Changing stakeholder influences in managing authoritative information – The case of the *Centraal ReferentieAdressenBestand* (CRAB) in Flanders

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Abstract

Municipalities are typically responsible for maintaining address data. Building and maintaining regional or national datasets from local sources requires careful coordination among stakeholders. The *Centraal ReferentieadressenBestand* (CRAB) is a digital authoritative address dataset, also referred to as a register, for the Flemish Region in Belgium. We present an analysis of the influence of CRAB stakeholders before and after the merger between the agencies responsible for geospatial information and e-government respectively. Tensions between stakeholders who create and maintain address data locally and those with an interest in the data for a larger area are discussed, and how these changed after the merger.

Keywords: address data, stakeholder, stakeholder analysis, spatial data infrastructure, SDI, geographic information, Flanders

1. Introduction

Drawing on the definitions for 'infrastructure' in Dictionary.com (2019) and Wikipedia (2019), a spatial data infrastructure (SDI) can be defined as the facilities, services, systems and installations to provide a country, city or area with spatial data and services that are required for the functioning of society. The discovery, use and sharing of spatial data and services has to be facilitated and coordinated by the SDI and its stakeholders (Coetzee *et al*., 2018).

SDI datasets are those fundamental datasets required for the management of cities, regions or countries, such as topography, building, street and address information. In many cases, national SDI datasets are the result of integrating datasets from many local sources. However, the responsibilities and data requirements of local governments are very different to those of national governments. Address datasets are a classical example because they are typically created and maintained within a municipality, but used beyond the jurisdictional boundaries of an individual municipality (Coetzee and Bishop, 2009).

In this paper, we analyse and compare the influences of stakeholders in the *Centraal ReferentieadressenBestand* (CRAB) before and after the merger between the agencies responsible for geospatial information and e-government respectively. The aim of this merger was to join forces regarding geographic and non-geographic information into a single organization focused on government information. CRAB is a digital authoritative address dataset, also referred to as a register, for Flanders, one of three regions in Belgium.

The article commences with a brief review of related work and background on stakeholder theory. Next, background information about CRAB is provided. In section 4, the stakeholder analyses are presented for the situation before and after the

merger. For each, CRAB stakeholders are identified, described, and the network of relationships between them is mapped. Based on this, the relative importance of different stakeholders is analysed. Results are discussed in section 5 and conclusions are drawn in section 6.

2. Background and related work

2.1 Related work

Rowley (2011) notes that stakeholders play a significant role in ensuring the long-term success of the e-government enterprise. SDI stakeholders have been described and categorized by many researchers. Typically, the purpose of the study dictated how stakeholders were grouped or characterised, e.g. by their training needs (Rautenbach *et al.*, 2012), by involvement in a process (Dessers *et al*., 2014) or by the area of jurisdiction of public sector stakeholders (Vandenbroucke *et al.*, 2009). In this study, stakeholders are identified in the legislation. Authors have noted the importance of local governments for national SDIs (Rajabifard *et al*., 2006), but research on how local SDIs can and should contribute to national SDIs is limited (Van Loenen, 2006; Vancauwenberghe *et al.* 2010; Hećimovic *et al.*, 2014; Coetzee and Wolff-Piggott, 2015). In related work, the balance between local and national stakeholder influences in the Dutch address register were reviewed (Coetzee *et al.* (2018). This article makes a unique contribution by reviewing the changes in local and national stakeholder influences before and after a significant change in legislation related to the governance framework.

2.2 Background on stakeholder theory

Freeman (1984) defined a stakeholder as any group or individual who can affect or is

affected by the achievement of an objective. A stakeholder analysis reveals information about the characteristics, intentions, interrelations and interests of actors in an endeavour, which is useful for developing strategies for managing stakeholders, for facilitating implementation of specific objectives, or for understanding the context so that future directions can be assessed (Brugha and Varvasovszky, 2000).

Generally, there are three steps in a stakeholder analysis: (1) identifying stakeholders; (2) describing stakeholder characteristics and interests; and (3) investigating relationships between stakeholders (Brown *et al.* 2016). Stakeholder influence can be measured in various ways, e.g., Mitchell *et al.* (1997) measured this according to

- Power, i.e. degree to which stakeholder can impose its will in a relationship.
- Legitimacy, i.e. degree to which stakeholder is socially accepted
- Urgency, i.e. degree to which stakeholder is prepared to go to any length to achieve the desired outcomes.

Legitimacy of a stakeholder is difficult to operationalise and not always relevant (Mitchell *el al.*, 1997; Bourne, 2005; Yang, 2014). Because all CRAB stakeholders in this study have legitimacy based on their role in the public governance framework inferred from legislation, we did not consider legitimacy (but power and urgency were considered). Additionally, we considered proximity, i.e. how directly the stakeholder is involved, as proposed by Bourne (2005).

3. Centraal ReferentieadressenBestand (CRAB), a base registry of the Flemish regional government

3.1 Base registers of the Flemish regional government

Belgium is a federal state with three levels of political power: the federal government;

the three language communities (Flemish, French and German); and the three regions (Flanders, Wallonia and the Brussels capital). The regions supervise provinces, municipalities and inter-municipal utility companies (Belgian Federal Government 2019). Flanders has five provinces (Antwerp, East-Flanders, Flemish-Brabant and Limburg, West-Flanders) and 300 municipalities (Belgian Federal Government, 2019).

The Flemish base registers for large-scale topography, roads, addresses, buildings, organisations and public services (the first four are georeferenced) are considered to be strategic building blocks for realizing the concept of an information-driven authority. This aligns with the concept of a base registry defined by the European Commission (2017): "a reliable source of basic information on items such as people, companies, vehicles, licenses, buildings, locations and roads". In the European Interoperability Framework (EIF), it is recommended that such registers be maintained and legally controlled by public administrations, but that the information should be made available for wider reuse with the appropriate security and privacy measures (European Commission, 2017). Implementations of base registers form, separately or in combination, the cornerstone of public services (European Commission, 2010).

A data exchange platform is envisaged for the Flemish registers that facilitates the 'once only' principle (i.e. 'don't ask what is already known'). The platform allows different authorities to use the same interlinked base registers, thus promoting reuse of information and avoiding duplication of information (Informatie Vlaanderen, 2015). In Flanders, base registers are part of a semantically coherent system of objects and relations, achieved via the 'Open Standards for Linked Organizations' programme

(OSLO), which aligns core data with two European standards, ISA² and INSPIRE with local (Flemish) enrichments (Buyle *et al.*, 2016; 2018).

