

### 3. Science and Innovation Centres: Definitions and Concepts

This chapter introduces Science and Innovation Centres (SICs), the instruments that are central to this study. SICs are a distinct and novel policy instrument and are among the few institutional responses in the science diplomacy toolbox. Whilst these institutions are notable and unique, they largely constitute a black box in academic scholarship. It also introduces and characterises SICs as a novel instrument and provides an insight into these institutions and their significance to this study. First the phenomenon of SICs is explained in the wider context of the institutional responses that have been developed at the interface between foreign affairs and science, such as science attachés (section 3.1). This is followed by a solid definition of SICs that is underpinned by a systematic comparison (section 3.2). These findings are derived from an inductive and exploratory research exercise, which was undertaken to demonstrate the uniqueness of the research object and the insufficient scholarly attention to it. The comparative section of this chapter is therefore seen as a response to the absence of literature on this topic and aims to identify the key characteristics of SICs, as well as to compare institutions and evaluate their similarities and differences (section 3.3). Finally, there is an attempt to structure the empirical data observed by proposing a SIC typology. This chapter classifies three (ideal-typical) SIC models which facilitate the analysis and study of this novel institutional development (section 3.4). In the course of this study, two of these models will be analysed in depth to provide a scholarly assessment of this novel instrument. Furthermore, an empirical account of the study of science diplomacy is provided, which once again reveals a gap in scholarly literature.

#### *3.1. A New Instrument—Challenges in Researching SICs*

Following the rise of science diplomacy discourse in recent years, it has become evident that the majority of diplomatic missions increasingly also address science and technology matters (Berg, 2010; Fleury & Zala, 2012). This is due to the huge impact of science and technological developments on a country's prosperity and progress, particularly in light of contempo-

rary challenges (Carlsson, 2006; Hesse, 2010). The significance of science and technology is reflected in the thematic portfolio of diplomatic missions; furthermore, there has also been an increase in institutional responses. A prominent example of this is the creation of science attachés, dedicated positions responsible for science and technology matters. Although the introduction of science attachés dates back to the 1950s, this concept has become increasingly institutionalised in recent years. The USA and Switzerland were among the first countries to appoint science attachés. In the early 1950s, the USA appointed its first science attaché to its embassy in Stockholm (Loftness, 1955), while Switzerland appointed an attaché for science at its embassy in Washington in 1958 (Fleury & Zala, 2012). Their tasks were to connect and distribute scientific information, as well as to advise and represent the government in matters of scientific relevance (Jost, 2012; Loftness, 1955). Loftness (1955) clarifies that science attachés served both the government and scientists (see similarly Forbes, 1957).

Science attachés have become an integral and consolidated element of diplomatic representation around the world, while their portfolio increasingly also covers innovation. Despite this, the profile of science attachés is considered to be changing in the sense that countries increasingly draw on (seconded) experts rather than diplomats to serve as science attachés (cf. Berg, 2010, p. 72). Similarly, another example mirroring the significance of science and technology to diplomacy is the creation of *distinct units* abroad. These units operate as a point of contact and concentrate activities, resources and personnel. As Leijten explains: “*Many, if not all, developed nations have special offices in their foreign services, which are responsible for science diplomacy actions. In organisational terms, it can be anything from a dedicated attaché in embassies to rather independent offices*” (2017, p. 19). This study focuses in particular on these independent offices and organisational units<sup>28</sup>, which are known as Science and Innovation Centres (SICs). Drawing on scholarly literature, it becomes apparent that there has so far been limited academic interest in examining and analysing these SICs, despite their innovative and unique character, and their implementation by

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28 Please note that SICs are organisational units or organisational instruments. The question of the organisational nature of SICs is not answered in this study and requires a distinct organisational analysis. This links, for instance, to aspects such as actorhood, which are elaborated in the works of Krücken and Meier (2006) or Whitley (2008).

several pioneering countries<sup>29</sup>. There are a handful of single case studies which explore one specific SIC, namely Switzerland's Swissnex (Fetscherin & Marmier, 2010; Marmier & Fetscherin, 2010; Schlegel et al., 2011).

While these scholarly contributions are insightful, they do not cover contemporary developments in the field and are not set up in a longitudinal and nuanced way, such as this study. Aside from the works of Epping (2018, 2020) and Ruffin (2018), there appears to be no other scholarly literature on this topic, despite ongoing and revived discourse on science diplomacy (Flink, 2020a; Ruffini, 2020b). Furthermore, there are few (recent) comparative studies and none which are systematic; Berg (2010) briefly describes these units (though for the first time) and Ruffin (2018) provides a three-country comparison of Denmark, Germany and the United Kingdom. Ruffin describes the basic characteristics of SICs, while also suggesting a framework to classify their work (this will be discussed in more detail later). Other sources (i.e., Flink & Schreiterer, 2010; Witjes & Sigl, 2015) refer to these units but do not analyse them in detail. Accordingly, current research on SICs is still in its infancy. There are no systematic overviews of countries that operate SICs as part of their national strategies and there are no comprehensive studies of the exact structure, composition, mission, institutionalisation or set-up of such institutions. Moreover, there are limited explanations available of how SICs operate at the interface of science (policy) and foreign affairs, the dynamics they create or their (potential) impacts<sup>30</sup>. Therefore, SICs present an open avenue for research since, to a large degree, they constitute a black box in academic literature. This is noteworthy, given that these hybrid units systematically bring together actors from science, diplomacy and business.

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29 It is, however, acknowledged that particularly in “*knowledge-intensive contexts*” novel forms of collaboration become visible and, in fact, new organisational forms arise (cf. W. W. Powell and Soppe (2015, p. 1295)).

30 Evaluative data is publicly available for some SICs, such as the ICDK and Swissnex. However, other evaluations have not been published (as in the case of Germany) or are not yet available (Nordic Innovation Houses). For the purpose of this study, such data serves as background information since it is primarily addressed to governments rather than academic scholarship.

### 3.2. Defining SICs

The first attempt to define these institutions was probably made by Berg (2010), who refers to science and technology networks or science diplomacy networks. He defines them as “*those types of dedicated S&T staff who work abroad with a national mandate and usually in association with the respective ministry for foreign affairs*” (2010, p. 70). Berg observes that countries extend their network by “*establishing additional hubs abroad which operate independently to the diplomatic missions*” (2010, p. 73). He considers these to be innovative business models that are opened in key-tech hotspots rather than in capitals. As such, they are a “*powerful instrument to achieve individual policy goals and to support overall science policy agenda*” (Berg, 2010, p. 74). Switzerland, Denmark and Finland were among the first countries to put such structures in place; Berg refers to this as the first wave. Germany and Ireland introduced such institutions in the second wave<sup>31</sup>. Berg affirms that this type of centre has the potential to become a “*professional player in the host country’s innovation market*” (Berg, 2010, p. 73) in a way that is different to embassies. Berg explains that this is due to geographic location, the diversity of their staff members and finally to their set-up; embassies, on the other hand, fulfil a role as door-openers and should not be underestimated (cf. Schlegel et al., 2011).

