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## **Developing methods to empirically study 'Institutional thickness' framework in cross-border regions**

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### **Data accessibility statement:**

Data used in this paper is available on request. Please, contact the author for any enquiries.

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## **Abstract**

Institutional cross-border interactions support the EU goals for regional development by creating joint local initiatives and cross-border institutional cooperation networks. This paper aims to develop a new methodological strategy for studying the processes of cross-border territorial integration within the EU. By building on the Cross-Border Institutional Thickness (CBIT) conceptual framework, the paper analyses the policy targets in the cross-border regional context. The CBIT measures how its components support the required development or policy goals in different regions. Therefore, this paper provides a theoretical and methodological approaches to the CBIT model and contributes to future studies in this field.

## **1 INTRODUCTION**

Since the 1990s, European Union (EU) Cohesion Policy has been actively supporting territorial integration by enhancing cross-border regional interactions and cooperation across different layers of society and governance. European cross-border institutional interactions are the inter-organisational networks that embody physical and formal participation as well as informal connections. Local cross-border networks are structured around clear common agendas and goals and run by the lead organisations that manage the finances and activities of the interaction. Lead partners and some other institutions in the network are central and influential drivers of cross-border institutional cooperation. Lead partners aim for sustainability and functional interdependence of the involving actors in cross-border initiatives (Perkmann, 1999, 2002, 2007, 2014).

The field is rich with academic debates on the pros and cons of cross-border regional cooperation and governance (Camagni et al., 2019; Capello et al., 2018; Castanho et al., 2018; Church and Reid, 1999; Daumal and Zignago, 2010; Hall, 2008; McCallum, 1995; Noferini et al., 2020). However, the empirical studies on the actual and formal interactions that connect distinct local and regional, public or non-public actors around the local initiatives are somehow scarce

(Cappellano and Makkonen, 2020; Javakhishvili-Larsen et al., 2018; Komárek and Chromý, 2020). Therefore, studying precisely such interactions will shed light on how well the EU Cohesion Policy conveys and adopts locally in European regions. Moreover, fundamental empirical studies will add to the further discussions of cross-border cooperation at the more complex level.

This paper aims to develop a new methodological approach for studying the processes of cross-border territorial integration within the EU. In Javakhishvili-Larsen et al. (2018), the attempt is to re-open the discussion of the *institutional thickness* framework and meet some challenges of its weaknesses regarding its empirical applications and lack of place boundedness in multi-tier governance in regions. They offer initial conceptual ideas to empirically apply quantitative and qualitative methods to study institutional thickness components in a case-study. They elaborate on the empirical model of *Cross-Border Institutional Thickness* (hereafter, CBIT), which they apply to experiment on the cross-border interactions in the Rhine-Waal Region (Dutch-German). According to them, Euroregion's one of the main priority areas was to support cross-border cooperation for human capital creation ("HC-Coop") in the Rhine-Waal region, however, the CBIT model observed the *institutional thinness* of the "HC-Coop" sub-networks instead (Javakhishvili-Larsen et al., 2018 pp.317-320). Such results raised the interest in the possibilities of replicating the CBIT model for studying the other types of cross-border interactions and policy goals. They develop the CBIT model from the institutional thickness perspective, yet their paper falls short in explaining a theoretical rationale of the model. This paper builds on the CBIT model proposed by Javakhishvili-Larsen et al. (2018) and supplements further by developing and strengthening a conceptual understanding of CBIT from the institutional thickness approach and the framework of the inter-organisational networks. The paper adopts social network analyses (SNA) and graph theories for implementing empirical research concerning cross-border regions. Therefore, it grounds the CBIT model theoretically and makes it usable to replicate and reapply in different sets of cross-border

interactions (EU or non-EU; with top-down or bottom-up initiatives). It provides suggestions to measure existing interactions and explains methods to apply to the comparative studies of different cross-border regions regardless of their size, history, or development level.

The main goal of CBIT is not to create one single “thickness” indicator but to measure how each of its components is observed in a concrete cross-border region and understand how to strengthen them to meet the required development or policy goals in a case-study. Therefore, this paper provides a theoretical conceptualization of the CBIT model's methodological approach and attempts to contribute to the future research of cross-border interactions in two ways:

1. By theorizing, quantifying and normalizing the cross-border interactions, which will help to replicate and compare regions, their priorities, structure, and essence, regardless of their size, development level, historical differences, and governance structures.