3.2 The Centraal Referentieadressenbestand (CRAB)

3.2.1 Definition

The CRAB data model in Figure 1 shows that an address is defined as an object (and not as an attribute of the addressable object). This makes it possible to track the different lifecycle stages of an address, e.g. initial assignment, changes to address components and retirement of the address. The CRAB data standard specifies an address data model and the entities involved in the maintenance of the centralised CRAB database, so that address components are interpreted in the same way by all communicating parties (Buyle *et al.*, 2018).

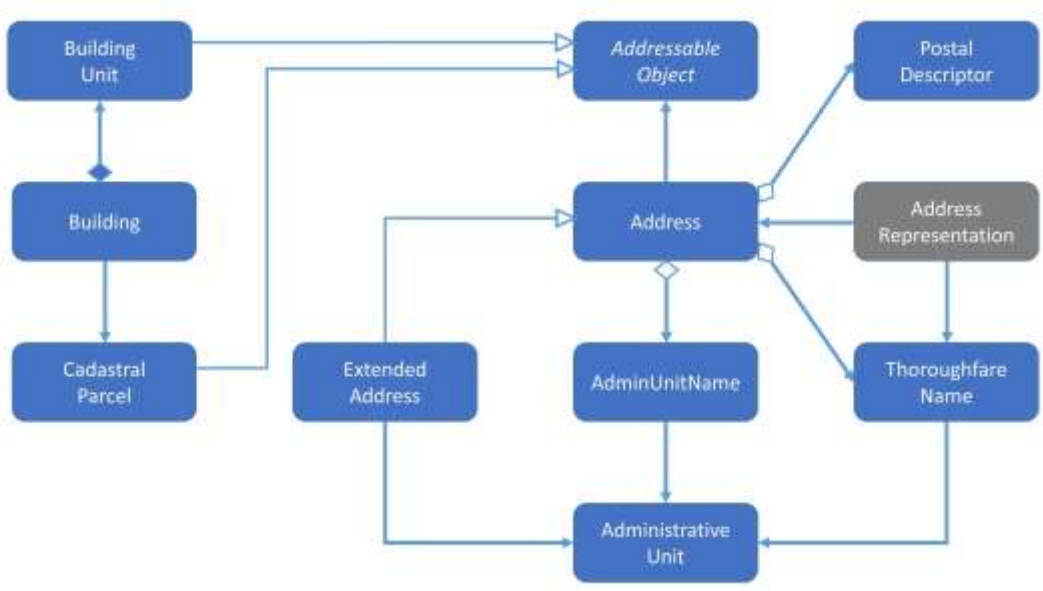

Figure 1. CRAB conceptual address model (Source: Buyle *et al.* 2018)

Today, CRAB contains over 4.5 million addresses. Through web services and/or a web application, municipalities maintain address data for their areas of

jurisdiction in a single centralised database (Informatie Vlaanderen, 2019b), hosted by the Flemish information agency (Informatie Vlaanderen) and made available through various platforms, including the Belgian geoportal (geopunt.be). Collectively, these services are called webGRAB; an XML data model, xGRAB, facilitates exchange of addresses through webGRAB services. Addresses were published as Linked Data in 2016, facilitating the use of CRAB addresses in the private sector (Buyle *et al.*, 2018).

3.2.2 CRAB timeline and history

Figure 2 provides an overview of the timeline of events that influenced CRAB since its inception.

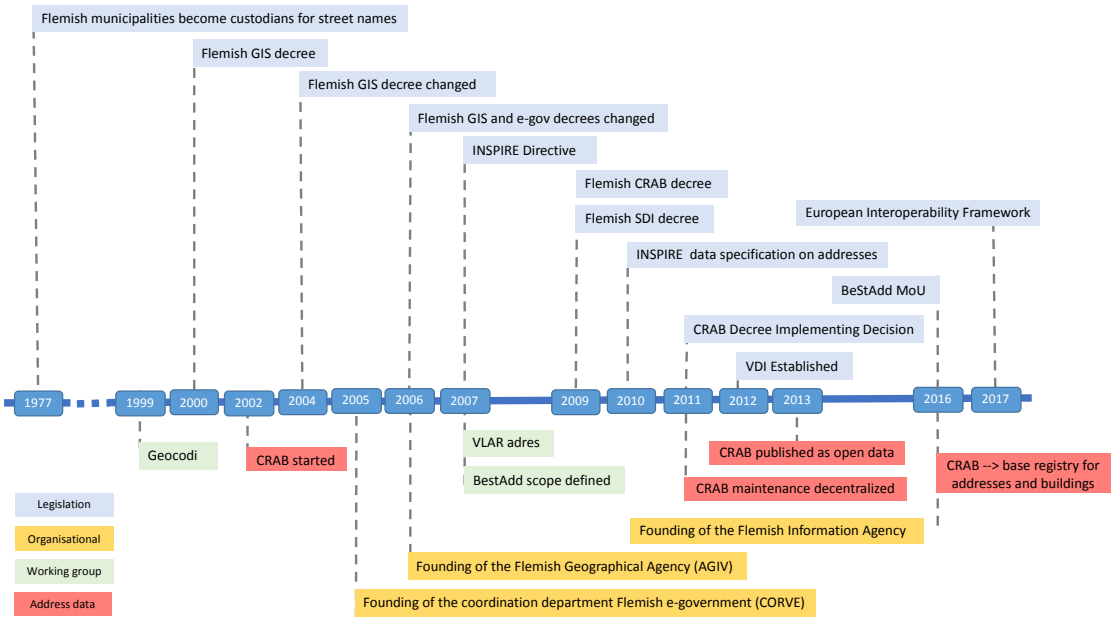

Figure 2. Overview of events that influenced the CRAB

1977: Flemish municipalities are authorised to assign street names (Belgisch Staatsblad, 1977).

1999: The CeoCoDi working group starts to work on an interoperable inter-federal data model and define a shared decentralised infrastructure for geographical information (Van Acker and Mortier, 2004).

2000: The Flemish GIS decree establishes a governance structure for the development of an SDI (Sjoukema *et al.* 2017).

2002: Development of the CRAB registry starts.

2004: The Flemish GIS decree is changed to include the Flemish Agency for Geographic Information (*Agentschap Geografische Informatie Vlaanderen,* AGIV).

