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Research in Social Change

THE IMPACT OF ENDOGENOUS AND EXOGENOUS FORCES ON INNOVATION: A LOGICAL ANALYSIS OF REGIONAL INNOVATION SYSTEMS IN CENTRAL AND EASTERN EUROPE

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Abstract

Regional innovation became a mainstream topic in the modern development paradigm. This topic is especially relevant in the European Union (EU), given its developmental gap on the national and sub-national levels. The research considered testing four hypotheses, conceptualising the importance of endogenous and exogenous (regional) factors for the innovation process. The results revealed that Regional Innovation System and Global Production Networks (GPN) approaches could offer necessary models to interpret innovation performance in Central and Eastern Europe (CEE). Regional cooperation, institutional support, implementation of innovation policy, positive attitude towards competitors, and the implication of international partners embedded in the region in the innovation process showed a high degree of association with innovation. Additionally, various configurations of conditions highlighted many paths to achieve innovativeness by combining endogenous and exogenous parameters. This leads to the conclusion that the outcome's equifinality depends on the regional context and circumstantiality of conjunction between local and global forces.

Keywords

regional development • innovation • regional innovation system • global production network • institutions • network • regional mindset • value chains

1. Introduction

The modern economic development paradigm relies heavily on the application and commercialisation of innovations. From leading multinational corporations (MNCs) to small and medium enterprises (SMEs), economic agents engage in innovation activities to sustain their competitiveness. Therefore, harnessing innovation has become a focal interest for many actors. European Union (EU) sees it as a primary tool for reaching strategic goals and achieving sustainable social development (European Union n.d.).

However, the situation is not as straightforward. Among the EU members, the developmental gap is acknowledged as an essential issue and obstacle to development. It is especially true when comparing Central and Eastern Europe (CEE) with Western and Northern members. Among the CEE countries, only two regions can be considered innovative leaders (European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs 2021a). And even among these, the development is uneven. Given various transition paths, institutional performance, sectoral differences and internal regional interactions (Isaksen 2001; Tödtling and Trippl 2005; Radosevic 2002), the sub-national regions of CEE represent a vast pool of innovation systems.

Emerging as new market economies after the 1990s, many of these regions considered fast integration into the global economy as a strategy for development (Gereffi 2014; Ernst 2002; Ernst and Kim 2001). This factor created additional opportunities associated with technology and knowledge transfer, learning and adoption skills (Giuliani, Pietrobelli, and Rabellotti 2005; Pietrobelli and Rabellotti 2011) and required constant bargaining and negotiations (Gereffi 2001; Dicken 2005). Therefore, it is to acknowledge another set of parameters in the CEE regional innovation.

Combining internal particularities and external conditions creates an avalanche of developmental possibilities. Therefore,

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the question emerges of what practices were the most useful. And among all the cases, what were the best strategies to follow? What constitutes an efficient innovation process in CEE, and what parameters can be universally applied? To answer these questions, the research will follow the first Research Question (RQ):

RQ1: *What endogenous and exogenous factors contribute to innovation performance in CEE regions?*

However, observing the impact of separate forces might not be conclusive. Sometimes accumulation of several factors is crucial in creating an adequate environment for innovation (e.g., Pietrobelli and Rabellotti 2011). It is especially true in the context of CEE, with its vast pool of regions and unique developmental paths. Various combinations of regional and extra-regional phenomena can have parallel yet similar effects. Therefore, the article's second aim is to understand what forces complement each other and empower innovation (RQ2).

RQ2: *What combinations of endogenous and exogenous forces contribute to regional development and innovation?*

Identifying the paths to innovation is imperative to solving the developmental gap in the EU. As such, it will reveal the practices to focus on in formulating new public policy and strengthening existing strategies. Moreover, it can help understand the CEE dynamics exclusively. Researching innovation conditions specific to the area should discourage local governments from copy-pasting 'western practices' and focusing more on the solutions that fit their context.

2. Theoretical Background

Concerning the sub-national and regional levels of analysis, the innovation process is thought to result from local cooperation and engagement. The Regional Innovation System (RIS) approach highlights the importance of voluntary interactions (social and economic), joint ventures and support forces as its main mechanisms (Asheim, Smith, and Oughton 2011; Doloreux and Porto Gomez 2017). When actors engage in a collaborative activity, it creates conditions for 'learning by interaction' (Cooke 1992). Learning builds up competencies that companies can further utilise in their activities. These are means to strengthen their absorptive capacity, contributing to the implementation of innovation (Kallio, Harmaakorpi, and Pihkala 2010; Tödtling and Trippl 2018). Knowledge and information are critical in this matter (Cooke 2003; Asheim and Coenen 2006; Asheim et al. 2005). Through their diffusion, enterprises gain innovative possibilities and replace old technology (Arieli et al. 2020). Moreover, depending on knowledge's practical and scientific utilisation, it can contribute to various learning and innovation patterns (Asheim et al. 2005).

Knowledge and learning are the backbones of innovation activities, so a network is the 'locus for innovation' (Spender et al. 2017; Radosevic 2002). It acts as a platform for knowledge and information sharing. Depending on its particularities (structure and links), shared knowledge's speed, degree and volume vary (Burt 2000; Wani and Ali 2015).

The importance of network characteristics and strength of ties has long been a parameter in the socio-economic field (Granovetter 1973, 1985). Therefore, dense connections and strong ties enable deeper embeddedness. With it, a firm's boundaries become 'porous' (Chesbrough 2003), leading to more interaction, learning and distribution of knowledge into the network. Therefore, the structure and connectivity in a network can shape (and are shaped) by the processual innovation activities. Stuck, Broekel and Revilla Diez (2014) considered network aspects in articulating RIS typology. According to them, the innovation practices are related to collaboration architecture and partnership preferences. Therefore, it allows us to formulate the first hypothesis:

H1: *The network and networking parameters are directly associated with innovation performance.*

Besides the interaction dimension, the RIS paradigm considers the available assistance and innovation-facilitating institutions. The theory differentiates them as the Support Subsystem (Tödtling and Trippl 2005; Coenen, Moodysson, and Asheim 2004; Asheim and Isaksen 1997), whose main purpose is to create an efficient environment for innovation (Isaksen 2001). Their activity[1] should be focused on enhancing the potential of private actors (or the Production Subsystem), contributing new knowledge and its diffusion (Besednjak Valič, Kolar, and Lamut 2021). In some regions, support organisations guide innovation activities (Institutional RIS, Cooke 2003; Asheim et al. 2005; Zukauskaite 2018). Their ability to concentrate, mobilise and channel resources shapes interaction patterns and defines the innovation system. As institutional RIS is prevalent in Europe (Cooke 2003), and considering the importance of institutions in the innovation process, some scholars entertained the thought that RIS is a result of good planning and execution. Ergo, a debate emerged on interpreting the innovation system as a well-formulated and implemented public policy (Uyarra and Flanagan 2010; Asheim and Isaksen 1997; Tödtling and Trippl 2005).

