What hampers research collaboration in a region?

The perspective of various stakeholders from ten German regions

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Abstract Research collaboration is an important instrument for innovation and knowledge transfer. In this respect, barriers that prevent or impede research collaboration between research institutions and companies are of particular importance. In this paper, we elaborate on the importance of research collaboration barriers by conducting and analysing 77 expert interviews from ten German regions. We go beyond the existing literature by examining differences in the perception of different kinds of experts and by comparing different types of regions classified according to the presence of important actors, namely research institutions and large companies. Our results show that research collaboration barriers are perceived as very significant barriers to innovation across all region types. We find differences in the perception of research collaboration barriers between the experts. On the regional level, the presence of research institutions shifts the relevance from missing partners to other research collaboration barriers, while all research collaboration barriers are not perceived as significantly less important.

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1 Introduction

Why is one region innovative and another not? This question has preoccupied scientists for many years. Not only because higher innovativeness is often associated with higher living standards, prosperity and economic growth but also to provide evidence on the obstacles to innovativeness (D'Este et al. 2011; Hadjimanolis 2003; Mirow 2010; Mohnen et al. 2008). In this paper, we approach the question from the perspective of research collaboration barriers. Collaboration between universities and companies (UI collaboration) is an important tool for knowledge and innovation transfer, which is essential in a regional environment (Goduscheit and Knudsen 2015; Kadlec and Blažek 2015).

Various determinants of UI collaboration can be identified from previous studies and, in turn, barriers to research collaboration can be derived from them (Figueiredo and Ferreira 2022; Lopes and Lussuamo 2021). Studies have established that geographic proximity can support collaboration between organizations whereas geographic distance can act as a barrier (Gertler 2003; Howells 2002; Pan et al. 2012; Petruzzelli 2011; Storper and Venables 2004). Also other determinants for UI collaboration are discussed e.g. founder's characteristics (Okamuro et al. 2011), firm independence (Mohnen and Hoareau 2003), technological relatedness and trust (Petruzzelli 2011), type (and definition) of innovation (Tether 2002), firm strategy (Fernández López et al. 2015) and country (Marzo-Navarro 2007; Rõigas et al. 2018).

In general, innovation barriers are perceived primarily by those companies that are innovative (Iammarino et al. 2009). Transferred to research collaboration barriers, this suggests that in regions with many knowledge actors, more research collaboration barriers are perceived, although no studies exist on this yet. On the other hand, it could also be argued that there should be more research collaboration barriers in regions with few research institutions, as there is often less research collaboration in such regions.

Moreover, there are no studies that distinguish between relevant actors in a region when it comes to the perception of research collaboration barriers and there are no studies that include the view of intermediaries in the respective region. Most studies focus on actors from either research institutions (Abraham et al. 2020; Belkhodja and Landry 2007; Muscio and Vallanti 2014) and/or companies (Bruneel et al. 2010; Lopes and Lussuamo 2021; Nielsen and Cappelen 2014), research transfer offices (Hülsbeck et al. 2013; Muscio 2010; Pohlmann et al. 2022).

Recent case studies emphasize the importance of the interface between academia and industry, especially in technologically less advanced regions and medium-sized universities (Alexandre et al. 2022). However, the case studies to date focus predominantly on the interaction channels and general collaboration determinants of UI (Alexandre et al. 2022), the way how intermediaries facilitate technology transfer (Villani et al. 2017) or on a specific intermediary group, e.g. the transfer center (O'Kane et al. 2021). In contrast, we focus on the differences between actors (companies-universities-intermediaries) in the perceived barriers to research collaboration in the region. This provides a more comprehensive picture of the different interests

and obstacles behind research collaboration due to the division of labor in innovation processes at the regional level.