2005: The Coordination Department Flemish E-government (*Coördinatiecel Vlaams e-government*, CORVE) is established with responsibility for all non-geographical transactions, such as sharing of information on persons, (public) organisations and diplomas. CORVE and AGIV are under the authority of different ministries.

2006: AGIV is established as an independent entity, tasked with implementing the GIS plan for producing, maintaining and distributing geographic data, including addresses, and for providing services related to the data (Belgisch Staatsblad, 2009a).

2007: The working group on Flemish authentic registration of addresses (*Vlaamse Authentieke Registratie, VLAR-adres*) is initiated by AGIV in collaboration with the Association of Flemish Cities and Municipalities (*Vereniging van Vlaamse Steden en Gemeenten*, VVSG) and eight municipalities. They report that daily management and use of address data happens in isolation at different administrations, e.g., addresses related to population data, planning permissions, environmental permits, economic policies, cultural policies and those in the municipal GIS are managed separately (Dessers *et al.*, 2011; *Vlaams Parlement*, 2009). *VLAR-adres* analysed the address registration lifecycle at a municipality and paved the way towards an authoritative address registry for Flanders (AGIV, 2007).

2007: The INSPIRE (INfrastructure for Spatial InfoRmation in Europe) Directive

establishes an SDI in Europe (European Commission, 2007) with addresses as one of the 34 data themes.

2009: The Flemish government identifies three shortcomings for linking different kinds of government-related information to each other (Vlaams Parlement, 2009):

- A common definition and encoding for addresses did not exist.
- An address did not have a geographic location or position (coordinates).
- A comprehensive address reference dataset for the Flemish region did not exist.

The CRAB decree aims to address these shortcomings by providing (Belgisch Staatsblad, 2009b):

- a single generally applicable standard definition and encoding for addresses;
- a geographic position (coordinates) for each address; and
- a single, up-to-date, complete and authentic source for addresses in the Flemish region.

2009: The Flemish SDI (*GDI-Vlaanderen)* decree establishes the SDI in Flanders and replaces the Flemish GIS decree with its governance structure. AGIV is responsible for implementing the SDI (Belgisch Staatsblad, 2009a). The decree follows the 2007 INSPIRE Directive (European Commission, 2007) and its implementation is aimed at fulfilling the INSPIRE obligations. CRAB is one of the SDI datasets; CRAB implementations have to adhere to the technical specifications and included in SDI plans. Using CRAB and reporting inconsistencies to the Flemish information agency

becomes mandatory for SDI partners (AGIV, 2010a; AGIV, 2010b; AGIV, 2010c; Informatie Vlaanderen, 2019a; Belgisch Staatsblad, 2009a).

2010: The INSPIRE address data is published (INSPIRE Thematic Working Group Addresses, 2010). It is aligned with the international standard, ISO 19160:2015, *Addressing -- Part 1: Conceptual model*; CRAB is aligned with both.

2011: The CRAB decree comes into force with the CRAB decree implementation decision. Central CRAB maintenance by AGIV is replaced by decentralized maintenance at municipalities (Belgisch Staatsblad, 2011). Subsequent implementation of webGRAB ('GRAB' for *Gemeentelijk Referentieadressenbestand)* leads to improved integration and inter-organisational maintenance of addresses.

2012: A coordination committee for Flemish service integration (*Coördinatiecomité Vlaamse dienstenintegrator,* VDI) is established for simplifying and optimising data exchange among authorities, and between the authorities and other service integrators and external authorities (Belgisch Staatsblad, 2012).

2013: CRAB is published as free and open data under the impulse of the European Directive on the re-use of public sector information (European Commission, 2003).

2016: The agreement on 'Belgian Streets and Addresses' (*BeSt Add*) between the federal government, Flemish Region, the Brussels-Capital Region, and the Walloon Region establishes the organisational framework and data model for intergovernmental address exchange and maintenance in Belgium, (Belgisch Staatsblad, 2016a). The *Best Add* Address Committee implements the agreement. It reports to the Intergovernmental Strategic E-Government Committee, tasked with harmonizing and aligning initiatives towards an integrated e-government in Belgium

(Belgisch Staatsblad, 2013). The CRAB data model was used as point of departure for the *BeSt Add* data model (Informatie Vlaanderen, 2019a) and they are therefore harmonized.

2016: AGIV and CORVE are integrated into the Flemish information agency (Belgisch Staatsblad, 2016b*)* with the primary focus on establishing a coherent government-wide information policy (Chantillon *et al.*, 2017). The integration of VDI and the Flemish SDI establishes a single point of contact for all digital services in Flanders (Vlaamse Regering, 2018). The Flemish information agency is now responsible for the implementation of the Flemish SDI. This accelerates the alignment of different base registries into a coherent information network, including CRAB being morphed into the Base Registry for addresses and buildings, and CRAB being aligned and linked with the registry of public organisations based on European ISA standards (Buyle, 2018). Also in 2016, a Steering Body for Flemish Information and ICT Policy was established to provide strategic direction to the Flemish information agency and for engaging regional and local governments.

2017: The new European Interoperability Framework (EIF) is published (European Commission, 2017). Interoperability as defined in the CRAB decree can be mapped to the interoperability levels defined in the EIF: legal (data sharing principles), organisational (governance processes), semantical (vocabularies), and technical (architecture).

4. Stakeholder analysis

4.1 CRAB stakeholders

Stakeholders in the CRAB governance framework were identified from relevant

legislation (Belgisch Staatsblad, 2004; Belgisch Staatsblad, 2009a*;* Belgisch Staatsblad, 2009b; Belgisch Staatsblad, 2010; Belgisch Staatsblad, 2013; Belgisch Staatsblad, 2016a; Belgisch Staatsblad, 2016b). This information was complemented with and contextualised by information collected from reports and official websites (Belgisch Staatsblad, 2009a*;* Belgisch Staatsblad, 2009b; Belgisch Staatsblad, 2010; Belgisch Staatsblad, 2013; Belgisch Staatsblad, 2016a; Belgisch Staatsblad, 2016b) and through discussions with representatives of selected stakeholders, namely the National Geographical Institute (*Nationaal Geografisch Instituut*, NGI), the VVSG, and the Flemish information agency. The stakeholders identified for the situation before and after the integration of AGIV and CORVE into the Flemish information agency are listed in Table 1, together with their respective organizational objectives.