Flink & Schreiterer (2010) consider the distinct functions that these institutions fulfil; their main purpose is to promote science and technology. They connect stakeholders in higher education and research and open doors for the business sector. Ultimately, they contribute to the promotion and branding of a country with respect to its systems of higher education, research and science. Hence, SICs are understood as a politically anticipated branding tool, as “*an early attempt at capitalizing on a niche in nation branding by fostering S&T, higher education and innovation abroad*” (Schlegel et al., 2011, p. 297 and also Fetscherin & Marmier, 2010). Ruffin (2018) also attempts to characterise SICs in his comparative analysis of Swissnex, the Innovation Centre Denmark and the Science and Innovation Network (UK). He suggests referring to these units as science and innovation diplomacy agencies; furthermore, he considers them to be a distinct element of a country’s science diplomacy strategy. They are considered

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31 The Irish Innovation Centre has since been closed. Desk research has revealed that the workings and set-up of this centre were poorly documented and therefore little information is available for this study.

to be “*qualitatively different from older approaches*” (Rüffin, 2018, p. 5), such as attachés. Despite this comparative effort, Rüffin fails to provide a comprehensive definition of these institutions. He analyses these units in relation to possible tensions due to their set-up and their isomorphic tendencies, as well as their approach to science and innovation diplomacy.

The findings show that SICs reflect differences in terms of their exact orientation and their set-up (cf. Epping, 2020). However, they are also considered to be isomorphic, for instance, in terms of their locations, mix of employees and governmental management<sup>32</sup> (cf. Epping, 2018). As an attempt to describe and define these institutions, the literature discussed above is considered too narrow and, to some extent, even misleading. Consequently, a definition should be chosen that both allows for stronger content-driven labelling and also frees the instrument from immediate notions of direct (science) diplomacy. At the same time, however, these ties should not be ignored; it is evident that, while science diplomacy notions may be linked to this instrument, they reflect a particular political *zeitgeist* (Epping, 2020). Furthermore, this definition should also provide a description that is closer to the original names used by different countries (which do not evoke immediate notions of science diplomacy). In response to these shortcomings, this study proposes referring to these institutions as *Science and Innovation Centres (SICs)*. To specify, a Science and Innovation Centre is defined here as:

*a distinct unit or satellite institute which has been established in another country by a government and which operates at the nexus of higher education, research, innovation and diplomacy. Thus, SICs typically operate within a network structure (cf. Epping, 2018, 2020).*

This definition of SICs derives from the author’s extensive explorative work on the subject and responds to the subject’s largely absent and incomplete conceptualisation in scholarly literature. It will be used throughout this study to characterise these units. Due to the lack of a comparative overview of SICs, the following sections provide insights with the aim of consolidating and enriching this definition. Thus, they contribute to a coherent and comparative understanding of this new development.

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32 According to Witjes and Sigl (2015), this duality of governmental responsibility reflects the creation of a new policy field which bridges science, technology and innovation, and international relations.

### 3.3. Conceptualising and Comparing SICs

#### 3.3.1. Operating Countries (Sending Countries)

Berg (2010) refers to Denmark<sup>33</sup>, Finland<sup>34</sup> and Switzerland as examples of countries that run or have run SICs; these countries constituted the first wave of SICs and are hence forerunners in this field (the Finnish FinNode joined the Nordic Innovation House a couple of years ago). As these countries are known to be highly innovative, this is not surprising. Given that those three are known to be highly innovative countries this is also evident from their rankings in the Global Innovation Index, which identifies highly innovative countries<sup>35</sup> (WIPO, 2021). Similarly, the UK<sup>36</sup> network started operating in 2000 (see Table 1). Berg, however, does not refer to the UK in the list of first wave countries possibly since there may not have been a separate unit but instead a distinct subunit within the embassy. The second wave of countries referred to by Berg (2010) is comprised of Germany and Ireland<sup>37</sup>. The Nordic Countries, the Netherlands<sup>38</sup> and more recently the Flemish representation<sup>39</sup> can be added to this list of countries (see Table 1).

One background interview conducted as part of my research revealed that the concept of SICs had also been discussed as a potential instrument in the French context. Even more importantly, the French ministry was advised to create an institutional unit inspired by the German and Swiss models. Ultimately, however, this decision was not pursued<sup>40</sup>. The fact

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33 For more information on the development of the DIC, see Oxford Research A/S (2015).

34 For more information, see Embassy of Finland (2016).

35 A country's capacity for innovation is measured by the Global Innovation Index (WIPO (2021)). According to the most recent rankings (2021): Switzerland ranks first, the UK fourth, the Netherlands sixth, Denmark ninth, Germany 10th and France 11th. Other Nordic countries are in the top 15: Sweden scores second place and Finland seventh place.

36 For more information, see Morgan (2010).

37 The Irish Innovation Centre has since been closed for reasons unknown.

38 It was not possible to collect additional information on the Dutch Innovation Network, apart from a desk research exercise, since inquiries remained unanswered.

39 For more information, see <https://www.flandersinvestmentandtrade.com/en/strategy/tech-makes-flanders-tick> (accessed 18.02.2022); see also Vlaamse Regering (2020). Due to the novelty, there is little information available, yet.

40 It is unknown what ultimately impacted the decision not to implement such an instrument. On a contextual note, there are already institutional structures operating

that all these countries established SICs reflects an isomorphic tendency concerning instrument selection. This points, on the one hand, to the originality of this idea, and on the other hand to a certain (perceived) impact of these instrument, which presumably differs from what can be achieved with other (existing) instruments in the science diplomacy governmental toolbox<sup>41</sup>.

*Table 1 Overview: Science and Innovation Centres (SICs)*

Country	Name of SIC	Launch
Denmark	Innovation Centre Denmark (ICDK)	2006
Finland	Initially opened as FinNode; later became part of Team Finland. Since 2016, it has been part of the joint Nordic Innovation House.	2007
Flanders	Science & Technology Offices	2021
Germany	German Centre for Research and Innovation (DWIH)	2009
Ireland	Irish Innovation Centre	No data
Nordic Countries	Nordic Innovation House	2016
Switzerland	Swissnex	2000
The Netherlands	Holland Innovation Network	No data
The United Kingdom	Science and Innovation Network	2000

Source: created by the author.

abroad, such as the offices of the prestigious National Centre for Scientific Research (CNRS).

- 41 An immediate question which arises is whether a policy transfer took place between these countries (this is subject to additional research). Key hotspots such as Silicon Valley reveal a high institutional density and presence of different countries. Often, just like in embassy districts, these institutions reside next door to each other, allowing for fast knowledge exchange (interview SNXI). In addition, people working at these institutions form a distinct expat community, with their own channels of communication, since people know each other (interview DIS1). In turn, this creates a distinct environment and allows for ideas and news to travel quickly.