2. By intending to sketch a direction for a future conceptualization of the large cross-border networks. By suggesting the set of SNA methods to explore and measure relevant characteristics of the interactions in the empirical study.

This paper consists of four main parts. The second part describes the theoretical background of the CBIT framework, while the third part provides a detailed discussion of the empirical model based on the inter-organisational network and social network analyses theories. The paper ends with conclusive remarks.

## **2 THE CROSS-BORDER INSTITUTIONAL THICKNESS (CBIT) FRAMEWORK**

In the 1990s, the institutional approaches proliferated in the field of economic geography. Amin and Thrift (1994, 1995) adopted the *institutional thickness* framework, which defines the local conditions (non-economic factors) that are favourable for local and regional economic growth and create the necessary environment for regions to react fast to the changes and challenges of globalisation, internalisation and, even, Europeanisation. The *institutional thickness* framework has

been discussed and criticised over the last two decades; however, the critics have failed to provide improving suggestions and practical solutions (Coulson and Ferrario, 2007; Henry and Pinch, 2001; Amin and Thrift, 1995; MacLeod, 2001). The *institutional thickness* framework consists of four components: 1) a strong local institutional presence; 2) interaction between the institutions: formal and informal exchange; 3) a common agenda or strategy towards achieving the development goal and 4) distribution of power, coordination, and management. (Amin and Thrift, 1995; Coulson and Ferrario, 2007, p.593; Henry and Pinch, 2001; Javakhishvili-Larsen, 2016; Javakhishvili-Larsen et al., 2018, p.297; MacLeod, 2001).

As Amin and Thrift (1994, 1995) and later McLeod (2001) argue, institutional *thickness* exists in a region if all these four components are observed and are related to a given strategy or policy goal. There were a few attempts to fit the framework to other types of problems that appeared in regions over time (i.e., not only for the challenges in economic development but also in socio-economic and political conditions).

Zukaускаite et al. (2017) conceptually revisit the discussion on the *institutional thickness* and propose strategies to redefine the four components of the *thickness*. They challenge some of the limitations illustrated in the previous works. In their definition, there is a distinction between organisations and institutions where the organisations are formal entities, and institutions are norms, culture, etc. They also introduce the multi-scalar approach (i.e., defining the levels of governance). They provide a dynamic perspective that looks at the evolution of the *thickness* and, finally, provide guidance to assess whether there are *thickness* or *thinness* of institutions in the region (ibid.).

While previous research mainly focuses on the conceptual understanding of the *institutional thickness*, Javakhishvili-Larsen et al. (2018) propose an empirical strategy by developing the CBIT model. This paper builds on Javakhishvili-Larsen et al. (2018), takes one step further and elaborates

a theoretical rationale for adopting the CBIT model in the context of cross-border institutional interactions and policy goals. By refining the methodology, this paper provides suggestions of measures that rely on the inter-organisational and social network theories. Methodological improvement of CBIT allows the framework to be transferable, not as the policy guidelines, but as a research approach to explore, monitor, and develop strategies for cross-border cooperation. Even though the methods applied to case-study focus on the EU top-down initiatives for cross-border interactions, the inter-organisational and social network analyses methods allow expanding research to study non-EU and bottom-up cross-border interactions and initiations in future.

### **3 AN EMPIRICAL MODEL OF CBIT**

#### **3.1 An inter-organizational network approach**

Cross-border institutional interactions are characterised by inter-organisational networks created formally around joint initiatives and projects targeting common goals. Even in the inter-organisational network structure, some organisations lead the collaboration. A lead organisation manages the interactions of two (bilateral) or more (multilateral) institutions. Some organisations are active and involved simultaneously in multiple networks (i.e., projects, initiatives). Some others are passive and participate in a single network which often disappears right after the joint project is finished. Both active and passive inter-organisational interactions create the CBIT. In the EU cases, the Euroregion and INTERREG Joint Secretariats are the facilitators of the CBIT. While assuming CBIT to be the structural network of institutional interactions, the inter-organisational networks theory can better explain the following empirical strategy.