Table 1. Stakeholders in the CRAB governance framework before and after the integration of AGIV and CORVE into the Flemish information agency

Before: AGIV and CORVE	After: Flemish information agency
Flemish Region merged with Dutch language community Legislative powers (Flemish Parliament) and executive powers (Flemish Government).	Same as before
Flemish Parliament Legislative body of Flemish Region.	Same as before
Flemish Government Executive body of the Flemish Region.	Same as before
Intergovernmental Strategic e-Government Committee Strategic committee of the e-government partnership, aimed at setting principles and services for integrated e-government services.	Same as before
Ministry of Services for General Government Policy Responsible for the implementation of services and government policies	Ministry of Internal Affairs, Integration, Housing, Equal Opportunities and Poverty Alleviation Responsibilities include the structuring and storage, exchange and access to information, and the development of the geographic information infrastructure.

Before: AGIV and CORVE	After: Flemish information agency
	Steering Body for the Flemish Information and ICT Policy Develops overarching strategic policy framework for ICT in the Flemish Region.
	Secretariat of the Steering Body for the Flemish Information and ICT Policy Provides administrative support to the Steering Body for the Flemish Information and ICT Policy
	Flemish Information Agency Supports Flemish authorities with marketing, digitizing and improving their services. Acts as service integrator for Flemish authorities
Flemish Agency for Geographic Information (*Agentschap Geografische Informatie Vlaanderen,* AGIV) Independent entity that develops the central geographic information system for the Flemish authorities	Integrated into the Flemish Information Agency
Flemish SDI Council Statutory body providing strategic advice and guidance for SDI planning and development in Flanders.	Dissolved; all functions and powers relinquished to Steering Body for the Flemish Information and ICT Policy
Flemish SDI Steering Group Makes policy proposals regarding strategic decisions for SDI development in Flanders	Dissolved, all functions and powers relinquished to Steering Body for the Flemish Information and ICT Policy
Flemish SDI Secretariat Provides administrative support to the Flemish SDI Steering Group	Dissolved
Unit for Geographic Information Provides policy support to the Flemish SDI Steering Group	Dissolved
Working group on Flemish authentic registration of addresses *(Vlaamse Authentieke Registratie, VLAR-adres)* Provides technical and organisational guidance to Flemish SDI Steering Group	Dissolved
Projectgroep Geolokaal, a working group of the Flemish SDI Provides GIS support to municipalities	Inter-organizational collaboration working group (WG) under the Steering Body for the Flemish Information and ICT Policy This WG has taken over some of the functions of *Projectgroep Geolokaal*, but it has a wider scope than just spatial data. It also has a specific focus on municipalities.

Before: AGIV and CORVE	After: Flemish information agency
Coordination Department Flemish E-government (*Coördinatiecel Vlaams e-government*, CORVE) Start and supervise various e-government initiatives, also at local authorities. Development and implementation of an open data strategy for the Flemish government.	Integrated into Flemish information agency
Coordination committee for Flemish service integration *(Coördinatiecomité Vlaamse dienstenintegrator*, VDI*)* Supports CORVE in achieving its service integration objectives by organizing electronic service provision and data exchange.	Dissolved; all functions and powers relinquished to Steering Body for Flemish Information and ICT Policy
VDI Secretariat Provides administrative support to the VDI	Dissolved.
	Address Committee Committee responsible for the implementation of the *BeSt Add* agreement to establish a federal Belgian address register.
INSPIRE coordination committee Inter-federal consultation committee on INSPIRE implementation.	Same as before
INSPIRE Secretariat *(INSPIRE Cel)* Administrative support to the INSPIRE coordination committee	Same as before
Association of Flemish Cities and Municipalities *(Vereniging van Vlaamse Steden en Gemeenten*, VVSG*)* Supports its members with information, advice and other services; promotes the interests of its members; functions as a network for its members; and serves as a single point of contact for its members.	Same as before
Municipality Lowest level of government charged with, amongst others, population registers. Their powers relate to public works, social welfare, maintaining public order, housing, education, etc. Municipalities are supervised by higher authorities (Federal State, the Communities, the Regions and the provinces) and must perform the tasks imposed on them by higher authorities.	Same as before
CRAB users Any user (individuals and organizations) of the CRAB	Same as before

4.2 CRAB stakeholder interests, rights, ownerships and responsibilities

Information about the interests, rights and ownerships (defined in Carroll and Buchholtz, 2008), as well as the legal responsibilities of stakeholders in the CRAB governance framework was compiled from the same sources as above and is summarized in Table 2.

Table 2: Interests, rights, ownerships and responsibilities of stakeholders in the CRAB governance framework before and after the integration of AGIV and CORVE into the Flemish information agency.

Before: AGIV and CORVE	**After: *Informatie Vlaanderen***
Flemish Region, merged with Dutch language community – Provides an annual grant to AGIV for CRAB-related work. – Regional interest	Flemish Region merged with Dutch language community – Provides an annual grant to the Flemish Information Agency for CRAB-related work. – Administrator for the address register in Flanders (*BeSt Add* agreement). – Regional interest
Flemish Parliament – Due to its legislative powers, approves CRAB legislation, rules and guidelines. – Regional interest	Flemish Parliament – Same as before
Flemish Government – Due to its executive powers, responsible for the CRAB implementation by AGIV. – Regional interest	Flemish Government – Due to its executive powers, responsible for the CRAB implementation by the Flemish Information Agency – Regional interest
Intergovernmental Strategic e-Government Committee – CRAB is used in e-government services. – Inter-federal interest	Intergovernmental Strategic e-Government Committee – Same as before
Ministry of Services and General Government Policy – Provides technical specifications for CRAB implementation – Regional interest	Ministry of Internal Affairs, Integration, Housing, Equal Opportunities and Poverty Alleviation – Regional interest
	Steering Body for the Flemish Information and ICT Policy – Develops overarching strategic policy framework for ICT in the Flanders Region and therefore provides strategic direction to facilitate the Flemish information agency in