### 3.3.2. Target Countries (Receiving Countries)

Besides identifying the countries that run SICs (home/sending countries), in order to fully understand these instruments, it seems equally relevant to identify the target countries (host/receiving countries) where SICs are based. A comparative overview (see Table 2) reveals a general coherence in terms of the target countries of SICs (this is also confirmed by Ruffin, 2018). These countries can be categorised as a) the BRICS<sup>42</sup> countries, also referred to as emerging economies, b) centres of excellence, such as the Boston area, where the Ivy League universities are located and c) locations in the vicinity of key technology hubs, such as Silicon Valley. While these three categories apply to most SICs, there are some variations between countries. Brazil and the USA seem to be attractive locations for all countries, while European locations are less relevant, except for the Danish and Dutch SICs, which have offices in Germany (Munich). They are also represented in Israel. Germany and the Netherlands, on the other hand, have offices in Russia. The specific geographical coverage which different countries have opted for is also seemingly linked to their historical ties and existing institutional infrastructures abroad, not to mention political and scientific/innovation relevance, as the research data reveals (interviews DIS1, SIS2). The combination of these factors seems to explain why certain locations/regions are selected in favour of others.

A closer look at the target countries reveals another distinct characteristic of the structure of SICs; they operate as international networks. Comparing the size of the networks, with the exceptions of the Dutch and the UK networks (this will be elaborated on later), they tend to be of a similar size. The Danish network, which has eight offices, is the largest, while Germany, the Nordic countries and Switzerland currently each have five main locations in their networks. However, the present network sizes only provide a snapshot as they have been subject to change in the past and have at times taken an incremental approach. Most SICs have gradually increased the number of their offices over time; however, in the cases of Germany and Switzerland, one office was also closed down<sup>43</sup>. Both networks, however, also recently expanded their network: in early 2020, the German network

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42 The abbreviation BRICS refers commonly to the following five countries: Brazil, Russia, India, China and South Africa.

43 In addition, Switzerland has drawn on the concept of outposts, which are smaller, more fluid and flexible units in larger countries; they are topical and responsive to changing needs and conditions. In the past, outposts were created in China, New



opened a site in San Francisco, USA (additional locations are also under discussion). Switzerland will open another Swissnex in Osaka, Japan in 2022 (Swissnex, 2021d). To some degree, this signals a change to the findings of Rüffin (2018, p. 4), who predicted that there would not be many new offices established in the future, and that the BRICS countries would create their own agencies (the latter prediction, in particular, is still open).

Table 2 Target Countries SICs

Country	Denmark	Germany	Flanders	Nordic Countries	Switzerland	The Netherlands	The UK
<b>Geographical Spread</b>	Brazil (São Paulo) China (Shanghai) Germany (Munich) India (New Delhi) Israel (Tel Aviv) South Korea (Seoul) USA (Boston, Silicon Valley)	Brazil (São Paulo) India (New Delhi) Japan (Tokyo) Russia (Moscow) USA (New York) <b>2021/2022:</b> USA (San Francisco)	China (Guangzhou) Denmark (Copenhagen) France (Paris) Germany (Munich) India (Mumbai) Japan (Tokyo) Singapore UK (London) USA (New York, Palo Alto)	Hong Kong Japan (Tokyo) Singapore USA (New York, Silicon Valley)	Brazil (Rio de Janeiro)* India (Bangalore) China (Shanghai) USA (Boston, New York, San Francisco) <b>2022:</b> Japan (Osaka)	17 countries**: Brazil Canada China (3)*** France Germany (2) India (3) Israel Japan Russia Singapore South Korea Sweden Switzerland Taiwan Turkey UK USA (3)	100 SIN officers in ca. 40 countries & territories  <b>Key regions:</b> 1)Europe 2)Asia Pacific 3)India, Middle East & Africa 4)Americas
<b>Institutional set-up</b>	Located in embassy/consulate	Mainly own offices	No data	Mainly own offices	Own offices / located in consulate****	Located in embassy/consulate	Located in embassy/consulate

\* The exact network composition changed in the past, since Switzerland had so-called outposts, being smaller and more fluid representations in certain large countries, such as for instance the outpost in São Paulo.

The concept of outposts seemed to have disappeared over time and in the case of Brazil, there is now one Swissnex with the team being split between Rio de Janeiro and São Paulo (cf. <https://swissnex.org/brazil/about-us/our-team/>, accessed 13.01.2022).

\*\* For more information, visit <https://english.rvo.nl/partners-network/international-economic-network/netherlands-innovation-network/contact> (accessed 12.08.2021)

\*\*\* The bracketed number refers to the number of offices in the country.

\*\*\*\* For an overview, see Eidgenössische Finanzkontrolle (2016, p. 15)

Source: created by the author.

If we focus on the geographical spread of SICs, two countries have a larger number of locations: the UK (Science and Innovation Network) and the Netherlands (Holland Innovation Network). These two cases differ from the other SICs since they are distinct units operating within embassies. Both units are officially tied to their countries' diplomatic representation abroad and operate under their umbrella (however, it should be mentioned that the latter is overseen by the Ministry of Economic Affairs). These close ties explain the SICs' comparatively wide geographical coverage. In contrast, the other countries operate their SICs as satellite institutions (with their own premises) which operate alongside national diplomatic representation bodies. These SICs have their own structures in place and

York and São Paulo. The outpost in New York, for instance, was gradually officially integrated into Swissnex Boston; the São Paulo outpost was later closed but Swissnex Brazil remained. Over time, the concept of outposts disappeared.

can hence be considered to operate outside the umbrella of diplomacy, in contrast to those units based within embassies. Admittedly, it became evident that there is nevertheless regular and intense exchange between SIC satellite institutes and their corresponding embassies. Finally, reference is made to *mainly own offices* (see Table 2), which signals that a unit is not located within the diplomatic premises or does not constitute a subunit of an embassy. Instead, SICs might either have their own facilities or share a workspace or premises with partner institutions that already have international offices.

#### 3.3.3. Links to Diplomacy

The previous sections have already touched upon a key characteristic shared by all SICs: they are tied to the diplomacy umbrella of their home country to varying degrees (cf. Berg, 2010 Ruffin, 2018). The most obvious connection relates to financial and administrative responsibility. SICs are under the auspices of ministries of foreign affairs, albeit conjointly with sectoral ministries for education and research. In some SICs, other ministries are also involved, such as the Dutch Ministry of Economic Affairs and the German Ministry of Economic Affairs and Energy (although their role is more peripheral than the two leading ministries)<sup>44</sup>. Furthermore, Swissnex, for instance, is administratively part of Switzerland's external diplomatic representation, reflecting the decisive role of SICs in foreign policy. Similarly, the Innovation Centres Denmark (ICDK) are officially the responsibility of the Danish embassies/consulates, but in practice they operate largely autonomously (Oxford Research A/S, 2015). Moreover, some SICs' CEOs have diplomatic status, as in the cases of Denmark and Switzerland, while for Germany, this is not the general construct (however, the DWIH Moscow is an exception to this, and its director is part of Germany's official diplomatic representation there<sup>45</sup>). As described in the previous section, SICs may also be physically linked to diplomacy since they are distinct subunits or are located in consulates or embassies, which underlines their

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44 In the case of Denmark, the Trade Council is part of the Ministry of Foreign Affairs and is in charge of the ICDK, see Gottlieb (2019b, 2019a).