1 These are defined by the functionality and services provided by specialized institutions and organisations.

Although any policy is rarely sufficient to be the sole driver of a RIS, its impact on any innovation system should not be undermined. One of the practices in the policy formulation in CEE was the creation of networking and fostering interaction (Radosevic 2002), indicating that it also facilitates networking externalities. Therefore, support organisations' engagement in technology transfer, business tutoring and ever-growing area of influence (e.g., universities, Audretsch 2014) must not be overlooked in explaining the innovation process. This leads to the second hypothesis:

H2: *The efficiency (as being receptive and creating a favourable environment) of the institutional framework is directly proportional to a region's innovation performance.*

When discussing the network externalities and support factors, many academics touch on the issue of cultural and moral norms. It can take the form of social capital in a network structure, as means to generate entrepreneurial benefits (e.g., Burt 2000), or as a parameter in the institutional framework (e.g., Zukauskaite 2018). This attention comes from the role that regional mindset plays regarding the other two aspects. Shared norms, visions, problems and attitudes are important factors for developing collaboration (Boschma 2005; Bland et al. 2010). Social, cultural and institutional proximities contribute to easier contact and reduce collaboration costs. By 'smoothing' the interaction, it empowers the network learning abilities and therefore contributes to the innovation process (Lin and McDonough 2014).

The second argument to consider is an agent's perception and individual abilities reflected as mental potential. This approach can be traced back to Schumpeter's vision of entrepreneurship (Schumpeter 1983 [1934]; Śledzik 2013). In his first work on innovation, he described the entrepreneur as the actor of development. Through personal traits, he implements innovation and causes Creative Destruction. This is now known as the Mark I model of innovation (Croitoru 2012), which implies introducing new technology through establishing start-ups and continuous new entries.

Given its importance, some scientific works capture cognitive frames as a separate parameter to explain innovation (Modic and Rončević 2018; Cepoi and Golob 2017). Acting as both network and agent characteristics, the mindset contributes to implementing different innovation practices and enables innovation ambidexterity[2] (Lin and McDonough 2014). Consequently, the research considers the third hypothesis:

H3: *An enabling mindset (open and entrepreneurial) positively influences innovation performance.*

2 The ability to engage in knowledge and technology exploration and exploitation simultaneously.

With the liberalisation and globalisation of the economy, endogenous factors explain only a part of the developmental opportunities available to regions. The integration into modular production chains, and their embeddedness in a regional context, brings additional possibilities for value creation, capture and enhancement (Henderson et al. 2002; Yeung and Coe 2015; Coe, Dicken, and Hess 2008). These Transnational Value Chains (TVCs) permeate multiple cultural and institutional frameworks, linking various RIS on a global scale (Dicken 2005). Maintaining such connections is important for avoiding 'locked-in' innovation systems (Tödtling and Trippl 2005). The cooperation with TVC ambassadors in regions diversifies the knowledge pool (Bathelt, Malmberg, and Maskell 2004; Martin and Moodysson 2013). In some cases, the TVC representatives become leading actors in the regional network, manifesting control over innovation cooperation and practices (Stuck, Broekel, and Revilla Diez 2014). Therefore, they dictate the innovation vector and the network composition (e.g., local sector and group) to benefit from their information.

Integrating into modular production triggers technology, knowledge and skills transfer, enhancing local learning (Pietrobelli and Rabellotti 2011; Giuliani, Pietrobelli, and Rabellotti 2005). As the relationship progresses, the volume, sophistication and quality of knowledge passing to the region increases, offering further development paths for local RIS (Ernst 2002, 2009). Therefore, TVCs' adaptation into a regional framework contributes not only as a source of new knowledge but also as pressure and motivation to gradually improve absorptive capacity. Depending on the regional production competencies, the ability of regions to satisfy the demand of production networks, and the governance system within the TVC, regions can develop different models of 'upgrading' and value capture (Gereffi 2014; Ernst 2002). This process is associated with continuous bargaining between the TVC leaders and regional stakeholders. As such, the embeddedness conditions and the position in the production process will create different innovation possibilities. Hence, the fourth hypothesis:

H4: *The embeddedness conditions of TVC in a regional context can determine regional innovation performance.*

Endogenous and exogenous factors amplify regional conditions contributing to innovation. Yet, many of these parameters act simultaneously, making it difficult to observe any individual impact. Different contextual combinations create distinct parameters and offer divergent opportunities to regional stakeholders. In such a case, the analysis cannot end with testing the aforementioned hypotheses, as it has to

consider an inclusive model where the same outcome can be achieved through different paths.

3. Research Design and Methodology

To analyse the impact of endogenous and exogenous forces on innovation performance in CEE, the research will consider eight regions. The sample includes Continental Croatia (Croatia), Goriska (Slovenia), Moravia-Silesia (Czech Republic), Nord (Republic of Moldova), Sofia (Bulgaria), Zakarpattya (Ukraine), Cluj and Timis (Romania). As the goal is to see general patterns of the innovation process, this sample offers the necessary diversity. It represents a wide spectre from peripheric regions (e.g., Zakarpattya, Nord), semi-periphery (e.g., Timis) to central, capital administrative units (e.g., Sofia). Moreover, most of these regions have dissimilar national contexts, which excludes the observation bias on this level.

Given the small number of cases and the intent to answer the second research question (RQ2), building a statistical model is unsuitable for the study. Therefore, the research design considers Qualitative Comparative Analysis (QCA) (Ragin 2008, 2014). QCA allows the evaluation of the association between variables (the outcome and conditions leading to it) based on a set relationship. It is not as competent to offer generalisations as statistic regression (Seawright 2005), but the asymmetric approach offers the possibility to establish equifinality of the outcome (Wagemann and Schneider 2010) based on Boolean logic (AND, OR, NOT). The QCA operates on identifying Sufficient (when a condition is a subset of the outcome) and Necessary (when the outcome is a subset of a condition) associations with the outcome.