Popp et al. (2014) define inter-organisational networks as three or more organisations or institutions working under a common purpose. Many scholars argue that inter-organisational cooperation is crucial to summon resources and solve complex societal problems (see references in the literature review by Popp et al., 2014). Popp et al. (2014) describe how the institutions involved

in inter-organisational networks can expand their capacities, increase their resources, and have access to knowledge know-how while at the same time benefiting from the shared responsibilities and accountability. In such inter-organisational networks, the actors are more likely to reach common agendas and goals in a more efficient and innovative form (ibid.).

European cross-border institutional networks rely heavily on the 50% of the EU financial support facilitated and managed by the INTERREG Joint Secretariat in most Euroregions. A large portion of EU funding bears a political influence on the institutions to focus attention on some initiatives more than others. The lead partner institutions in the cross-border projects, which manage a cross-border institutional network and co-finance the cooperation, attempt to achieve some degree of centrality in the networks that strengthen their strategic position and leverage for the resource flow from the INTERREG and other partners.

### **3.2 Strong institutional presence and direct and indirect interactions in CBIT**

The *institutional thickness* approach considers that there exist several institutions that are willing to participate in the cooperation. However, it also highlights the importance of their direct and indirect interactions, mutual exchange of activities and common goals. The main functions of the cross-border institutional networks are information exchange and diffusion, knowledge generation and learning, problem-solving, innovation and collaborative governance (Popp et al., 2014). The institutions that play a central and influential role in the network can facilitate information exchange. In 1948, Bavelas introduced the idea of ‘centrality’ measure in human communication, as he anticipated the relationship between structural centrality and influence in groups (Bavelas, 1950). Freeman (1978/79) developed centrality measurement methods based on graph theory. Graph theory is a structure of *nodes* and a set of *edges* with which these *nodes* connect. In the light of cross-border institutional networks, the CBIT approach distinguishes the *nodes* as the institutions which participate in the cross-border interactions and the *edges* as the local joint projects and

initiatives. Freeman (1978/79) argues that a person or an institution with many *edges* (i.e., project connections) with other participants in the interaction holds the central position in the network. He elaborates that such a *node* in the network has a high 'degree centrality' measure, or it can be characterised as an institution with maximum direct interactions (ibid.). However, Freeman argues that having maximum direct interaction with others is not enough to be central and introduces the measure of 'betweenness centrality' (maximum indirect control between the *nodes*). For example, *node B* controls the diffusion and the flow of information in the network if the information moves from *node A* to *node C* through *node B*. In this case, *node B* has high betweenness centrality (ibid.). Borgatti (2005) explains that Freeman et al.'s (1991) betweenness centrality assumes proper paths that *nodes* have passed once (e.g., transit). Bonacich's (1987, 1991) measure 'eigenvector centrality', on the other hand, counts walks, and assumes multiple trajectories among the *nodes* simultaneously (e.g., information flow). Considering that the type of flow in the cross-border institutional network is similar to a flow of information exchange, then the maximum indirect interactions in the cross-border institutional cooperation should be measured by eigenvector centrality and not by the betweenness centrality.

Another way of spreading and controlling the communication flow is to measure how well-connected the *nodes* are in the network. Freeman introduced 'closeness centrality', which signifies the shortest distances between the *nodes*. The shorter is the path to other *nodes*, the faster and more efficient will be the communication in the network. Therefore, closeness centrality does not show any influential direct or indirect positions of any given *node* but demonstrates how embedded and connected is the whole network. If many *nodes* in the network have maximum closeness centrality, then the network is embedded and the distances of communication and the flow of information are fast and efficient (Freeman, 1978/79).

Therefore, to summarise, the closeness centrality emphasises how embedded and efficient is the CBIT; degree centrality identifies the actors in the CBIT which have maximum direct connections and Bonacich's eigenvector centrality points at the institutions that have a maximum indirect influence.