45 This is explained by administrative and legal aspects in the host country. Since the framework conditions vary strongly between the host countries, different set-ups are in place to create these official representations abroad (confirmed in a background talk (12.05.2022)).

close links. This applies, for instance, to the SIN (UK) and the ICDK (Denmark), which are located in their countries' embassies.

This embeddedness reflects a dual connotation: being a door-opener for SICs in some on the one hand, since “*a certain diplomatic leverage effect occurs behind the networks (stronger political status through the ‘embassy label’)*” (Schlegel et al., 2011, p. 297). On the other hand, the closed nature of embassies may hamper the open and connecting character that SICs wish to convey. Embassies, for instance, typically have strict access procedures in place. Simply walking in is not possible since access must be granted. Thematically, this organisational set-up is noteworthy as internationalisation activities in higher education and science have traditionally been the responsibility of the respective sectoral ministry. While the core task of ministries of foreign affairs is the external representation of national interests, the explicit promotion of higher education and research carried out by SICs is a newer development<sup>46</sup> and it ultimately feeds the science diplomacy paradigm: science is used as a vehicle in foreign affairs. An exception to the previous example is the Holland Innovation Network, which is physically located within the diplomatic representation body. However, it is the Ministry of Economic Affairs that oversees the network (which is possibly explained by the strong focus on innovation). This shared ministerial responsibility is not uncontested and could conceivably lead to tensions which might hamper the SIC's activities (Rüffin, 2018). Findings for the German DWIH reveal severe inter-ministerial struggles, which have ultimately impacted the design and mission of those units (Epping, 2020). The close links between SICs and foreign affairs are also reflected in official strategies: foreign affairs ministries stress the political dimension and the potential impact of these instruments on wider (political) science diplomacy goals. This has been analysed in detail for Germany and Switzerland (cf. Epping, 2020).

#### 3.3.4. Core Activities and Key Stakeholders

A comparison of SIC names reflects a certain convergence in the labelling of these units and points to their core missions. Almost all SICs have

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46 This development must also be understood in light of the changing roles of foreign ministries in recent years: scholarly literature highlights a loss of their core activities to other (state) actors (cf. Moses and Knutsen (2001); Lequesne (2020)).

the word ‘innovation’ in their name (see Table 4) with the exception of Swissnex<sup>47</sup>. Following re-branding in 2007/2008, the name Swissnex was established as a joint brand that evokes immediate notions of innovation. Innovation is currently considered a core element of Swissnex activities. The German and UK SICs also refer to research and science in their names, as well as innovation; this suggests that these elements are both core elements in their work; however, further research would be required to establish whether science and research indeed play stronger roles in their activities than in the other networks. The names of the German and the UK SICs certainly constitute a deliberate branding exercise for the two countries<sup>48</sup>: both countries wish to promote and be internationally recognised for excellence in research/science and innovation.

Taking a closer look at the descriptions of SICs’ core missions reveals that, in most cases, research and science also play a significant role—and it would be surprising if this was not the case<sup>49</sup>. The Danish unit, for instance, aims to help Danish research institutions gain access to international opportunities and to enable them to operate abroad. Likewise, Switzerland explicitly aims to connect with global partners in the field of education and research. The Nordic Innovation House, however, mainly focuses on innovation activities and business support (Nordic Innovation House, 2021), and stakeholders from science and research are referred to only to a minor degree<sup>50</sup>. The Dutch network also has a more dominant focus on accelerating innovation, and technological themes are central to the Flemish SICs. Finally, the names of SICs also differ in terms of their own characterisation as houses, centres, offices or networks. Units that refer to themselves as networks (SIN (UK) and the Holland Innovation Network) are located

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47 This is also referred to as the “*integrative narrative of innovation*” by Ruffin (2018, p. 4).

48 The interview data for Germany indicates that the idea was initially to create units that focus mainly on research/science, while innovation was, nevertheless, added as a key topic. However, this proved to be an ongoing point of discussion between the actors involved, particularly the traditional research-oriented actors.

49 While a distinction is made between innovation and research/science, the importance of and connection between education, research and innovation is not explored here. Instead, the intention is to gain a sense of the predominant thematic focus, which in turn may point to the key actors involved. Accordingly, this distinction is slightly artificial but serves as a focus.

50 This study firmly acknowledges that education and research are core elements of a successful innovation policy (cf. Edler and Fagerberg (2017)).

within embassies, while the units referred to as houses or centres have their own premises<sup>51</sup>.

A closer look at SICs' core missions points to the variety of actor groups that operate within SICs (partially with a governing function (cf. Epping, 2020)) or are SIC clients. These range from research institutions to universities, to entrepreneurs and companies, to name a few (see Table 3). Typically, research and science organisations and business entities do not operate under a shared roof. This diversity of stakeholders therefore leads to a broad coverage of themes, which SICs unite under one roof. Accordingly, given this diversity in actors and themes, SICs can be considered "hybrid" units (cf. Schlegel et al., 2011, p. 292). In addition, SICs promote national higher education, research and innovation systems in a holistic way (cf. Fetscherin & Marmier, 2010; UK Science & Innovation Network, 2015). Due to their international locations and core goals, SICs function as a one-stop solution agency representing streamlined coverage of their national ecosystem. This is a unique development, considering that in most countries, there is a scattered international presence of national actors and that this is limited to a few (prestigious) higher education institutions, research institutes or intermediary and research organisations, not to mention corporate offices.

The creation of institutional structures abroad is costly and at times administratively burdensome; thus, the creation of SICs marks a turning point. Due to their integrated approach, SICs bring added value to the visibility of the combined national higher education, research and innovation systems, while also enabling individual actors and institutions to benefit from this new visibility. SICs specific tasks include providing expertise to higher education and research institutions, finding partners abroad or setting up cooperation programmes. Another core area of their work relates to networking (cf. Berg, 2010): SICs aim to connect scientific communities in the host and home countries by, for example, providing lecture series on current topics or hosting academic and informative events. This networking character is deeply interwoven in the DNA of SICs since they also operate in a network structure (see section 3.3.2). At the other end of the spectrum, SICs support businesses that are striving to enter certain markets.