The data for the analysis was collected through the Jean Monnet Centre of Excellence, entitled 'Technology and Innovations in Regional Development for Europe 2020 (TIR2020)[3]'. The methodology included expert focus groups in each region with respondents from the triple helix – representatives of leading regional industries, support organisations and academia. The questionnaire for the focus groups (Annex 1) comprises 20 questions in five blocks (Innovation Process, Institutional Parameters, Network Parameters, Cognitive Parameters, and Value Chain Parameters). The first question, measuring the regional innovation performance, is set as the outcome, and the rest are considered conditions. Therefore, to test the formulated hypotheses, the network, institutional, cognitive and value chain factors will be represented by four variables each (Table 1).

Table 1. Questionnarie variables

Block	Conditions	Indicators (corresponds to Questions in Annex 1)
Innovation process (control conditions)	*Information*	Information quality and disseminations means (Q2)
	R.D	Engagement of the regional private sector in R&D activities (Q3)
	OI	Open Innovation practices (Q4)
Institutional parameters	*InstSupp*	Quality of Institutional support (Q5)
	Attract	Capacity to attract talented people (Q6)
	Retain	Capacity to retain talented people (Q7)
	InnoPolicy	Impact of Innovation Policy (Q8)
Network parameters	*Network*	Network structure/connectivity (Q9)
	RegCoop	Degree of cooperation between regional stakeholders (Q10)
	ExtCoop	Degree of cooperation between regional and stakeholders outside the region (Q11)
	Trust	Manifestation of regional trust (Q12)
Cognitive parameters	*Entrepreneurship*	Openness to entrepreneurship (Q13)
	Learning	Practices of lifelong learning (Q14)
	Competition	Attitude towards competition (Q15)
	Globalisation	Attitude towards globalisation (Q16)
Value chains parameters	*TVCembed*	Degree of embeddedness of TVC partners in regional processes (Q17)
	tvcTIER	The role in modular global production (Q18)
	tvcR.D	TVC's engagement in the local innovation process and R&D (Q19)
	tvcEconom	Dependence on economic exchange with TVC partners (Q20)

R&D, Research and Development; TVC, transnational value chain.

Each question offered four labels describing a possible regional scenario (Annex 1). Respondents had to unanimously agree on one score that best describes the region. Besides offering additional validity,[4] these scores were selected based on qualitative deliberation, making them fit into the selected methodological design.

The data collection ended with a database of ordinal scores (1–4). Therefore, the research will rely on the fuzzy-set QCA (fsQCA) that can accommodate a non-binary variation. The fsQCA assesses set relationship based on threshold

3 Jean Monnet Center of Excellence, Technology and Innovations in Regional Development for Europe 2020 (TIR2020), Co-funded by the Erasmus+ programme of the European Union, Key Action: Cooperation for innovation and the exchange of good practices, Action Type: Knowledge Alliances for higher education, Project Reference: 587540-EPP-1-2017-1-SI-EPPJMO-CoE. More information available at https://www.tir2020.net/

4 When all the respondents agreed on a score easily, it indicated that the label describes the regional situation adequately. On the contrary, when a debate emerged, it put respondents' opinions against each other, which decreased the impact of personal or professional bias.

Table 2. fsQCA indicators

	Consistency	Coverage
Sufficiency	$\frac{Sum\ of\ (minimal)\ values\ of\ O \times C}{Sum\ of\ values\ of\ C}$	$\frac{Sum\ of\ (minimal)\ values\ of\ O \times C}{Sum\ of\ values\ of\ O}$
Necessity	$\frac{Sum\ of\ (minimal)\ values\ of\ O \times C}{Sum\ of\ values\ of\ O}$	$\frac{Sum\ of\ (minimal)\ values\ of\ O \times C}{Sum\ of\ values\ of\ C}$

fsQCA, fuzzy-set QCA.

comparison (Seawright 2005) after calibration – i.e., determination of set membership (Ragin 2008). The lowest score is associated to non-membership (calibration value 0), and a score of 4 represents full membership (calibration value 1). The mid scores indicate a position of 'more out than in' (score 2, calibration value 0.33) and 'more in than out' (score 3, calibration value 0.67).

To determine sufficient and necessary conditions, the QCA methodology relies on the indicators of Consistency/Inclusion (strength of a relationship) and Coverage (importance of a relationship). In fsQCA, both operate on the premise of calibration variation between the outcome and the condition (Table 2). Auxiliary parameters include Relevance of Necessity (RoN) as indicators of the irrelevance of a condition or combination of conditions. For example, it has low values when a condition is constant (or close to it) and thus unimportant in the analysis (Ragin 2008; Mattke et al. 2022). Further, Proportional Reduction of Inconsistency (PRI) indicates the degree to which a condition is associated with the outcome and its negation (Mattke et al. 2022). This is important to consider by comparing the PRI between cases to understand which has a better (meaningful) relationship.

Given the low number of observations and a vast number of variables in the analysis, the research will deviate from the suggested thresholds of sufficiency and necessity (Mattke et al. 2022). The benchmark is selected based on the sample context. For necessity, the validation criteria are set to accommodate one divergent case out of eight possible (inclusion, consistency and RoN, at 0.875). For sufficiency, the consistency threshold (that validates the empirical evidence of a condition) is set at the same value. However, sufficient conditions require less coverage, based on the possibility of having multiple conditions leading to the outcome. Consequently, the analysis will consider 0.5 as a validation point (4 out of 8 cases). This can be enough to suggest that a condition has a meaningful impact on CEE and should be considered in future policy.

4. Research Results and Discussion

The fsQCA methodology operates on the premise of the association of variables and the alignment of calibrated values. It neither provides proof of a relationship nor indicates the vector of interdependency. The strength of QCA comes through the possibility of validating certain individual conditions and combinations of conditions through empirical examples and theoretical models. Therefore, the associations (especially cases that include conjunction and disjunction of different conditions) will be critically examined through a logical and theoretical lens.

The analysis revealed several sufficient conditions that met the necessary thresholds (Table 3). Among control conditions, *R.D* and *OI* showed high inclusion and coverage. Their association with innovation indicates that the degree of regional research and development (R&D) engagement and the adherence to Open Innovation practices is a good way to describe the innovation process, even in CEE. Most numerous are institutional conditions. Institutional support (*InstSupp*), capacity to retain talented people (*Retain*) and the implementation of regional innovation policy (*InnoPolicy*) showed high covariation with innovation output. A possible interpretation of this finding can be the prevalence of Institutional RIS (Cooke 2003; Asheim et al. 2005) in the CEE macro-region. Even in a system where the private sector determines the innovation conditions, the supportive public framework can contribute to institutionalising good practices. The capacity to retain people can be interpreted from the perspective of the brain drain and depopulation crisis in the area. Therefore, the association with innovation can come from the fact that people settle and stay in regions with good living and economic conditions, which usually result from good innovation and competitive performance. Another important factor is considering the human resources associated with educated personnel, which is also a part of the European Innovation Scoreboard (Bielińska-Dusza and Hamerska 2021; European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs 2021b).