Before: AGIV and CORVE	After: *Informatie Vlaanderen*
	fulfilling its role as the operational coordinator for the development and operation of the SDI, which includes CRAB. – Regional interest
	Secretariat of the Steering Body for Information and ICT Policy – Indirectly relevant to CRAB through its administrative support to the Steering Body for the Flemish Information and ICT Policy – Regional interest
	Flemish Information Agency – Coordination of the creation, maintenance, management and dissemination of government information, including CRAB. It includes the assignment of CRAB street name codes; support with creation and maintenance; processing and integration of address data into CRAB; coordination of quality control of CRAB; user access to CRAB. – Provides free web services and an application to the municipalities, with which they can query and edit address data in the central CRAB; free mechanism for data exchange with CRAB. – May agree with municipalities to receive address components, over and above the street name, house number and sub-address. – Makes CRAB publicly available on the SDI geoportal. – Collects revenue from selected users for using CRAB. – Regional interest
Flemish Agency for Geographic information (*Agentschap Geografische Informatie Vlaanderen, AGIV)* – Coordinates, maintains, manages and disseminates geographic information, which includes the CRAB dataset – Regional interest	Integrated into the Flemish Information Agency
Flemish SDI Council – Strategic advice to the Minister regarding the Flemish SDI, which includes CRAB. – Regional and local interest	Dissolved; all functions and powers relinquished to Steering Body for Flemish Information and ICT Policy
Flemish SDI Steering Group	Dissolved; all functions and powers relinquished to Steering Body for Flemish Information and ICT Policy

Before: AGIV and CORVE	After: *Informatie Vlaanderen*
– Makes policy proposals regarding strategic decisions for SDI development in Flanders, which includes CRAB. – Regional and local interest	
Flemish SDI Secretariat – Indirectly relevant to CRAB through its administrative support to the Flemish SDI. – Regional and local interest	Dissolved
Unit for Geographic Information – Provides policy support to the Flemish SDI Steering Group regarding CRAB – Regional interest	Dissolved
Working group on Flemish authentic registration of addresses *(Vlaamse Authentieke Registratie, VLAR-adres)* – Provides technical and organisational guidance to Flemish SDI Steering Group regarding CRAB – Regional and local interest.	Dissolved
Projectgroep Geolokaal, a working group of the Flemish SDI – Provides GIS support to municipalities enabling them to capture, maintain and disseminate CRAB – Regional interest, with specific local focus.	Inter-organizational collaboration working group (WG) under the Steering Body for the Flemish Information and ICT Policy – Provides support to municipalities, not only on spatial data such as CRAB, but also non-spatial data. – Regional interest, with specific local focus.
Coordination Department Flemish e-Government (*Coördinatiecel Vlaams e-Government*, CORVE) – No direct involvement in CRAB but indirectly relevant because CRAB is used in e-government – Data exchange for service integration – Regional interest	Integrated into the Flemish information agency
Coordination Committee for Flemish service integration *(Coördinatiecomité Vlaamse dienstenintegrator*, VDI) – Indirectly related to CRAB through its support to the VDI objectives – Regional interest	Dissolved; all functions and powers relinquished to Steering Body for Flemish Information and ICT Policy
VDI Secretariat – Indirectly related to CRAB through its administrative support to the VDI coordination committee – Regional interest	Dissolved.
	Address Committee

Before: AGIV and CORVE	After: *Informatie Vlaanderen*
	CRAB is part of the *Best Add* address register. Any rights and responsibilities regarding the address register specified in the *BeSt Add* agreement also apply to CRAB, namely: – Establish a data exchange platform to link address registers with each other and to make the registers freely accessible to federal government. – Provide a single free access point to address registers. – Partners have to use the register; contribute to the implementation of the register; and report any anomalies in the data. – Determines the common address model; plans and implements the agreement; oversees implementation of the agreement; coordinates between administrators, source holders and partners; and matters connected to this. – Same Secretariat as the INSPIRE coordination committee – Inter-federal interest.
INSPIRE coordination committee – Address data (CRAB) is one of the themes in INSPIRE. – Inter-federal interest.	Same as before.
INSPIRE Secretariat (*INSPIRE Cel)* – Indirectly related through its administrative support to the *INSPIRE Coördinatiecomité* – Inter-federal interest.	Same as before.
Association of Flemish Cities and Municipalities *(Vereniging van Vlaamse Steden en Gemeente*, VVSG) – Supports and represents municipalities, but not specifically mentioned in the CRAB decree. – Local interest	Same as before
Municipality – Since 2011, responsible for the physical assignment and digital creation and maintenance (lifecycle) of the following address components: street name, house number and sub-address (box and apartment numbers). – Submit address data updates and quality improvements to the Flemish information agency for integration into CRAB. – Local interest	Municipality Same as before

Before: AGIV and CORVE	After: *Informatie Vlaanderen*
CRAB users – Right to free access to CRAB. – Responsibility to report anomalies. – Inter-federal, regional or local interest, depending on the specific user.	Same as before

4.3 Relationships between CRAB stakeholders

Based on the CRAB stakeholders, their interests, rights, ownerships and responsibilities (as presented in 4.1 and 4.2), network diagrams of relationships between stakeholders are presented in Figures 3 and 4 (see Figure 5 for the legend).

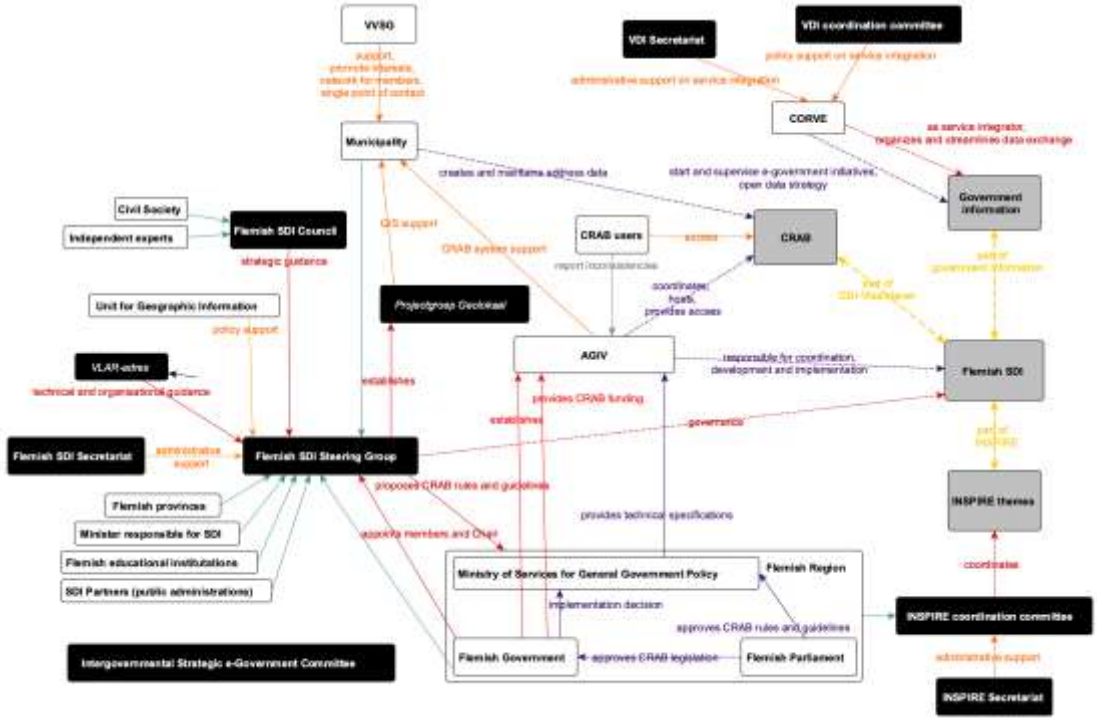

Figure 3. Before (AGIV and CORVE): Stakeholder relationships in the CRAB governance framework