SICs typically have access to or maintain a certain infrastructure abroad, such as having their own offices and contact databases, and ideally also

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51 The research data for Germany reveals that there has been an ongoing discussion as to whether the German SICs should be referred to as houses or centres.

Table 3 Dimensions for Comparison I: Tasks and Thematic Focus

<b>Dimensions for Comparison</b>	
<b>Names of SICs</b>	<ul style="list-style-type: none"> <li>* Innovation</li> <li>* Innovation &amp; research/science</li> </ul>
<b>Core Activities</b>	<ul style="list-style-type: none"> <li>* Promoting higher education, research and innovation</li> <li>* Horizon scanning</li> <li>* Business entry</li> <li>* Reporting to governments</li> </ul>
<b>Key Stakeholders and Clients</b>	<ul style="list-style-type: none"> <li>* Individual researchers</li> <li>* Research institutions</li> <li>* Universities</li> <li>* Entrepreneurs</li> <li>* Companies</li> </ul>

Source: created by the author.

developing a reputation and an established local network of researchers, policy-makers and expats. These resources can easily be accessed by pertinent national actors in the ecosystem of education, science and innovation in relation to their own activities abroad, while, at the same time, responding to ongoing calls for internationalisation (cf. Altbach, Reisberg, & Rumbley, 2009; Carlsson, 2006; de Wit et al., 2015; Edler & Fagerberg, 2017). Accordingly, SICs function as a low-threshold platform for those actors wishing to launch internationalisation activities. Furthermore, SICs may also function as a horizon scanner for national actors in science, research and innovation, and for policy-makers. Depending on the political ties of each SIC, the latter aspect may be more strongly woven into the DNA of certain SICs, while for others, this may be more of a sideline. To give an example, one of SIN's core tasks is to generate policy insights in order to improve overall UK policy in the fields of science and innovation (cf. UK Science & Innovation Network, 2015, p. 3). In addition, Swissnex is, to some extent, considered to function as a horizon and trend scanner.

Table 4 SICs' Core Missions<sup>52</sup>

Country	Name	Core Mission
<b>Denmark</b>	Innovation Centre Denmark (ICDK)	"Denmark has Innovation Centres in Shanghai, Silicon Valley, Boston, Munich, São Paulo, New Delhi, Seoul, and Tel Aviv. Their purpose is to help Danish research institutions and companies with access to foreign knowledge, networks, technology, capital and market opportunities".
<b>Germany</b>	German Center for Research and Innovation (DWIH)	"The German Centres for Research and Innovation (DWIH) are a network of German research organisations, universities and research-based companies. In five cities around the world, the DWIH provide a joint platform for German innovation leaders, showcase the capabilities of German research and connect German researchers with local cooperation partners".
<b>Flanders</b>	Science & Technology Offices	"Together with our Science & Technology Coordinator, our Science & Technology Counselors play a crucial role in FIT's tech mission. Abroad, they build an extensive network of tech companies, venture capitalists, knowledge and research centers, clusters, incubators, accelerators and so on, while creating connections to Flanders' ecosystem".
<b>Nordic Countries</b>	Nordic Innovation House	"Nordic Innovation House is a unique collaboration with the Nordic countries. We are a bridge connecting the cold corners of the globe with the main hotspots around the world. With backing from Nordic Innovation, we bring Nordic entrepreneurship, values, and our way of doing business to the global innovation ecosystem. We bring together the most innovative entrepreneurs, all working to connect the dots – and getting connected".
<b>Switzerland</b>	Swissnex	"Swissnex is the Swiss global network connecting Switzerland and the world in education, research and innovation. Our mission is to support our partner's outreach and active engagement in the international exchange of knowledge, ideas and talent. The five main Swissnex locations are established in the world's most innovation regions. Together with around 20 Science Offices and Counselors based in Swiss embassies, they contribute to strengthen Switzerland's profile as a world-leading hotspot of innovation".
<b>The Netherlands</b>	Holland Innovation Network	"Holland Innovation Network ("Innovatie Attaché Network" in Dutch) is part of the Dutch Ministry of Economic Affairs that operates in multiple countries with a strong innovation capacity and/or potential. This network aims to improve the innovation capabilities of the Netherlands by linking global and Dutch innovation networks. Focal areas for the organization are science, research, technology and innovation".
<b>United Kingdom</b>	Science and Innovation Network	"The Science and Innovation Network (SIN) has approximately 100 officers in over 40 countries and territories around the world building partnerships and collaborations on science and innovation. SIN officers work with the local science and innovation community in support of UK policy overseas, leading to mutual benefits to the UK and the host country".

Source: created by the author.

The exact portfolio of tasks, however, varies between SICs (cf. Rüffin, 2018), and this is also linked to the way that these institutions are governed and funded (this will be explored further in section 3.3.5). SICs manoeuvre between the logic of international cooperation and that of competition (J. J. W. Powell, 2018, 2020) and seem to provide new distribution channels and ways to make an impact. Thus, in response to the wider discourses on SICs, they can be viewed in many ways: as manifestations of the knowledge society, an instrument that reinforces a country's position as a global key player, a response to a run for excellence and the need to attract talent, and a way to enter new (emerging) markets and tackle global challenges (Epping, 2020). Accordingly, the fact that SICs unite and respond to these global (political) themes while, at the same time, accounting for individual actor interests is another example of why SICs should be considered hybrid units.

### 3.3.5. Governance Arrangements

#### 3.3.5.1. Organisational Set-Up

In terms of organisational set-up and governance, ministerial authority is generally shared between foreign affairs ministries and sectoral ministries (see section 3.3.3). This set-up may offer several advantages, particularly in relation to the management and employment of staff members abroad. However, it may also constitute a (potential) source of conflict in terms of direction setting<sup>53</sup>. A comparison of different SICs reveals that, in ad-

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52 Core missions are taken from the respective websites:

Denmark: <https://ufm.dk/en/research-and-innovation/international-cooperation/global-cooperation/innovation-centres-and-attaches> (accessed 06.08.2021)

Germany: <https://www.dwih-netzwerk.de/en/who-we-are/> (accessed 06.08.2021)

Flanders: <https://www.flandersinvestmentandtrade.com/en/strategy/tech-makes-flanders-tick> (accessed 18.02.2022)

Nordic countries: <https://www.nordicinnovationhouse.com/#about-nih> (accessed 06.08.2021)

Swissnex: <https://swissnex.org/about-us/mission> (accessed 06.08.2021)

The Netherlands: <https://netherlandsinnovation.nl/> (accessed 06.08.2021)

The UK: <https://www.gov.uk/world/organisations/uk-science-and-innovation-network> (accessed 10.08.2021)

53 In scholarly literature, this conflict is referred to as jurisdictional egoism between different ministries (see Mai (2016)).



dition to ministries, other key stakeholders may also be involved in the governance of SICs. In the case of the German DWIH, a strong stakeholder-led governance structure can be observed<sup>54</sup>, with a key role assigned to intermediary organisations. This actor-led structure seems to be a distinct characteristic of the DWIH and could not be identified in relation to Swissnex (cf. Epping, 2020) or SIN (UK).