Regional cooperation (*RegCoop*) is the only sufficient condition from the networking parameters. Its importance fits well with the argumentation provided in the theoretical chapter. By enhancing 'learning by interacting' and knowledge dissemination (Cooke 2003), cooperation leads to new combinations within the network. In the case of regional mindset, *Competition* is the sole condition that meets the threshold. A good attitude toward competitors can be a factor of collaboration, indirectly influencing innovation performance. Its importance might be perceived in the context of adverse

Table 3. Individual sufficient and necessary conditions

	Sufficiency			Necessity		
Condition	**inclS**	**covS**	**PRI**	**inclN**	**covN**	**RoN**
Information	0.813	0.929	0.625	0.929	0.813	0.727
R.D	0.917	0.786	0.800	0.786	0.917	0.923
OI	1.000	0.643	1.000	0.643	1.000	1.000
InstSupp	0.929	0.929	0.833	0.929	0.929	0.909
Attract	0.800	0.857	0.571	0.857	0.800	0.750
Retain	1.000	0.786	1.000	0.786	1.000	1.000
InnoPolicy	1.000	0.857	1.000	0.857	1.000	1.000
Network	0.846	0.786	0.600	0.786	0.846	0.846
RegCoop	1.000	0.929	1.000	0.929	1.000	1.000
ExtCoop	0.800	0.857	0.571	0.857	0.800	0.750
Trust	0.867	0.929	0.714	0.929	0.867	0.818
Entrepreneurship	0.800	0.857	0.571	0.857	0.800	0.750
Learning	0.632	0.857	0.364	0.857	0.632	0.417
Competition	1.000	0.786	1.000	0.786	1.000	1.000
Globalisation	0.765	0.929	0.556	0.929	0.765	0.636
TVCembed	0.813	0.929	0.625	0.929	0.813	0.727
tvcTIER	0.867	0.929	0.714	0.929	0.867	0.818
tvcR.D	0.909	0.714	0.750	0.714	0.909	0.929
tvcEconom	0.765	0.929	0.556	0.929	0.765	0.636

PRI, proportional reduction of inconsistency; RoN, relevance of necessity; TVC, transnational value chain.

effects when hostile sentiment jeopardises the creation of new links and cooperation patterns or impedes imitation and adoption (Anderson and Semadeni 2015). The same is true for the degree of *Trust,* which indicated high inclusion and coverage, very close to the selected benchmark. Finally, among the TVC parameters, *tvcR.D* is the only sufficient condition. The implication of TVCs in the regional innovation process is one of the preconditions mentioned in the Global Production Networks theory (GPN, Ernst 2009; Ernst and Kim 2001; Henderson et al. 2002; Coe, Dicken, and Hess 2008). Its inclusion and coverage scores are slightly lower than the *R.D* condition, raising the question of whether the regional R&D in CEE is guided by the influence of the value chain integration. Their intent to capitalise not only from production means but also innovation potential (Ernst 2009) creates additional opportunities to accommodate and finance local R&D and support other innovation activities. The regional production competence (*tvcTIER*) is very close to the set values, which supports this claim. As the production sophistication grows, it increases the attention of the MNCs (Breul and Revilla Diez 2018) and the innovation involvement with it.

In the case of necessity, the list is significantly shorter. Only two conditions met the qualification parameters. Regional cooperation (*RegCoop*) and institutional support (*InstSupp*) are both sufficient and necessary conditions and are both crucial aspects of the RIS framework. Showing both super and sub-set relationships indicates a high covariation with the outcome. Such a development enforces the conclusion of the importance of the RIS framework, not only in Western and Northern Europe (e.g., the case of Wales and Norway, in Cooke 1992; Asheim and Isaksen 1997) but also its viability in its developing part.

To assess the equifinality of multiple conditions, QCA methodology consists of three possible combinations: 'AND/*' (conjunction of two sets), 'OR/+' (disjunction of two sets) and 'NOT/~' (inversion of the set value) (Ragin 2008; Duşa n.d.). Each indicates a Boolean algebra operation to set merging and combinations. In fs QCA, AND selects the minimal value out of the presented conditions, OR considers the highest value, and NOT indicates a reversed score (1-condition). In this context, the number of possible outcomes rises gradually. To avoid redundancy, QCA performs a minimisation process, selecting only the conditions that have a meaningful (logical) impact and omitting redundant conditions. However, the possibility of combining multiple conditions creates new boundaries for error. The distribution of values for analysing and selecting particular scores among a group of conditions creates a premise to see false associations. These cases will be considered a calculation excess and explained in the context of the analysis. The results for combinations that met the validation threshold are presented in Table 4. Some of them replicate the findings of previous analyses (Table 3), such as the importance of *RegCoop*, *InstSupp*, *InnoPolicy*, *Competition*, *Retain, R.D* and *OI.* The *tvcTIER* can no longer be considered sufficient alone, indicating that it has a stronger impact when coupled with other conditions.

Some results are to be considered a calculation excess based on the reversion of scores. When a score is low, after the reversion and conjunction, it can meet the inclusion and coverage marks. Cases 1, 8, 10, 11, 15, 18, 19, 21 and 22 (Table 4) pose doubts about their logical and theoretical relevance. For example, a shortage of information flow in the region (~*Information*) contradicts the RIS approach and other empirical observations (e.g., Bathelt, Malmberg, and Maskell 2004). Similarly, a region with an absent external collaboration (~*ExtCoop*) leads to a 'locked-in' situation (Tödtling and Trippl 2005), which is an antipode of high innovation potential. Therefore, these cases present limited explanatory potential and will be omitted from consideration.