### **3.3 Identification of a common goal component in CBIT**

The third component of *institutional thickness* is the common goal or the strategy that the institutions try to achieve. In the case of CBIT, different objectives are specified at the different levels of governance. The main goal at the supranational level is to create a mutual understanding, common culture and establish norms across the EU states. Financial support from the EU is also granted to those projects and local initiatives that enhance the cross-border relations and let the different local actors meet and have contact (i.e., Leresche and Saez's (2002) *barrier-contact dichotomy*). According to the EU Cohesion Policy (2014), the goals and objectives often convey economic and social cohesion across the borders, such as employment, education, innovation, social inclusion, and climate/energy. At the regional level, the general goals and objectives are converted through the EU financial support system, where the regions choose which issues to prioritise within the EU policy framework. At the cross-border level, the main supranational (or national goals, as these are elaborated based on the agreement of every EU state) objectives are translated into more locally relevant initiatives and programmes facilitated by the Euroregions and organised by the local actors. As Perkmann states, such local initiatives and cooperation networks are either created to contribute to the cross-border regional development or simply spend the EU support funds (Perkmann, 2014). In his study, Perkmann evaluates the local initiatives in the INTERREG II programme and argues that 75% of the cross-border interactions continued after the completion of EU funded projects (ibid.). Earlier studies point out that in some cases, the initiatives born at the

local cross-border level, even within the framework of EU Cohesion Policy goals, can have locally targeted long-term outcomes (Medeiros, 2014; Perkmann, 2014).

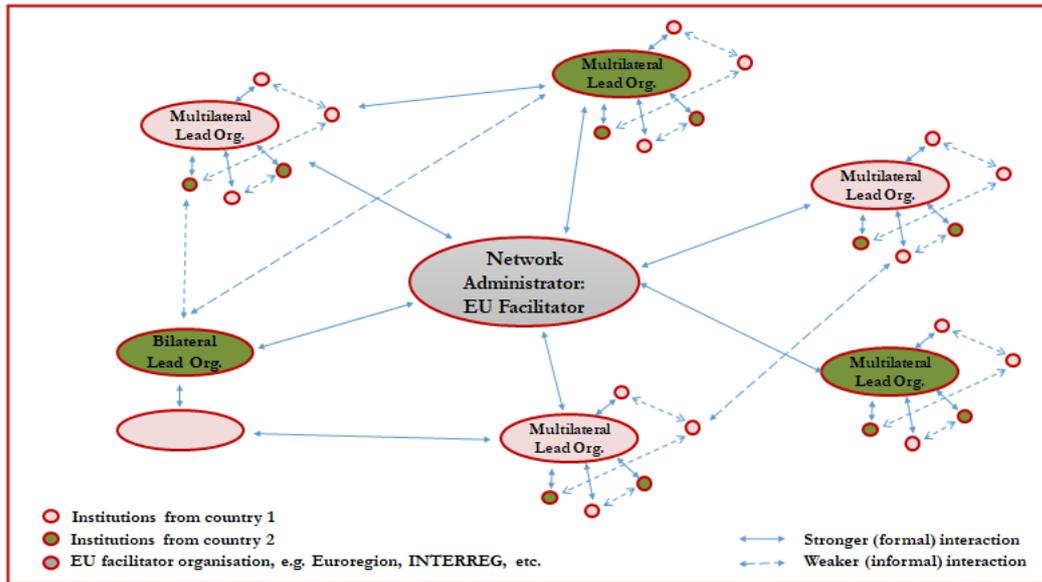
Cross-border projects and initiatives are reflections of the joint local interests of the cross-border regions. The embeddedness of the cross-border networks and the centrality of the institutions participating in the network makes it empirically possible to evaluate locally prioritised common goals and strategies with the CBIT approach.

### **3.4 The lead partner's role in the network**

The last component of *institutional thickness* identifies the distribution of power, coordination, and management in cross-border institutional networks. Considering that the influence and coordination in CBIT lie in the hands of Euroregions and the INTERREG secretariat, their role in the CBIT is still to act as a bridge between the local actors and supranational and national decision-making authorities (Blatter, 2003). Therefore, these organisations play a more network facilitators' role rather than network participants. As Provan and Kenis (2008) argue, a network administrator organisation is a type of network where one or more institutions set out the priorities, goals, and resources for the whole network without engaging themselves in the activities (i.e., Euroregions and the INTERREG create the network administrator in the CBIT).

The lead organisation network is another governance type within the CBIT. The CBIT only exists to enhance the active participation of the public and non-public local and regional actors willing to summon their financial resources and engage in cross-border action. According to Provan and Kenis (2008), a lead organisation network is a governance type, where one lead partner organisation takes responsibility for managing finances and facilitating network activities. The CBIT, therefore, consists of many lead organisation networks (sub-networks) that gather under the network administration and its common platform of EU Cohesion Policy, facilitated by Euroregions and the INTERREG Secretariat (Figure 1).