Furthermore, other forms of key actor involvement were also identified, such as advisory boards, for example in the cases of Denmark (Ministry of Foreign Affairs Denmark, 2021), Germany (DWIH-Netzwerk, 2021) and Switzerland (Swissnex, 2021b). These advisory boards provide advice either at a network-wide level or on-site at particular SICs. On-site governance arrangements differ between SICs, although they usually have a head of unit, who coordinates a team. Teams vary in size and are often composed of a mixture of national and local employees. Berg (2010, pp. 69–70) mentions that the type of staff working at SICs ranges from diplomats and people on secondments to locally recruited employees; again this varies between SICs. Moreover, not all SICs operate as teams; there are also solutions that focus on individuals, such as the Flemish science and technology counsellors (Switzerland also uses a similar system with representatives who are part of the embassy's staff).

### 3.3.5.2. Funding

Funding arrangements are a central element to understanding and comparing how SICs function (see Table 5). Among the countries included in this study, there are several different funding models. On the one hand, some SICs are fully government funded, such as the DWIH (Germany) and SIN (UK). The DWIH are institutionally funded by the Federal Foreign Office through the intermediary organisation, the German Academic Exchange Service (DAAD). Similarly, SIN is funded by the Foreign and Commonwealth Office and the Department for Business, Energy and Industrial Strategy (SIN, 2018). Some SICs, on the other hand, have mixed funding sources. Swissnex, for instance, runs on a public-private partnership model, where one third of the costs are covered by public sources, while the remaining two thirds need to be earned. In addition, each location has certain individually agreed upon (political) targets or key performance indicators which determine their success. In a similar vein, the Danish model

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54 Bach and Jann (2010) consider this to be a reflection of the German system.

is partially publicly funded, while additional income is earned through consultancy services. This is also reflected in the IC DK's portfolio: the Danish SICs offer services free of charge (for instance to university clients), whereas they provide commercial services to Danish enterprises.

Table 5 Dimensions for Comparison II: Organisational Set-Up and Funding

Dimensions for Comparison	
Advisory Boards	* In place / not in place
Staff Categories & Size	* Diplomatic / seconded / recruited staff members * Team vs. individual
Funding Model	* Fully governmentally funded * Public-private partnerships

Source: created by the author.

### 3.3.6. Demarcations to Similar Institutions

The rise of SICs has similarities to several other publicly funded institutions that also operate internationally, for instance cultural sector institutions; these often fulfil similar roles (although in a different context) and are frequently associated with notions of public diplomacy (Ostrowski, 2010; Srugies, 2016). Such institutions seem to play an equally strong representative and bridge-building role, drawing on culture as a vehicle. The German Goethe Institute is a well-known and comparable example and, like the DWIH, it is funded by the Federal Foreign Office; its aim is to promote cultural exchange and dialogue (Mosch, 2009; G. Schneider, Schiller, & Goethe, 2000). Similarly, the concept of Amerika Haus in Berlin and Munich is relevant here; these institutions were financed by the USA and aimed at offering German citizens an opportunity to learn about America<sup>55</sup>. In a similar vein, the Swiss Pro Helvetia institutes<sup>56</sup> should be mentioned here (cf. Eggenberger, 1986; Kowner, 1993). These institutes are located in selected countries, which in some cases correspond with Swissnex locations. For instance, *Pro Helvetia* has centres in India (New Delhi, a different

55 For more information see [https://culturaldiplomacy.org/amerikahausberlin/index.php?en\\_about](https://culturaldiplomacy.org/amerikahausberlin/index.php?en_about) (accessed 11.08.2021).

56 For more information, see <https://prohelvetia.ch/de/>.

city from its Swissnex office), China (Shanghai) and the USA (New York). Its core task is to promote Swiss culture and facilitate bridge-building activities between Switzerland and its host countries. However, despite the similar aims of these cultural institutions, such as the key objective of building bridges between countries and connecting communities, SICs are nonetheless distinct in their set-up due to their hybrid nature and holistic approach to operating as a national nucleus for the research, science and innovation sectors.

### 3.4. Typologising SICs

Bringing together insights from the previous sections, it is evident that in light of common (global) challenges, highly innovative countries have adopted similar responses over time and thus created SICs. While there are some differences in the national character of these SICs, a certain isomorphic tendency can be observed<sup>57</sup>. The comparative overview of the previous sections highlighted similarities and differences, as well as key characteristics of SICs' different national characters. The relevant aspects for comparison include core missions, geographical spread, governance and funding, and proximity to politics and diplomacy, to name a few. With these in mind, a typology is proposed that provides a structure for the empirical data gathered (see Table 6). Typology building is considered a useful strategy for generalisation and structuring purposes (cf. Kuckartz, 2006)<sup>58</sup> (see also section 5.2.1 for more detail).

To this end, three models are identified that differentiate between SICs based on the key principles of organisational set-up and method of operation (as such, they are more specific and encompassing than already

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57 The issue of policy transfer or policy learning, as addressed in Dolowitz and Marsh (2000), is a relevant concept here, although this requires further research, given the existence of common pressures or the wider culture that results from these isomorphic responses (cf. Meyer, Boli, Thomas, and Ramirez (1997)). Does the emergence of SICs as a response to joint challenges suggest a case of policy learning among highly innovative countries, which have adopted a common response applicable to their respective contexts?

58 If we draw on Kuckartz (2006, p. 4050 ff.), creating typologies is a useful strategy to navigate between singularity and generalisation. Methodological implications and steps for doing so will be explained in the methods chapter (see section 5.2.1).

### 3. Science and Innovation Centres: Definitions and Concepts

existing typologies (cf. Rüffin, 2018<sup>59</sup>); further criteria, such as funding and proximity are accordingly aligned with these principles. While it should be noted that the boundaries between the models are not 100% watertight, they are considered ideal-typical. Based on the criteria allocated, i.e., primarily their organisational set-up and method of operation, the three models are as follows<sup>60</sup>:

- (1) *Service-oriented SICs*: operate according to market dynamics
- (2) *Representational SICs*: operate mainly according to stakeholder preferences
- (3) *Policy-led SICs*: operate in line with policy demands

Table 6 Typology of Science and Innovation Centres

	Service-oriented model	Representational model	Policy-led model
Pattern of activity	Client & market driven	Stakeholder driven	Policy-led
Funding	Public-private partnership	Fully funded	Fully funded
Proximity to politics	Detached (with limits)	Detached (with limits)	Close
SIC Cases	Swissnex, IC DK, Nordic Innovation House	DWIH	SIN (+ Dutch and Flemish Network)

Source: created by the author.