Some cases can consider a negation. For example, *Trust* '~*tvcR.*D and ~*R.D*' *Trust* conditions might indicate a general pattern in the CEE. Suppose the local innovation system is not supported by the TVC anchors and does not rely on R&D. In that case, a substitute can be found in building regional trust and enhancing cooperation (e.g., switching to empower local clusters). In this regard, other conditions (13, 20, 23, 24 and 26) support this conclusion. Trust is presented as an important

Table 4. Combination of conditions. Sufficiency

No.	Sufficient combinations	inclS	covS	PRI
1	*~Information*	1.000	0.571	1.000
2	*R.D*	0.917	0.786	0.800
3	*OI*	1.000	0.643	1.000
4	*InstSupp*	0.929	0.929	0.833
5	*Retain*	1.000	0.786	1.000
6	*InnoPolicy*	1.000	0.857	1.000
7	*RegCoop*	1.000	0.929	1.000
8	*~ExtCoop*	1.000	0.643	1.000
9	*Competition*	1.000	0.786	1.000
10	*~Globalisation*	1.000	0.500	1.000
11	*~TVCembed*	1.000	0.571	1.000
12	*Information × Attract*	0.923	0.857	0.800
13	*Information × Trust*	0.923	0.857	0.800
14	*~R.D × Trust*	1.000	0.571	1.000
15	*~OI × Trust*	1.000	0.786	1.000
16	*Attract × Network*	1.000	0.714	1.000
17	*Attract × Entrepreneurship*	1.000	0.857	1.000
18	*~Retain × Trust*	1.000	0.714	1.000
19	*~InnoPolicy × Trust*	1.000	0.714	1.000
20	*Network × Trust*	1.000	0.714	1.000
21	*~RegCoop × Trust*	1.000	0.643	1.000
22	*Trust × ~Competition*	1.000	0.786	1.000
23	*Trust × TVCembed*	1.000	0.929	1.000
24	*Trust × tvcTIER*	0.929	0.929	0.833
25	*Trust × ~tvcR.D*	1.000	0.643	1.000
26	*Trust × tvcEconom*	0.929	0.929	0.833
27	*Entrepreneurship × Globalisation*	0.923	0.857	0.800
28	*Entrepreneurship × tvcEconom*	1.000	0.786	1.000
29	*TVCembed × tvcTIER*	0.929	0.929	0.833
30	*tvcTIER × tvcEconom*	0.929	0.929	0.833

PRI, proportional reduction of inconsistency; TVC, transnational value chain.

parameter in activating innovation processes. It combines with endogenous and exogenous forces to activate or boost the impact these have on innovation. *Network*‘ *Trust* is basically synonymous with regional cooperation, highlighting the same finding again. In the context of TVC factors, it seems that an embedded TVC becomes a part of local interaction when there is trust (especially in cases of higher production modulation). Therefore, both scenarios lead to knowledge diffusion (*Information* ’*Trust*). It can also be stipulated that the best possible way to benefit from information sharing is to build a trustworthy regional environment.

The entrepreneurial mindset seems to thrive when coupled with exogenous conditions (17, 27, 28). When R&D is unavailable, local clustering and reliance on the Mark I innovation model (Croitoru 2012) lead to innovation. A possible conclusion in this scenario is that pushing regional start-ups to supply global demand opens additional perspectives for them and gives them ‘space’ for growth. The TVCs consider the importance of regional innovation, and new entries capitalise on regional knowledge (Audretsch, Grilo, and Thurik 2011). Therefore, the innovation system benefits TVCs, and, in return, the local stakeholders gain more value capture.

The attraction of talented people covariates with innovativeness in regions with a high entrepreneurial spirit, a good network and information-sharing conditions. By opening new businesses, sharing information that was not in the region and integrating into the local network, they contribute to innovation. Similar to *Retain,* this relationship might be indicative of people moving to regions with better socio-economic conditions, where they exploit their talents.

The combination of exogenous factors among themselves (*TVCembed* ‘*tvcTIER* and *tvcTIER*’ *tvcEconom*) suggests the importance of the governance positioning within TVC for the innovation process. Depending on the production role, regional stakeholders can feel the pressure to innovate that comes from their collaboration with TVC partners. For higher-tier regions, it is through more robust collaboration with the flagships (Ernst 2002). For lower, the increase in demand and production relationships. In either case, strengthening these connections validates the TVC learning argument (Pietrobelli and Rabellotti 2011) and the GPN framework. This can also indicate paths to upgrading (Gereffi 2014), whereas strengthening relational and economic ties with the TVCs leads to increasing production sophistication and moving to higher manufacturing modules.

Concerning the necessary conditions, 86 combinations passed the validation threshold (Table 5). Many of these conditions can be considered a ‘calculation relationship’ rather than real associations. Multiple observations contain negated outcomes which raise doubt about their validity. Especially disjunction of sets acts as means to have numerous combinations that fit the threshold but are not relevant empirically. Therefore, the analysis will consider a joint interpretation of conditions indicating the same conclusions.

Some important observations can be drawn for the RIS approach in CEE. First, the combination *Information* ‘*RegCoop* reinforces the argument that interactions contribute to knowledge circulation. Moreover, it suggests other practical conclusions, such that the cooperation should target information sharing and that any policy focusing on knowledge generation should also encourage its utilisation (Audretsch, Grilo, and Thurik 2011). The combination *InstSupp*’ *Trust* suggests a precondition for an efficient support subsystem. Considering RIS in developed countries, this precondition might be easily overlooked, given their high degree of general trust. In CEE, however, national institutions face a trust deficit (Eurofound 2018). Therefore, organisations should be