Figure 1. A structure of Cross-Border Institutional Thickness (CBIT)



Source: Author's diagram developed from the CBIT conceptual model from Javakhishvili-Larsen et.al. (2018)

In the CBIT, the lead partners of cross-border projects have responsibility for administering, managing and facilitating the resources, and therefore, they form the lead organisation networks. Keast et al. (2004) argue that the leadership in the networks is less hierarchal than in the traditional understanding of leadership in an intra-organisational setting. In the networks, the leadership depends as much on informal power and interpersonal relationships as on formal power and rules. Silvia and McGuire (2010) observe that the leaders of the lead organisation networks are more open to sharing information and “treating all networks equal”. They are more willing to create trustful relationships with the participants and ensure the “good standing” of the network (ibid.: 270-271). As shown in Figure 1, the institutions that create networks around initiatives or concrete projects choose the lead partner institutions that are often characterised by size, available resources, and formal and informal influence. In the multilateral lead organisation networks, where more than two organisations join, the lead partner has a clear advantage (shown as the larger *nodes* (big oval circles) on the figure). However, in the bilateral lead organisation networks, where only two partner

organisations join the project, both organisations have the strongest possible cross-border interaction. Therefore, one can detect another's power and influence depending on their engagement in the whole cooperation network (i.e., CBIT). The figure shows that in a bilateral lead organisation network, both nodes are similar in size, however, one has more formal and informal edges (i.e., the stronger and weaker interactions), and therefore, exhibits more influence in the CBIT than another. Thus, the question is, how to identify and measure the influence of those institutions in the whole network? Even in the bilateral sub-networks?

If one can consider Keast et al.'s (2004) and Silvia and McGuire's (2010) arguments, the lead partner organisations should play not only the managerial role in their sub-networks but also influence the whole CBIT. The lead partners might hold power and influence in the information and knowledge flow, therefore, the proper empirical strategy to measure it is by identifying their position both within their sub-network and in the whole CBIT. The power (or the influence) in the network is measured by the 'β-centrality'. Bonacich (1987) proposed a centrality measure based on the values of the β parameter, where the β measures the status of an individual actor among the statuses of other actors it is connected to. If  $\beta > 0$  for one actor in the network, then it shows that the information available to that actor is equally accessible to all other actors it is connected to. Bonacich (1987) argues that, in bargaining situations, the power is higher for those individual actors who are not as well connected. Naturally, if the powerful actor is connected to other powerful actors, then the bargaining power of that actor decreases, and that will mean that  $\beta < 0$ . In technical terms, as β increases, the centrality of other connected actors is taken more into account<sup>1</sup>. This measure will allow identifying which institutions have enough influence to receive and diffuse the information not only in their sub-networks but in the whole administrator network (i.e., in CBIT) both directly and indirectly while maintaining the network's sustainability.

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<sup>1</sup> If  $\beta > 0$  then  $c_i(\alpha, \beta)$ , where  $i$  is a degree of unit and "becomes a function of the indirect as well as the direct ties connecting it to the system" (Bonacich, 1987:1171)

### 3.5 Summarized CBIT empirical model

Based on the discussion above, it is possible to suggest an empirical model for studying CBIT in any cross-border region (Table 1).

Table 1. CBIT Empirical Model

CBIT components	SNA Empirical method	Expected analyses
1. A strong local institutional presence	<ul style="list-style-type: none"> <li>• Network cohesion</li> <li>• Core-periphery structure</li> <li>• Closeness centrality</li> </ul>	<ul style="list-style-type: none"> <li>-The structure of the whole network.</li> <li>-Its cohesiveness, embeddedness and efficiency.</li> </ul>
2. Interaction between the institutions – direct and indirect	<ul style="list-style-type: none"> <li>• Degree centrality</li> <li>• Eigenvector centrality</li> </ul>	<ul style="list-style-type: none"> <li>-The maximum direct interactions of any institution (immediate influence).</li> <li>-The maximum indirect interactions of any institution (long-term influence).</li> </ul>
3. A common agenda or strategy towards achieving the development goal	<ul style="list-style-type: none"> <li>• Identification of the common goal of interest (e.g., innovation)</li> <li>• Degree and Eigenvector centrality</li> </ul>	<ul style="list-style-type: none"> <li>-The institutions with maximum direct and indirect interactions in the network and participate in the projects that meet the common goal of interest (e.g., innovation).</li> </ul>
4. Structures of domination, patterns of coalition and coordination regarding the financial matters	<ul style="list-style-type: none"> <li>• Identification of the lead partners in the networks</li> <li>• <math>\beta</math>-centrality</li> </ul>	<ul style="list-style-type: none"> <li>-The lead partner organisations role/power/and centrality in the CBIT.</li> </ul>