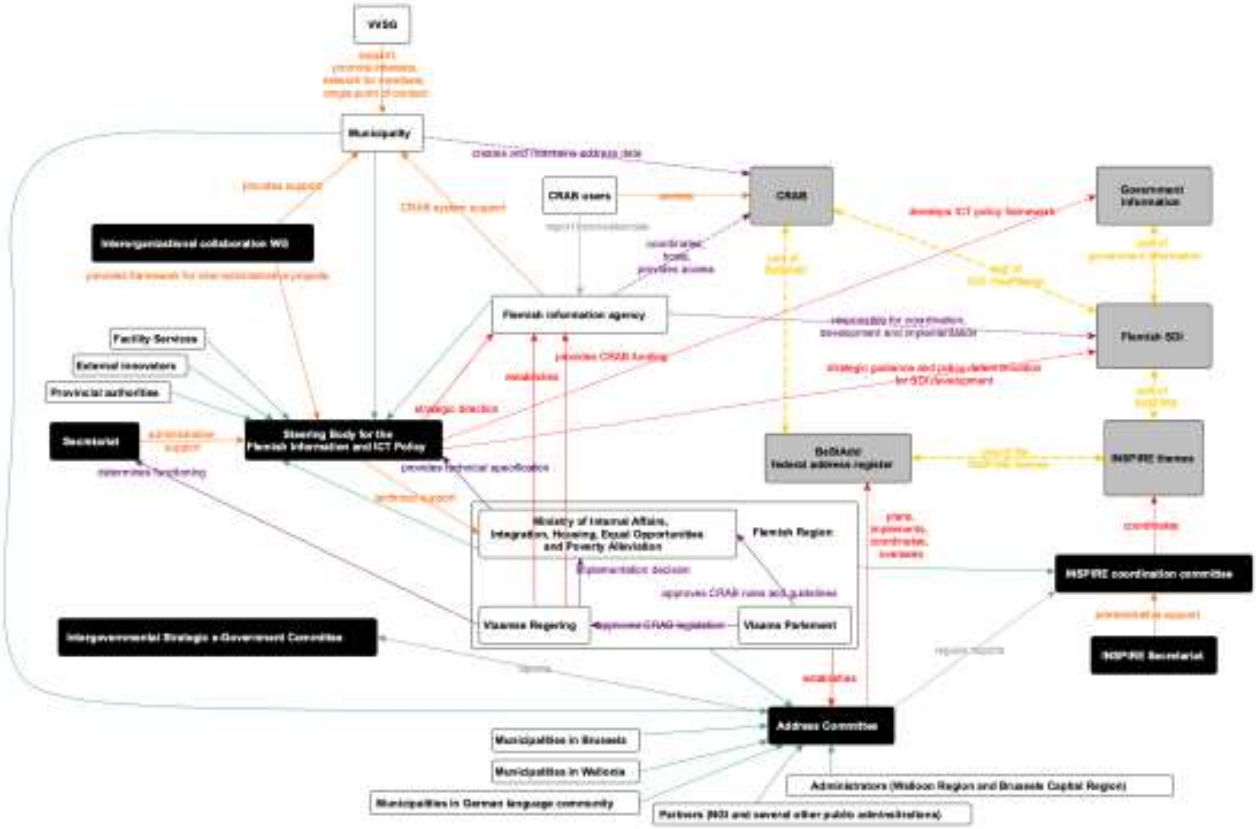

Figure 4. After (Flemish information agency): Stakeholder relationships in the CRAB governance framework

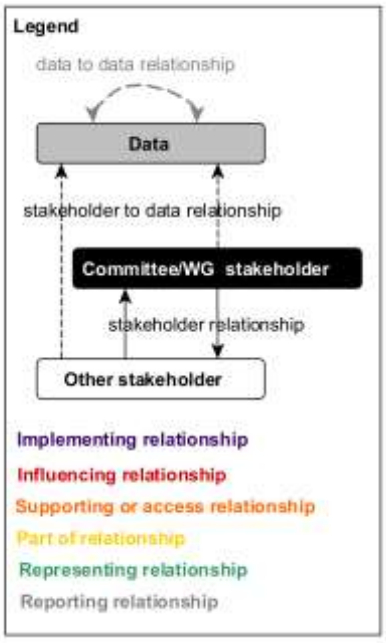

Figure 5. Legend for the stakeholder relationship diagrams

4.4 Relative influence of stakeholders

In this section the relative influences of CRAB stakeholders are presented for the

situation before and after the integration of AGIV and CORVE into the Flemish information agency. The relative influence of a stakeholder was determined based on the Stakeholder Circle method developed by Bourne (2005), which considers three parameters, namely:

1) power to influence CRAB objectives;

2) proximity of the stakeholder to the CRAB (closely associated or relatively remote with no direct involvement in processes); and

3) urgency of the CRAB stakeholder to take immediate action related to CRAB, irrespective of other commitments (vs little need for action outside routine activities).

The power of a stakeholder was determined by the sum of the weights of edges from the stakeholder to others in the stakeholder relationship network. Weights were assigned according to the strength and therefore influence of the relationship as follows: implementing relationship (6), influencing relationship (5), supporting relationship (4), access relationship (4), part of relationship (3), representing relationship (2) and reporting relationship (1). Proximity to CRAB was calculated as the shortest distance from stakeholder to CRAB along weighted network edges. An urgency value was assigned as *high* (10) if the stakeholder is prepared to take immediate action, irrespective of other commitments, *low* (0) if there is little need for action outside routine activities, and *intermediate* (5) for anything between. See Table 3.