Table 5. Combination of conditions. Necessity

N	Necessary combinations	incIN	covN	RoN	N	Necessary combinations	incIN	covN	RoN
1	*InstSupp*	0.929	0.929	0.909	44	*Retain + ~Network*	0.929	0.929	0.909
2	*RegCoop*	0.929	1.000	1.000	45	*Retain + ~ExtCoop*	0.929	1.000	1.000
3	*Information × RegCoop*	0.929	1.000	1.000	46	*Retain + ~Entrepreneurship*	1.000	0.933	0.900
4	*InstSupp × Trust*	0.929	0.929	0.909	47	*Retain + ~Learning*	0.929	1.000	1.000
5	*InstSupp × TVCembed*	0.929	1.000	1.000	48	*Retain + ~Globalisation*	0.929	1.000	1.000
6	*InstSupp × tvcTIER*	0.929	1.000	1.000	49	*Retain + tvcR.D*	0.929	0.929	0.909
7	*InstSupp × tvcEconom*	0.929	1.000	1.000	50	*InnoPolicy + ~Network*	1.000	0.933	0.900
8	*Trust × TVCembed*	0.929	1.000	1.000	51	*InnoPolicy + ~ExtCoop*	0.929	1.000	1.000
9	*Trust × tvcTIER*	0.929	0.929	0.909	52	*InnoPolicy + ~Entrepreneurship*	0.929	0.929	0.909
10	*Trust × tvcEconom*	0.929	0.929	0.909	53	*InnoPolicy + ~Learning*	0.929	1.000	1.000
11	*TVCembed × tvcTIER*	0.929	0.929	0.909	54	*~Network + Competition*	0.929	0.929	0.909
12	*tvcTIER × tvcEconom*	0.929	0.929	0.909	55	*~Entrepreneurship + Competition*	0.929	0.929	0.909
13	*InstSupp × Trust × TVCembed*	0.929	1.000	1.000	56	*~Learning + Competition*	0.929	1.000	1.000
14	*InstSupp × Trust × tvcTIER*	0.929	1.000	1.000	57	*~Information + R.D + ~Learning*	0.929	0.929	0.909
15	*InstSupp × Trust × tvcEconom*	0.929	1.000	1.000	58	*~Information + OI + tvcR.D*	0.929	0.929	0.909
16	*InstSupp × TVCembed × tvcTIER*	0.929	1.000	1.000	59	*~Information + Competition + ~Globalisation*	0.929	1.000	1.000
17	*InstSupp × TVCembed × tvcEconom*	0.929	1.000	1.000	60	*~Information + Competition + tvcR.D*	0.929	0.929	0.909
18	*InstSupp × tvcTIER × tvcEconom*	0.929	1.000	1.000	61	*~Information + ~TVCembed + tvcR.D*	0.929	0.929	0.909
19	*Trust × TVCembed × tvcTIER*	0.929	1.000	1.000	62	*R.D + ~ExtCoop + ~Learning*	0.929	0.929	0.909
20	*Trust × TVCembed × tvcEconom*	0.929	1.000	1.000	63	*OI + ~Network + ~ExtCoop*	0.929	0.929	0.909
21	*Trust × tvcTIER × tvcEconom*	0.929	0.929	0.909	64	*OI + ~Network + ~TVCembed*	0.929	0.929	0.909
22	*TVCembed × tvcTIER × tvcEconom*	0.929	1.000	1.000	65	*OI + ~Network + ~tvcTIER*	0.929	0.929	0.909
23	*InstSupp × Trust × TVCembed × tvcTIER*	0.929	1.000	1.000	66	*OI + ~ExtCoop + ~TVCembed*	0.929	1.000	1.000
24	*InstSupp × Trust × TVCembed × tvcEconom*	0.929	1.000	1.000	67	*OI + ~ExtCoop + ~tvcTIER*	0.929	0.929	0.909
25	*InstSupp × Trust × tvcTIER × tvcEconom*	0.929	1.000	1.000	68	*OI + ~ExtCoop + tvcR.D*	0.929	0.929	0.909
26	*InstSupp × TVCembed × tvcTIER × tvcEconom*	0.929	1.000	1.000	69	*OI + ~ExtCoop + ~tvcEconom*	0.929	0.929	0.909
27	*Trust × TVCembed × tvcTIER × tvcEconom*	0.929	1.000	1.000	70	*OI + ~TVCembed + tvcR.D*	0.929	0.929	0.909
28	*InstSupp × Trust × TVCembed × tvcTIER × tvcEconom*	0.929	1.000	1.000	71	*~Network + ~ExtCoop + ~Entrepreneurship*	0.929	0.929	0.909
29	*~Information + Retain*	0.929	1.000	1.000	72	*~Network + ~ExtCoop + ~Learning*	0.929	0.929	0.909
30	*~Information + InnoPolicy*	0.929	1.000	1.000	73	*~Network + ~ExtCoop + ~Globalisation*	0.929	0.929	0.909
31	*R.D + OI*	0.929	0.929	0.909	74	*~Network + ~ExtCoop + ~TVCembed*	0.929	0.929	0.909
32	*R.D + InnoPolicy*	1.000	0.933	0.900	75	*~Network + ~ExtCoop + ~tvcTIER*	0.929	0.929	0.909
33	*R.D + Competition*	0.929	0.929	0.909	76	*~Network + ~Entrepreneurship + ~TVCembed*	0.929	0.929	0.909
34	*R.D + ~Globalisation*	0.929	0.929	0.909	77	*~Network + ~Entrepreneurship + ~tvcTIER*	0.929	0.929	0.909
35	*R.D + ~TVCembed*	0.929	0.929	0.909	78	*~Network + ~Learning + ~TVCembed*	0.929	0.929	0.909
36	*R.D + tvcR.D*	0.929	0.929	0.909	79	*~Network + ~Learning + ~tvcTIER*	0.929	0.929	0.909
37	*OI + Retain*	0.929	1.000	1.000	80	*~Network + ~Globalisation + ~TVCembed*	0.929	0.929	0.909
38	*OI + InnoPolicy*	0.929	1.000	1.000	81	*~Network + ~Globalisation + ~tvcTIER*	0.929	0.929	0.909
39	*OI + Competition*	0.929	1.000	1.000	82	*~ExtCoop + Competition + ~Globalisation*	0.929	1.000	1.000
40	*~Attract + Retain*	1.000	0.933	0.900	83	*~ExtCoop + Competition + tvcR.D*	0.929	0.929	0.909
41	*~Attract + InnoPolicy*	0.929	0.929	0.909	84	*~ExtCoop + ~TVCembed + tvcR.D*	0.929	0.929	0.909
42	*~Attract + Competition*	0.929	0.929	0.909	85	*~Learning + ~TVCembed + tvcR.D*	0.929	0.929	0.909
43	*Retain + InnoPolicy*	0.929	1.000	1.000	86	*OI + ~Learning + ~Globalisation + tvcR.D*	0.929	0.929	0.909

RoN, relevance of necessity; TVC, transnational value chain.

investing in their image to efficiently implement decisions and mobilise stakeholders.

The necessity configurations also confirm some previous conclusions. This is related to the importance of R&D in the CEE area. The *R.D+tvcR.D* combination acts as proof that the implication of TVC anchors supports regional R&D. This replicates the interest of production chains to build their Global Innovation Networks, in which Easter European counties are gradually integrated (Ernst 2009).