*Source: Author's elaboration*

According to Table 1, the empirical model is in four main steps (following the institutional thickness framework, discussed in the previous sections). The analyses obtained from the CBIT model have an exploratory nature that observes how the institutions interact and facilitate resources to support any specific goal or policy target. In the first step, one can determine the objectives or policy target area for the research interest; identify possible actors (institutions) and collect their data to study the first CBIT component. Mapping the inter-organisational network makes it possible to observe how representative is the network, whether there is a local presence of diverse actors; whether the overall network is cohesive and embedded; and whether it has an efficient flow of information and action. In the second step, one can identify the actors with a direct and indirect influence on others. The application of the SNA methods that measure centrality, summarised in the table, helps to detect the key institutions in the study. In the next step, for studying the third CBIT

component, it is possible to analyse whether these key actors (which showed high degrees of direct and indirect interactions and influence on the overall network) share the same goal or policy target area highlighted in a research project. In the last step, one can identify the lead partners by applying the  $\beta$ -centrality measures and shed light on the institutions with the strongest bargaining power in the network. This helps to examine whether these institutions also have the same goals or policy targets in question. If that is so, then one can argue that there is a strong probability for the goal or policy target to have long-term priority in the cross-border region and, i.e., has the “thickness” of the cross-border institutional support. (For more detailed clarification on how to operationalize the empirical model, with the suggestion of variables and data, see Appendix)

#### **4 CONCLUSIVE REMARKS**

The questions, like, whether the cross-border regions can succeed in achieving sustainable interaction and cooperation? Or whether the EU cohesion policy is successful in territorial development and integration of the border regions? Alternatively, how emerged the cross-border regions are in the processes of Europeanisation and regionalism? The answers have always been different to different regions. Some regions are more emerged, some - more integrated and some - with more sustainable cross-border interactions in play. This paper aimed to develop the theoretical framework to the methodology that would allow studying these questions empirically in cross-border regions. There are two principal traits to the CBIT empirical model. Firstly, in the case of gathering similar data, it is possible to replicate the model in different regions. Secondly, in the case of comparability, the SNA measurements in the model can be normalised, allowing the model to be tested on the CBITs of all sizes (big and small). This technique enables comparing different CBITs within the EU. During its development, the model has been experimented on in the Dutch-German region (Javakhishvili-Larsen et al., 2018) and replicated to the Danish-German region and proved to

be valid (results not published yet). The results from the replicated CBIT models could be drawn in comparative analysis.

However, the model has its limitations. Firstly, it was tested on the cross-border interactions that were co-financed by INTERREG. The INTERREG project data were collected in the case regions and applied to the CBIT empirical model. The INTERREG projects were chosen to simplify the data collection process and focus mainly on the conceptual development of the model. The model was not tested on other types of interactions, therefore, the replicability and comparability of the model on other types of CBITs are yet not proven but have the potential for future research. The practical implication of the model, with its background theoretical framework of inter-organisational and social networks, can make the model replicable to any cross-border region, EU or non-EU. It can be applied to study any goals or policies (whether it is a top-down or bottom-up) for solving the local cross-border regional issue of interest or even exploring different aspects of socio-economic development conditions.

Another limitation is that the model was tested in the cross-border regions with similar socio-economic, cultural and historical structures and a similar level of cross-border integration (i.e., symmetric cases). The model has not been tested in the cross-border regions with asymmetric cases (for example, border regions from Western vs Eastern EU countries, border regions of EU vs non-EU countries).

Considering the limitations, the model needs further replication, particularly in the different cross-border regional settings. The author intends to continue her research in the field and improve the empirical approaches of CBIT to investigate the complex processes of cross-border regional dynamics.