These three models range on a continuum as far as the questions of steering and the actors in charge are concerned. On the one hand, service-oriented SICs reflect a (comparatively) low degree of steering both politically and

59 Rüffin (2018, p. 13) similarly aims to establish a typology of SICs alongside the dimensions of science vs. diplomacy-steered, applied vs. basic research-focused and the way that SICs are steered (top down vs. bottom up). To that end, he compares Denmark, the UK and Switzerland. This attempt at typology building is less encompassing in terms of the countries it is informed by, while the criteria are also not specific and refined enough to shed light on the governance of science diplomacy. In this study, insights into the governance of science diplomacy are most relevant and, hence, organisational set-up and method of operation are considered in a more detailed way.

60 Neither the Holland Innovation Network nor the Flemish network are included in this typology since, based on desk research, too little information was available to enable a solid classification. Requests for additional information and for an interview remained unanswered. However, these SICs seem to correspond most closely to the policy-led model since they are tied to diplomatic representation bodies and, similarly, seem to respond to policy priorities.

steering according to client and market demands. Policy-led SICs are found at the other end of the continuum; in terms of organisation, they are part of the diplomatic apparatus and respond mainly to political demands. The representational model can be placed in the middle since it is strongly driven by key stakeholders (from the science and innovation sector) who project their interests in and through the instrument and hence shape the SICs' main patterns of activity.

#### 3.4.1. Service-Oriented SICs

The *service-oriented model* will be discussed first (see Figure 1); this model can be described as operating according to market dynamics. SICs are equipped with a strong degree of *autonomy*, which is also reflected in their *governance set-up*. They function as relatively independent actors<sup>61</sup> since they fulfil a service function for the national system, yet they also convey international visibility. This model seems to operate above national structures (with certain limitations). Service-oriented models are only partially funded by public means and operate on a public-private *funding basis*. Accordingly, they must secure their continuing existence through contracts. In line with the need to generate their own income, they can be considered volatile due to changing market developments and client needs. A core business element for service-oriented SICs is to closely monitor and listen and respond to the needs of their key stakeholders, as well as pay close attention to the markets in which these stakeholders operate. In addition, they seem to have sufficient autonomy to develop innovative formats and ideas for their clients, and they position themselves accordingly. Hence, the way that service-oriented SICs operate is strongly influenced by market logic and their clients' needs due to a certain dependence on these factors.

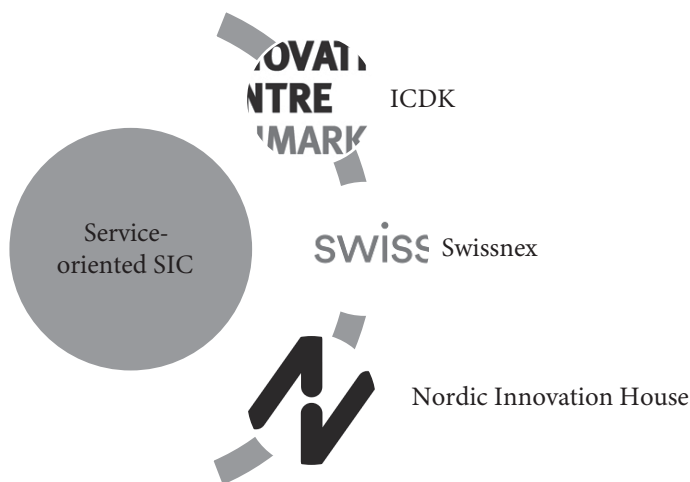
This set-up similarly provides a basis for legitimacy. An ongoing demand for a SIC's services constitutes an indicator (to all stakeholders) of their added value. Hence, aside from their inherent symbolic function, these SICs are directly subject to stakeholder needs. In line with their funding composition, service-oriented SICs seem to have greater *detachment from political goals*. They have weaker links to (daily) politics in comparison to other models, despite a certain level of supervision and steering through

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61 For an overview of literature on (strategic) actorhood and organisations, see Brunsson and Sahlin-Andersson (2000); Krücken and Meier (2006).

performance agreements by ministerial actors. Finally, SICs in this category tend to have a stronger focus on *innovation* activities, and this is reflected in their names. Innovation Centre Denmark, Swissnex and the Nordic Innovation House are all categorised as service-oriented SICs. Accordingly, SICs that fall into this category can be characterised by the need to secure their own existence by delivering specific services. This design principle and the need to generate their own income, in line with market demands, structures the work and set-up of these SICs.

Figure 1 Service-Oriented SIC



Source: illustration author's own account; the logos are taken from the official website.

### 3.4.2. Representational SICs

The second model identified is the *representational model*, inspired by the German DWIH<sup>62</sup> (see Figure 2). The representational model can be described as operating according to stakeholder preferences, which is also evident from the *governance set-up* and the level of *autonomy* of this organisation. The SICs' scope of action is determined by key stakeholders

62 The definition of the representational model draws on one case only. Accordingly, its characterisation is subject to refinement and additional research to validate or dismiss this model. This is not yet possible due to the absence of comparable cases. This characterisation would certainly benefit from additional research in the future.

and subject to their approval. Therefore, representational models have less autonomy to act and to develop as independent actors since they are constrained by the corset of their stakeholders' preferences. To elaborate further, stakeholder's needs and wishes are not always in accordance with each other; this model is hence driven by the principle of the lowest common denominator. This potentially limits collective action and collective representation. In addition, there is a further constraining factor regarding the autonomy of the representational model; a representational SIC is led by one representative (DAAD) of the many key stakeholders rather than by an organisationally independent CEO. As a result, representational SICs may be more passive and potentially less dynamic and responsive to developments in comparison to their service-oriented counterparts. This is due to (conflicting) organisational interests projected on to this instrument.

In a similar vein, the portfolio of the DWIH's activities (at least in broad terms, but also more specifically) is subject to the approval of key stakeholders. Therefore, the exact tasks presumably remain at a level that is generally undisputed, and there may be a greater focus on presenting and providing information about the German system. In other words, rather than fulfilling a service function, this representational SIC seems to be concerned with the collective branding and showcasing of Germany. This underlines the SIC's holistic representational function and its replication of the national system in an international context. In terms of *funding* and *proximity to politics*, it can be confirmed that the DWIH are fully funded from public sources and that they do not need to generate additional income. The DWIH are, in fact, not even permitted to generate income<sup>63</sup>. Secured funding creates a different starting position, for instance in terms of identifying the added value of an instrument. Whilst for service-oriented SICs, this can be directly inferred from the existing demand, it might be more difficult to identify the added value for representational SICs.

