B. (2009), Information Sharing and Public Health: A Case-based Look at the ICT Expectations-Reality Gap in, A. Meijer et al. (Eds.), 2009, ICTs, Citizens and Governance: After the Hype! IOS Press, 180-197.

Pardo, T. A. & Giri Kumar, T. (2007). Editorial; Inter-organizational information integration: a key enabler for digital government. Government Information Quarterly 24, Volume 24, issue 4. Elsevier, 691–715.

Provan K.G. & Kenis, K. (2008) Modes of Network Governance: Structure, Management, and Effectiveness, JPART 18, 229-252.

Provan K.G. & Milward B.H. (July/August 2001). Do networks really work? A framework for evaluating public-sector organizational networks, Public Administration Review, Vol 61, 4, 414-423.

Ring, P. & Perry, J. (1985), Strategic management in public and private contexts. Academy of Management Review 10 (2), 276–286.

Shannon. C. E. & Weaver, W. (1949), The Mathematical Theory of Communication, University of
Illinois Press, Urbana. IL.

Snijkers, K. (2004). Spoor eGovernment: egovernment in een interbestuurlijke context een exploratie, 37.

Teisman, G.R. & Klijn, E.H. (2002), Partnership Arrangements: Governmental Rhetoric or Governance Scheme?, Public Administration Review, Volume 62, issue 2, 197-205.

van Breemen, D. G. H. (2011) Synergie door verbinding: Keteninformatisering in relatie tot interorganisationele systemen en Bestuurskunde Journal of Chain-computerisation, Information Exchange for Chain Co-operation, Volume 2, Art. 5, 1-14.

Vancauwenberghe, G. (), Coördinatie binnen de Geografische Data Infrastructuur. Een analyse van de uitwisseling en het gebruik van geografische informatie in Vlaanderen, Proefschrift, 236 pgs.

Van der Aa, A. & Konijn, T. (2004). Ketens, ketenregisseurs en ketenontwikkeling. Het ontwikkelen van transparante en flexibele samenwerkingsverbanden in netwerken. Utrecht: Lemma.

Voets, J. (2011), in Bouckaert et al, Handboek overheidsmanagement, hoofdstuk 13 netwerk-management, Vanden Broele, Brugge, 385-408.

Voets, J., Van Dooren, W. & De Rynck, F. (2008). A Framework for Assessing the Performance of Policy Networks. Public management review, 10(6), 773-790.

Voets, J. (2008) , Intergovernmental Relations in Multi-Level Arrangements: Collaborative Public Management in Flanders., Leuven: Faculty of Social Sciences,, Katholieke Universiteit Leuven.

White, Jay, D. (2007), Managing Information in the public sector, M.E. Scharpe, New York.

Zmud. R. W., (April 1978). An Empirical Investigation of the Dimensionality of the Concept of Information. Decision Sciences, 9, 2 187-195.

7.2 POLICY DOCUMENTS

Boterbergh, Verbiest & De Clerk, (2008) Inventarisatie van verticale signalisatie-verkeersbordendatabank, Agentschap Wegen en Verkeer en MOW, 7 blz.

Europese Commissie. (1998), Overheidsinformatie: een essentiële hulpbron voor Europa, Groenboek
over overheidsinformatie in de informatiemaatschappij , 1-34.

MOW, (2010), folder: Het juiste bord op de juiste plaats, D/2010/3241/150.

Kabinet Crevits, (15 juli 2010), Verkeersborden-databank voor verkeerssturing, Persbericht, Mobimix.

Verbiest, P., (26 november 2009b), Powerpoint Verkeersbordendatabank, AGIV-Trefdag.

Verbiest, P. (19 mei 2009a), Groen licht voor de verkeersborden-databank –23 gemeenten van start, Piva Antwerpen.

Vlaams Parlement, (21 juni 2012), Vraag om uitleg van de heer Lode Vereeck tot mevrouw Hilde Crevits, Vlaams minister van Mobiliteit en Openbare Werken, over de Verkeersbordendatabank -2049 (2011-2012)