Table 3. CRAB stakeholder urgency

Stakeholder	Urgency - Before	Urgency - After
Flemish Region	Low	Low
Flemish Parliament	Low	Low
Flemish Government	Low	Low
Intergovernmental Strategic e-Government Committee	Low	Low
Ministry of Services for General Government Policy	Low	-
Ministry of Internal Affairs, Integration, Housing, Equal Opportunities and Poverty Alleviation	-	Low
Steering Body for the Flemish Information and ICT Policy	-	Intermediate
Secretariat of the Steering Body for the Flemish Information and ICT Policy	-	Intermediate
Flemish information agency	-	High
AGIV	High	-
Flemish SDI Council	Low	-
Flemish SDI Steering Group	Intermediate	-
Flemish SDI Secretariat	Low	-
Unit for Geographic Information	Low	-
VLAR-adres	High	-
Projectgroep Geolokaal	Low	-
Inter-organizational collaboration WG	-	Low
CORVE	Low	-
VDI	Low	-
VDI Secretariat	Low	-
Address Committee	-	Intermediate
INSPIRE coordination committee	Low	Low
INSPIRE Secretariat	Low	Low
VVSG GIS WG	Intermediate	Intermediate
Municipality	High	High
CRAB users	High	High

The relative influence of stakeholders before and after the merger is illustrated in Figures 6 and 7. Before the merger, AGIV, the municipalities, CRAB users and the Flemish SDI Steering Group had the highest influence. After the merger, this changed to the Flemish information agency, the municipalities, the Steering Body for the Flemish Information and ICT Policy, and CRAB users. Note the slight difference in the order.

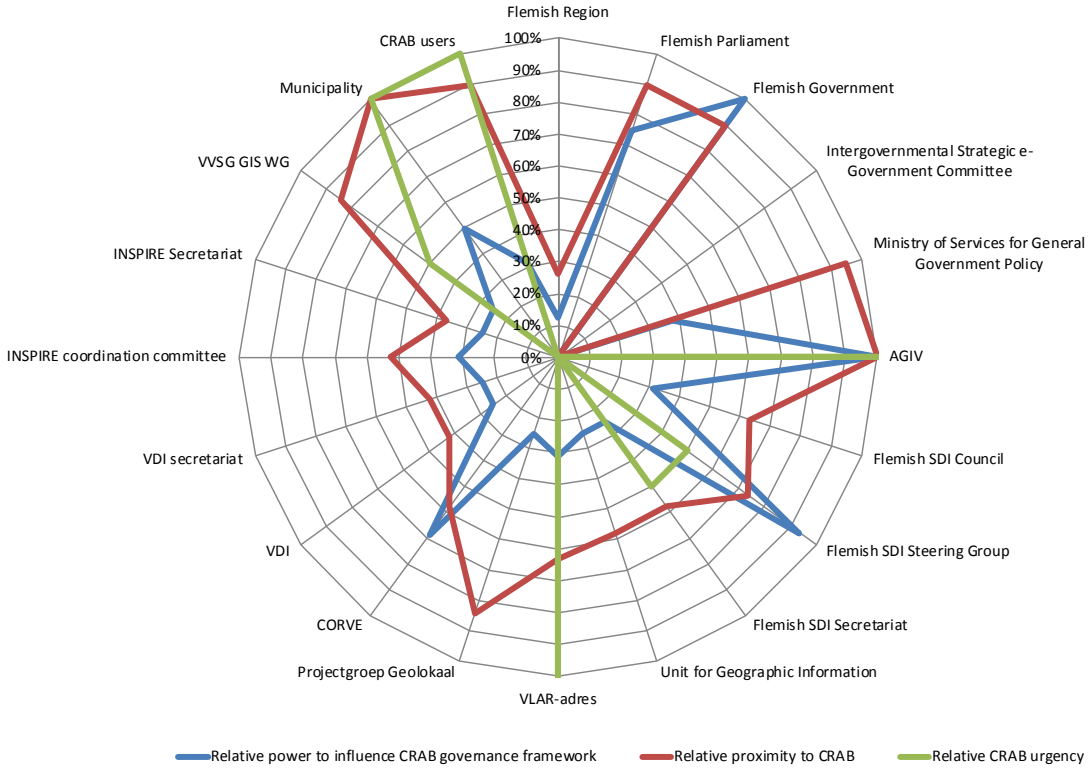

Figure 6. Before (AGIV and CORVE): Relative power to influence, proximity and urgency of stakeholders in the CRAB governance framework

After the merger, the average power to influence of stakeholders with a regional interest was slightly higher than before, while the total (sum of) power to influence of stakeholders with a local interest was significantly less than before. The difference in the sum of proximity to CRAB between stakeholders with local vs regional interests is significantly higher after the merger than before (less for stakeholders with local interests). The sum of local urgency values is higher before than after the merger. Overall, this suggests a shift away from local influence to regional and inter-federal influences after the merger.