Several groups of combinations (5–10, 13–28) represent a conjunction of endogenous and exogenous conditions. *InstSupp*, *Trust*, *tvcEconom*, *tvcTIER,* and *tvcEmbed* create different configurations highly associated with innovation. This proves that endogenous and exogenous factors complement each other rather than acting in parallel. On a conceptual level, it can represent the validation of GPN theory (Ernst 2002; Yeung and Coe 2015; Henderson et al. 2002, etc.). Its argument supports various interaction patterns, leading to distinct outcomes on a regional level. The equifinality of so many combinations might indicate the circumstantiality of any systemic innovation. The bargaining potential of institutions and local and global factors determine how these forces will interact. The interest from the TVC, regional competencies, the ability of regional institutions to accommodate TVCs and create preferential conditions, the degree to which supply chain anchors are embedded in a regional context, and the economic and innovation reliance (of TVCs) on regional production will shape the regional innovation process (Yeung and Coe 2015; Rainnie, Herod, and McGrath-Champ 2011; Nilsen 2019). This can also explain why most TVC factors were not considered sufficient or necessary individually. Their impact comes from interacting with local conditions, either leading them or creating various symbiotic relationships (Stuck, Broekel, and Revilla Diez 2014).

The disjunction (OR) configurations will not be considered, given the risk of redundant association. These cases resemble a mathematical excess of the fsQCA, which was triggered by a small number of observed regions and a big number of conditions (Mattke et al. 2022).

5. Conclusion

Regional innovation represents a very complex concept that shows distinctive parameters in different types of regions based on their internal and historical background (Radosevic 2002; Tödtling and Trippl 2005). The research sought to see developmental patterns in CEE by testing the impact of network configuration (H1), institutional framework (H2), regional mindset (H3) and influence for integration into global value chains (H4) on innovation performance. Additionally, the study identified various combinations of parameters that are associated with innovation in the European macro-region.

The fsQCA analysis partially confirmed all the initial assumptions. Regional cooperation, the potential of support institutions and the efficiency of innovation policy create the basis to consider the first two hypotheses and act in defence of the RIS approach. The results also confirmed that enabling mindset, associated with a positive attitude to local competition and a trustworthy environment, contributes to developing innovative practices. Similarly, the implication of TVC partners in local R&D and innovation can help understand the regional potential.

The study also found that it might be wrong to consider endogenous and exogenous conditions separately. These are compatible and circumstantial to local predetermined factors. Their impact is conjunctive, and the (unique) combinations that emerge in regional contexts create (unique) regional innovation pressures, conditions and opportunities.

In theoretical terms, research provides additional validation of RIS and GPN theories. The regional cooperation and institutional framework are the only sufficient and necessary conditions in the analysis. Their strong association with innovation suggests that regional stakeholders in CEE consider this model. The range of configuration with regional and global factors should urge local authorities to also analyse the global context and enhance their bargaining potential (Coe et al. 2004). Another practical implication is that regions should search to increase the degree of general and institutional trust. It was part of multiple configurations, including regional and global factors leading to innovation. Trust offers necessary network flexibility (the ability to easily switch to the right partner at the right time), which boosts the efficiency of regional cooperation, institutional impact and collaboration/integration into TVCs.

The research offers an extensive range of conclusions and, through fsQCA, a vast list of combinations relevant to innovation. However, it does not offer the possibility to generalise these findings. Many of the configurations reconstruct previously researched models, but others must be tested and proved empirically. The research on innovation is not easy and therefore requires continuous confirmations. Further analysis should verify the validity of these configurations.

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Annex 1: Questionnaire TIR2020

Block 1: Innovation Overview

Q1. Can you assess the level of innovation within your region? **(Outcome)**

a) Innovation is very poor or non-existent in the region. It does not play a role in the competitiveness of companies in the region. Companies have very poor capacities to innovate.
b) There are very minor levels of innovation in some companies of sectors. Nevertheless, innovation plays a very limited role in the competitiveness of companies in the region. Some companies have minor capacities for innovation.
c) Innovation plays a relevant role in the region, but the companies are not innovation leaders in their areas. Companies are increasing investments in innovations.
d) Innovative processes are very advanced. Innovation is the key to the competitiveness of companies in the region. Companies have significant innovative capacities.

Q2. Can you assess the situation regarding collecting, processing and disseminating information (such as funding opportunities, potential partners, available know-how, technologies and innovations) in the region? **(Information)**

a) Very poor quality of information, with very limited or non-existent dissemination channels.
b) Poor quality of information with limited dissemination channels
c) Relatively good quality information mostly disseminated either through formal or informal dissemination channels.
d) High quality information with effective and continuous dissemination through formal and informal channels for all interested actors.

Q3. Can you assess the involvement of enterprises in research and development (R&D)? **(R.D)**

a) Enterprises have no interest in R&D
b) Enterprises do not have R&D departments but would be willing to invest resources in R&D activities
c) Enterprises have R&D departments, but their resources to invest in R&D activities are limited.
d) Enterprises have R&D departments and invest significantly in R&D activities

Q4. Does the region rely on Open Innovation Practices, which is emphasising the use of freely and openly available ideas and knowledge in their own R&D? **(OI)**

a) Companies rely on closed innovation (own patents, closed databases, internally developed blueprints, etc.)
b) Companies rely not only on closed innovation (own patents, closed databases, internally developed blueprints, etc.) but also incorporate freely available external information
c) Companies rely not only on closed innovation (own patents, closed databases, internally developed blueprints, etc.) but also are willing to spend resources on external knowledge (e.g. licenses and technology, IPR)
d) Companies rely on open innovation (sharing patents, open databases, blueprints, etc.)

Block 2: Institutions

Q5. Can you assess the level of impact of the public authorities and/or publicly founded intermediary organizations (such as regional development agencies, innovation agencies, incubators and technology parks) in supporting R&D and innovations in the region? (R&D or Innovations?) **(InstSupp)**

a) Institutional support is very weak or non-existent and serves a formal function providing no real support.
b) Institutional support has the basic elements and provides a basic level of support, but also lacks real initiative and has insufficient resources.
c) The institutional support is well-developed, funded and competent and provides a significant level of support.
d) The institutional support is very well developed, funded and competent and provides excellent and effective support.

Q6. Does your region have the capacity to attract talented people? **(Attract)**

a) The region cannot attract people, even for less demanding non-creative jobs.
b) The region attracts some people, but mostly for less creative jobs.
c) The region is relatively successful in attracting people including more creative jobs.
d) The region is very successful and can attract the most talented people required for creative jobs.

Q7. Does your region have the capacity to retain talented people? **(Retain)**

a) The region cannot retain people, even those required for less creative and manual jobs.
b) The region can retain people, but mostly in less creative jobs.
c) The region is relatively successful in retaining people, including those required for more creative jobs.

d) The region is very successful in retaining the most talented people required for creative jobs.