In addition, there may be a limited added value for the individual actor since these SICs seem to operate based on the lowest common denominator. The composition of fully governmental funding underlines the political importance that is tied to these SICs, while there are generally loose links to ministerial actors. In line with the strong autonomy of the German science sector, it is anticipated that SICs will continue to maintain weak links to

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63 For contextualisation purposes, the DWIH first received institutional funding in 2017. Previously, a mixture of public/private funding sources was in place (inspired by the service-oriented model); however, this proved to be a misleading design principle.

ministerial actors/diplomacy. This is further reflected in the ongoing tensions that are characteristic of the representational model, i.e., the question of who is in the driver's seat: ministerial actors/diplomacy or science. In a nutshell, the *representational model* operates within strict framework conditions that are determined by and subject to the approval of key stakeholders. This model is characterised as representational for two reasons: firstly, because its set-up replicates and represents the characteristics of the national system, both in terms of actors and possibly also distribution of power, and secondly, because its autonomy is limited due to that complexity of actors and the fact that its activities focus on non-critical cases, such as representation and one-stop-shop functions. The representational SIC appears to be an instrument that organisations use to project their own interests.

Figure 2 Representational SIC



Source: illustration author's own account; the logo is taken from the official website.

### 3.4.3. Policy-Led SICs

The third type that can be identified is the *policy-led SIC*; this type is inspired by SIN, the UK's science and innovation network (see Figure 3). Policy-led SICs are characterised by their *proximity to politics*, and they thereby differ significantly from the two previous models. This is manifested firstly in their organisational set-up and secondly in the tasks they carry out. Organisationally, policy-led SICs, such as SIN, operate as distinct units under the diplomatic umbrella. They are an integral part of the UK's diplomatic representation body; within embassies, they constitute a subunit which deals with science and innovation matters. As such, in terms of size, they differ from individual science and technology counsellors (or attachés) since they are typically comprised of a larger team. They have a wide geographic spread due to their ties with and incorporation into embassies; they do not require their own premises and hence have a low



administrative burden. Thematically, SIN explicitly conveys and supports the UK's science and innovation priorities by ensuring exchange between the UK and its local partners. SIN's tasks and priorities derive immediately from national considerations and agendas since it is set up in such a way that it contributes to and supports the UK's strategic and political objectives abroad. Accordingly, the topics that are dealt with are clearly driven by the UK's (changing) strategic priorities, such as ensuring prosperity, security, influence and development (SIN, 2018); those topics are also country-specific and targeted by action plans. Despite fulfilling similar tasks to the previous models, such as being a one-stop shop or approaching new partnerships, policy-led models are responsive to changing political demands. They deliver insights for politics and are seen as a vehicle used to inform policy-making; they thus differ from the two other models. Since they are part of the diplomatic representation body, they are also *fully funded*.

Figure 3 Policy-Led SIC<sup>64</sup>



Source: illustration author's own account; the logo is taken from the official website.

#### 3.4.4. Synthesis of the Typology

The previous sections attempted to analyse the variety of SIC structures. The threefold typology which was identified marks an entry point into this novel field as it aims to portray the empirical diversity. SICs differ mainly in terms of how their thematic scope is determined. Thereby, the continuum

64 The Holland Innovation Network and Flanders Science & Technology Offices reflect similarities with this type; however, there is too little information available to be able to classify them. Nevertheless, section 13.5 proposes avenues for further research and suggests ways to provide an insight into these two cases and be able to categorise them.

stretches from clients and market demands to key national stakeholders, and to political and ministerial actors. The typology is inspired by the comparative overview provided earlier in this chapter; however, it is subject to empirical validation (and possibly modification). Despite observing key differences in terms of set-up, this chapter could not provide explanations as to why countries opt for certain models. Nevertheless, in some cases, the type of SIC appeared to be linked to distinct characteristics of a country's national science and innovation system. For example, the exact model of SIC might replicate how the national system is organised (i.e., bottom-up style, autonomy of the science sector, coordinated activities, etc.). Furthermore, the existence of similar (institutional) structures abroad may explain why some countries find it necessary to establish SICs while others do not. Drawing on Meyer & Rowan (1977, p. 341), we can ascertain that it is often the case that the “*formal structures of many organizations in postindustrial society (Bell 1973) dramatically reflect the myths of their institutional environments instead of the demands of their work activities*”. In a similar vein, it is argued that “[a]ll new organizational forms, no matter how radically new, are combinations and permutations of what was there before” (Padgett & Powell, 2012, p. 2). This underlines the assumption that SICs may be the product of their institutional environment, despite the fact that this may also limit the scope of their work.

This study sheds light on the question of how SICs can be understood and how their set-up can be explained. With regard to the research question, two of the previously identified SIC models have been selected for in-depth analysis. This will facilitate our understanding of how SICs function and fill some of the gaps in the existing literature relating to this novel instrument. In line with the inductive and exploratory logic that guides my research, the two models that will be explored empirically and analytically in this thesis are the *service-oriented model* and the *representational model*. In combination, the analysis facilitates a scholarly understanding of the institutionalisation and instrumentation of these SIC types in a national setting, while also offering insights into science diplomacy. In line with the exploratory nature of this study, the cases for closer study were selected based on the interest they evoke and the insights they provide; furthermore, they also enable a degree of comparability. The specific criteria and the two countries that will be investigated are Switzerland, which provides a prototype of the service-oriented model, and Germany, which exemplifies the representational model (see chapter 5).

### 3.5. Conclusion

This chapter constitutes a key component of this study since it serves three key purposes. Firstly, it introduced SICs, the instrument that is the subject of this investigation. Academic scholarship has not systematically addressed the topic of SICs; therefore, a definition, which will be used throughout this study, was provided (section 3.2). SICs were identified as hybrid units which respond to a variety of actors and issues. Despite a certain isomorphism, SICs were found to differ between countries in terms of their exact composition and expression. Secondly, an exploratory comparative exercise of SICs was undertaken to shed light on the richness and diversity of existing SICs. Key characteristics were revealed, while differences and isomorphic patterns became visible. The third and final aim of this chapter was to provide a structuring perspective on the variety of SICs and to propose a typology. Thus, three prototypical SIC types were identified from the range of SICs that were studied: *the service-oriented model, the representational model and the policy-led model* (section 3.4).

In combination, these three sections provided insights that facilitate a (scholarly) understanding of SICs, while also positioning them as a unique and distinct instrument in the science diplomacy toolbox. The core goal of this study is to explain how and why SICs developed by examining their emergence and institutionalisation as instruments of science diplomacy. To this end, two SIC models have been selected for closer analysis: service-oriented SICs and representational SICs (this selection will be further justified in section 5.2.4; also, ways of analysing policy-led SICs will be suggested in section 13.5). This will facilitate a) an understanding of how SICs are situated in their respective national contexts and b) an explanation of their institutionalisation and current set-up. In light of the increasing size of SIC networks and the fact that more countries are establishing SICs, this study will contribute to a greater understanding of this wider trend, while also providing an empirical account and contributing to research on science diplomacy. The subsequent chapter addresses the conceptual tools and theoretical assumptions that will facilitate the comparison of the two SICs.