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## **Appendix.**

### **The author's suggestions of how to operationalize an empirical model of CBIT**

This section is supplementary material aiming to provide some ideas of how to implement the CBIT model in practice. It intends to clarify the data gathering process and methods, identification of variables and putting all together. This section provides only the collection of the author's suggestions and guidelines, based on her empirical tests conducted in the Dutch-German region (Javakhishvili-Larsen et al., 2018), and replicated on the Danish-German region (not published yet). It is vital to stress that the practical elements of operationalization of this model are depended on the research question and the focus of a study, therefore, the author strongly advises employing a critical approach in choosing variables and data collection methods to make sure that the CBIT results meet the concrete research needs.

#### **Data collection and preparation method**

There are different methods to gather inter-organisational network data for the CBIT empirical research. After clarification of the research question, firstly, there is a necessary step to identify potential actors in the cross-border region. The potential actors are the institutions/organisations that might play a role in the cross-border regional development goal or policy target. (e.g., Figure 12.1 in Javakhishvili-Larsen et al., 2018, p. 298). Secondly, it is vital to identify the *edges* of interaction, whether the CB interaction is in the form of a collaborative project or initiative action or other. The data can be collected from the official sources of formal interactions (from organisations or project databases). The gathered data of the potential actors and their collaborative projects can be organized in the network matrix (Table A1).

Table A1 shows an example of collaboration of the institutions: A, B, C, and D. The numbers in the table represent the number of *edges* (projects or initiatives) that involve several actors, for example,  $AB=BA=2$ , where the A and B institutions are collaborating in 2 different

projects/initiatives while,  $AC=CA=1$ , while  $CB=BC=1$ , then we can see that A, C and B institutions collaborate in 1 joined project.

<b>Table A1. Unweighted institutional interaction matrix (Adjacent Matrix)</b>				
<i>Institution's name:</i>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>A</b>	0	2	1	
<b>B</b>	2	0	1	1
<b>C</b>	1	1	0	
<b>D</b>		1		0

*Source: Author's elaboration*

According to the table, the ABC is one network with multilateral interaction, while AB and BD are other sub-networks only with one bilateral interaction.

In the CBIT model, the information of the interaction matrix (Adjacent Matrix) will only address the first two CBIT components, "*1. A strong local institutional presence*" and some parts of "*2. Interaction between the institutions – direct and indirect*" (Section 3.5, Table 1). To study the rest of the CBIT components, it is necessary to collect more in-depth data, either by surveys, official records or by interviews. The type of variables is depended on the main research problem or study. Table A2 is a network attribute table that shows some of the examples of variables that could include in the qualitative and quantitative data collection process.

<b>Table A2. Network attributes per institution</b>		
<b>Groups:</b>	<b>Variables:</b>	<b>Explanation:</b>
Institution type:	Name*	The name of organisation. In the large CBIT, it is easier to codify all entries
	Size	Either number of employees, or the size of funding (depending on the research focus)
	Ownership	Whether the organisation is public or private
	Working/Responsibility area	What is the organisation's main activity (e.g., education, construction, etc.)
	Location	Where is organisation located, city or region (depending on the research focus)
	Governance level	Whether the organisation is local, regional, national, multination/supranational
	etc...	Could be added or modified depending on the research focus.
Interaction type:	Project/action/initiative*	The name of interaction, project, or action, (depending on the research focus)

	Partner(s) of interaction	The name(s) of the partner-organisation(s) in the collaborative interaction
	Goal of interaction*	The main purpose of the interaction (e.g., to create common product/service, or to co-educate, or to co-trade, etc.)
	Main area of interaction*	In which category is the main purpose of interaction, e.g., education, economy, healthcare, business, etc.
	Lead partner*	Whether the organisation is a formal lead partner or not in one sub-network.
	Intensity of interaction	Can be measured depending on the research focus (e.g., frequency of meetings, formal activities, informal relations, etc.)
	etc...	
<i>Source: Author's suggestions</i>		

In Table A2, the \* variables are necessary to measure the third and fourth CBIT components: "3. A common agenda or strategy towards achieving the development goal" and "4. Structures of domination, patterns of coalition and coordination regarding the financial matters". (Section 3.5, Table 1). Other variables could be used to create weights for interaction intensity or study more qualitative characteristics of the network.

As the CBIT empirical approach is the method for explorative research, it is the author's advice to gather as much information as possible, as it will be valuable for clarifying the CBIT results. In case of further questions regarding the suggestions provided here, please, contact the author.

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