Q8. Can you assess the innovation policy? **(InnoPolicy)**

a) The innovation policy is virtually non-existent, vaguely formulated or poorly developed.
b) The innovation policy fails to exploit basic regional developmental opportunities, sustain competitive advantage or generate stronger economic and innovative governance
c) The innovation policy manages to exploit regional developmental opportunities, sustain competitive advantage or generate stronger economic and innovative governance
d) The innovation policy is very successful in boosting the competitive advantage of the region, excellently enhancing the competitive advantages of the region in line with global trends.

Block 3: Networks

Q9. How do the networks between businesses, institutions of knowledge, public bodies, professional associations, trade unions, NGOs, etc. contribute to innovation performance in the region? **(Network)**

a) Networks are undeveloped so that the connections between actors are non-existent or have very limited added value for innovation performance
b) Only the most important actors engage and exploit regional networks for innovation purposes. The majority of actors are not engaged and experience none or very small added value from their connections.
c) Relevant and interested actors are included in regional networks and can use them to enhance their innovativeness. However, several actors are still not engaged.
d) Regional networks are very well developed, and the actors have open access and are making efforts to include as many actors as possible, to gain benefits from their interconnections.

Q10. Can you assess the level of cooperation between stakeholders within the region? **(RegCoop)**

a) Cooperation between actors is undeveloped and limited to actors among whom mutual trust exists. It does not have any significant benefits for business or other professional activities in the region.
b) Some forms of cooperation are beginning to form in the region, but there are limits, whereby cooperation is relatively limited.
c) Cooperation is relatively well developed, but there is significant space for improvement.
d) Cooperation is very well developed, with a high level of mutual understanding and trust among regional actors.

Q11. Can you assess the level of cooperation between regional stakeholders and actors outside the region? **(ExtCoop)**

a) Cooperation between actors is undeveloped and does not have or has insignificant benefits for business or other professional activities (outside the region)
b) There is a relatively developed cooperation, but most of the actors struggle to gain benefits from it (outside the region)
c) There is a well-developed cooperation level, but less connected actors do not gain benefits from it (outside the region)
d) Cooperation is very well developed so that the absolute majority of regional actors gain benefits from it (outside the region)

Q12. Do stakeholders trust each other? **(Trust)**

a) There is no or very limited trust between stakeholders in the region.
b) There is some trust among certain groups of actors but a low level of trust toward other stakeholders outside these groups.
c) There is well-established trust among certain groups of actors with a moderate level of trust towards other stakeholders outside these groups
d) Trust is mutual among regional stakeholders and most new interactions are easily established

Block 4: Cognitive Frames

Q13. Can you assess the level of the culture and attitude of the population concerning creativity and entrepreneurship? **(Entrepreneurship)**

a) The population in the region is highly risk-averse, not inventive, avoids responsibilities and lacks entrepreneurial initiative.
b) The population in the region is somewhat open to risk and inventiveness but definitely prefers to stay on the safe side.
c) The population in the region is open to calculated risk and is relatively open to innovations.
d) The population in the region is considered to be risky, inventive and responsible, with a strong sense of entrepreneurial initiative.

Q14. To what extent do the regional attitudes/culture enable learning processes in the region? **(Learning)**

a) The population of the region does not appreciate formal and life-long education. It is not interested in learning, is not curious and willing to accept feedback.
b) The regional population has some curiosity, prone to formal education, but lacks initiative for lifelong education.
c) The regional population is curious, is relatively analytical and can accept feedback, formal education is relatively important, but the initiative for life-long education is low or moderate.
d) The population of the region is curious, analytical and willing to accept feedback. Formal education is considered important and they embrace lifelong learning.

Q15. Is competition seen positively or negatively by most people? **(Competition)**

a) Competition is perceived as an absolute threat and jeopardy.
b) Competition is perceived as a threat but also seen as having benefits for the innovation process.
c) Competition is perceived in (mostly) beneficial terms but the population is also wary of its negative aspects.
d) Competition is perceived as an opportunity for improvement and people usually accept and enjoy the challenge.

Q16. How is globalisation perceived in the context of the innovation processes? **(Globalisasation)**

a) Globalisation is perceived as an absolute threat, jeopardizing innovation processes.
b) Globalisation is perceived as a threat but also seen as having benefits for the innovation process.
c) Globalisation is not only perceived as mostly beneficial but also can hinder the innovation processes, but individuals do not perceive it as a motivation for innovation
d) Globalisation is perceived as an opportunity for improvement and people usually accept and enjoy the challenge

Block 5: Transnational Value Chains (TVCs)

Q17. How embedded are TVC relationships or other forms of transnational relationships (TR) in the region? **(TVCembed)**

a) Such relationships are usually kept at a distance with no identifiable impact on the region's economic and social life
b) The region shows interest in good relationships with foreign partners, but these are not important for the economic and social development of the region
c) The region is usually having good relations with foreign partners and these have a positive supportive role for the region (motivating economic development and social changes)
d) The ties with foreign partners are strong and the region is highly dependent on these relations

Q18. What is the role of the regional actors (enterprises, industrial sectors and clusters) in the TVCs? **(tvcTIER)**

a) Regional actors supply TVC with raw materials, or simple products made from these materials (Tier III)
b) Regional actors are mostly specialised in delivering semi-products, that are used for assembling other semi-products (but not the final product itself) (Tier II)
c) Regional actors are specialised in delivering components for final products (tier I)
d) Regional actors' most important activity is to assemble the final product (possibly as OEM) using semi-products and components coming from abroad (assembler)

Q19. Can you assess the role of TVC relationships or other forms of TR for the R&D and innovative processes in the region? **(tvcR.D)**

a) Foreign partners usually do not support R&D and do not invest resources to foster innovative activities in the region.
b) Foreign partners usually provide indirect support for R&D and innovation through R&D expertise, analysis of data, information sharing, etc.
c) Foreign partners usually provide direct support for R&D and innovation through direct investment, transfer of technology to the regions, etc.
d) Usually, TVC partners are very interested in the region's innovative performance and help with all available resources.

Q20. To which extent does the regional economic performance depend on TVC relationships or other forms of TR? **(tvcEconom)**

a) Economic exchange (products sold) with the TVC partners is minimal and has a minimal impact on the region's economy
b) Economic exchange with the TVC partners has a small but sizable influence on regional economic performance
c) Economic exchange with the TVC partners is moderate and is one of the important factors for regional economic performance
d) Economic exchange with the TVC partners is very high and it is the most crucial factor for regional economic performance