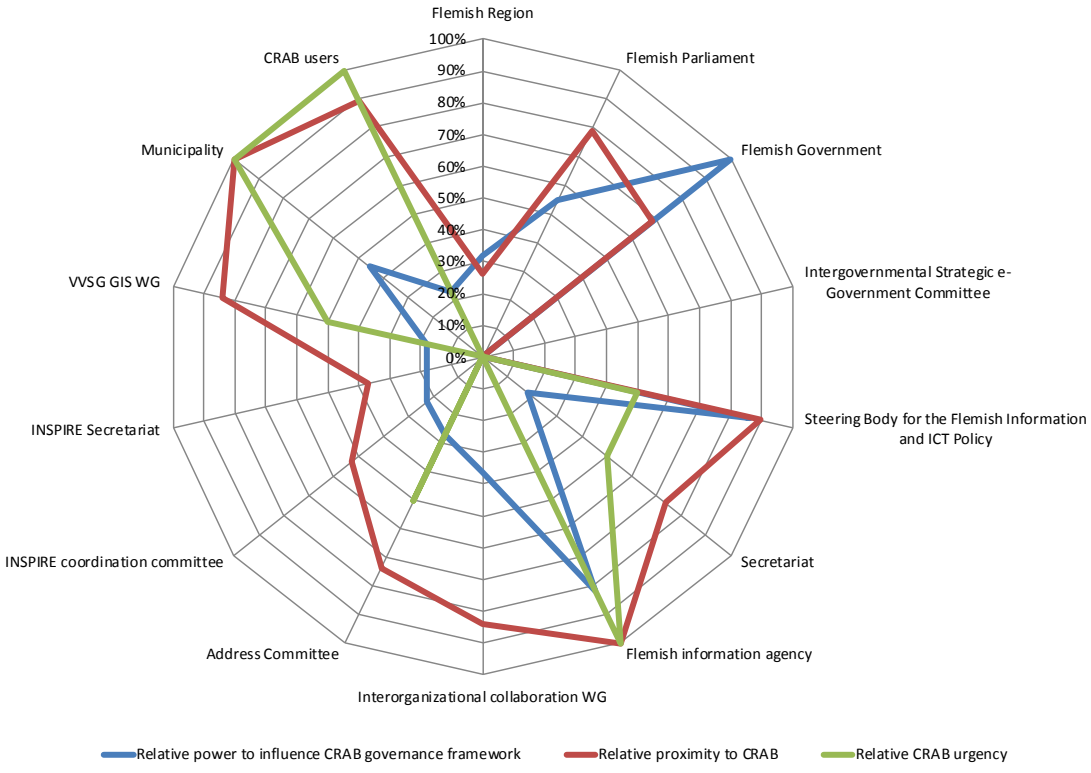

Figure 7. After (Flemish information agency): Relative power to influence, proximity and urgency of stakeholders in the CRAB governance framework

5. Discussion

The network diagrams of CRAB stakeholder relationships before and after the merger of AGIV and CORVE into the Flemish information agency reflect the merger aim of establishing a coherent government-wide information network: before the merger, CORVE and related stakeholders are isolated from the CRAB network of stakeholder relationships; after the merger, the two are integrated. The Intergovernmental Strategic e-Government remains rather isolated from other stakeholders, there is at least one link to it after the merger.

The shift away from local influence is partially a result of some of the stakeholders with regional and local interests (e.g. *Projectgroup Geolokaal* and *VLAR adres*), being replaced by fewer stakeholders with mainly regional interests (e.g. Steering Body for the Flemish Information and ICT Policy). The *BeSt Add* cooperation agreement is not directly related to the merger in the Flemish region, but it presents another pull away from local power and influences.

The regional interest is a strong factor in CRAB because the original idea has its roots in AGIV, a regional organization, and the current coordination, development and hosting is done by the Flemish information agency, also a regional organization. However, early CRAB developments had a strong local influence, such as the *VLAR-adres* initiative, which analysed the address lifecycle at a municipality and informed the establishment of the regional address registry. The inter-federal *BeSt Add* dataset will draw heavily on the current CRAB dataset, because its initial data model is based on the CRAB data model. Eventually, the original local and regional influences may be replaced by stronger inter-federal influences as and when *BeSt Add* gains momentum.

The above points to a situation in the future where address data will be seamlessly integrated into all federal government information and mostly managed 'above' the level of municipalities. This was the aim of the merger and there are many advantages, e.g. for streamlining governance (linking all kinds of government information to each other) and for reducing costs (by avoiding duplication of services and infrastructure). On the down side, address data and other geospatial data may lose their status and importance when managed as part of a plethora of other government information. Unless there is a focus on constant improvement and maintenance on the datasets, they run the risk of decreasing in quality and eventually becoming irrelevant. To turn around such a situation, would be a momentous endeavour. The move away from local influences can be positive, because there is usually more capacity (both in human resources and funding) at a regional or federal level, than at municipalities so that decisions can more readily be supported by implementations. However, decision-making should not move so far away from municipalities that they become alienated. Without them, an interfederal address register for the whole country is not possible.

The results of this CRAB stakeholder analysis can inform the establishment of effective and sustainable governance frameworks for collective endeavours, typically required for spatial data infrastructures. CRAB presents an interesting case study of address data integrated from local to regional level, and parallels can be drawn for national datasets to be integrated into international datasets. The results are of interest to countries embarking on local or regional datasets for the first time; countries currently establishing national address datasets, such as the US (FGDC 2018); national SDI datasets generally, such as those required for INSPIRE; and for the establishment of global datasets from national datasets, as envisaged by the UN-

GGIM. In all these cases, stakeholders need to be carefully managed to balance the tension between local, regional, national and even international influences.

When comparing the results to a recent stakeholder analysis of the Dutch address register (Coetzee *et al.* 2018), it can be seen that in both the Dutch and the Flemish cases, the municipalities and organizations responsible for hosting and maintaining the register have the most influence and responsibility. Jabbour *et al.* (2019) pointed to the challenges of this situation because of the scarcity of public budgets and proposed an approach for transitioning from government-funded SDI to self-sustained funding mechanisms.

The power to influence CRAB is relatively low for CRAB users – both before and after the merger. This, despite their high urgency and proximity values. Others have pointed out the shift in focus from suppliers to users and the importance of understanding and responding to user needs (Christensen *et al.* 2014, Rowley 2011). Accordingly, the requirements of CRAB users should be not be neglected.

Addresses are essential for good governance in cities and countries, amongst others, because they can be used to link information about people, organizations and services to each other. The advent of e-commerce and e-government gave new importance and relevance to the need for reliable and trustworthy digital address data. Despite the importance of addresses for municipal governance and reduction of urban poverty levels, Njoh (2010) reported that discourse on the topic is scant.

A further refinement of the CRAB stakeholder analysis could include organizations with representation on the different committees, e.g. the representatives on the Steering Body for the Flemish Information and ICT Policy, *etc*. Social network analysis, which focuses on the relationships between pairs of stakeholders in a network, can reveal the centrality (measure of importance), density and relationship

strength of actors in a network. Results of a social network analysis of the Flemish SDI were reported in Vandenbroucke *et al.* (2009). In future work, social network analysis could reveal interesting social behaviour about the informal and less tangible relationships among organizations and their employees involved in CRAB.

6. Conclusion

In this paper, we analysed the influences of CRAB stakeholders before and after the merger between the agencies responsible for geospatial information (AGIV) and e-government (CORVE) into a single organization, the Flemish information agency, *Informatie Vlaanderen*. The aim of this merger was to join forces on geographic and non-geographic information into a single organization focused on government information. Based on stakeholder relationships defined in legislation and illustrated in network diagrams, this aim was achieved. However, the move away from local influences in the merged scenario needs to be carefully managed to avoid a disconnect between those who do the work and those who coordinate the work. The findings can contribute to the development of effective legislation for sustainable governance frameworks for collective data endeavours, such as those typically found in an SDI. They are also relevant to any other governance framework through which collective endeavours at different levels of government are coordinated.

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