For these reasons, we extend the literature in two ways: First, we elaborate on actor-specific perceptions of research collaboration barriers, including key intermediaries from the Regional Innovation System. We extend the literature by including intermediaries and examining their argumentations. Second, using a classification of regions into four region types, we show that the presence or non-presence of research institutions and large firms influence the perceptions of collaboration barriers, while the overall relevance of research collaboration barriers is similarly important.

To deepen the understanding of the relevance of research collaboration for regions, we conducted 77 interviews with experts from ten selected German labor market regions (LMR). The interviews focused generally on barriers to innovation, research collaboration barriers and economic development. The interviews were analyzed using qualitative content analysis according to Mayring (2019).

Our paper is organized as follows: in Sect. 2 we start with a presentation of the different strands of theory to research collaboration. Section 3 describes the methodological approach in the paper and presents the ten chosen regions. Section 4 contains the empirical results and their discussion. Section 5 provided a conclusion of the topic.

2 Research collaboration

We divide the chapter on research collaboration into four parts below. First, we give an overview to the field of research collaboration (Sect. 2.1), second, we look at research collaboration barriers from the perspective of companies (Sect. 2.2), then from the perspective of research institutions (Sect. 2.3) and finally we take the regional perspective (Sect. 2.4).

2.1 Overview to research collaboration

UI collaboration is gaining relevance because universities are expected to contribute to the economic development of the respective region in the form of third-mission (Da Alves et al. 2015). Studies on research collaboration between individual actors are mainly studied in the literature as innovation systems, especially regional innovation systems (RIS). In particular, the triple helix theory focuses on collaboration between the three main actors—universities, governments, and firms—in a regional context and describes their various roles and functions with the focus of research institutions (Etzkowitz and Leydesdorff 2000).

Research institutions fulfil important functions for regions. First, they are the source of academic knowledge for a region. Research institutions generate and accumulate knowledge, through scientific exchange and own research (Goddard and Puukka 2008; Jäger 2017; Rutten et al. 2003). Second, universities in particular, but also most research institutions, serve as providers of academic education (Goldin 2016). They generate high-quality human capital for the region (Faggian and McCann 2006, 2009; Goldin 2016). However, from the multidimensional systemic view

of RIS, research institutions serve not only as providers of knowledge and education, but also as system developers. In the before mentioned triple helix model (Etzkowitz and Leydesdorff 2000), universities are a key shaping actor alongside industry and government. The hybrid, recursive, and cross-institutional relationships and interactions among the above actors lead to innovation processes that benefit all actors in RIS (Gunasekara 2006). Due to the increasing knowledge-intensive activities in the innovation process, the importance of research institutions is increasing (Perkmann and Walsh 2008). The role of research institutions as regional system developers is reflected in the literature on the engaged university (Chatterton and Goddard 2000; Holland 2001) or, more fundamentally, under the concept of the third mission. Universities also aim to create a dialogue between science and society (Predazzi 2012; Roessler et al. 2015). Through the antenna function of research institutions, they can "condense internationally available knowledge according to problems and demands" (Back and Fürst 2011, p. 2), make it available to the region with its diverse actors, and thus influence the region. As part of the concept of the engaged university, research institutions should also pursue a stronger regional focus in teaching and research (Back and Fürst 2011; Chatterton and Goddard 2000; Holland 2001). This means that academic research and knowledge created should be aligned with the needs of the regional economy. In addition, regional businesses must be able to adapt to this knowledge. When these conditions are met, research institutions can be important drivers for a region (Back and Fürst 2011; Chatterton and Goddard 2000).

Research collaboration is associated with the acquisition of new technological capabilities that are necessary or helpful for the introduction of new products or processes that boost regional economic growth (Iammarino et al. 2012). Collaboration between universities and companies also enables students and researchers to gain practical experience and develop their skills in collaboration with industry. This contributes to the development of a highly skilled workforce in the region. At the same time, collaboration can help retain qualified professionals in the region (Heidenreich and Mattes 2021). University collaboration enables the transfer of research results and technologies from the academic environment. By creating a dynamic and collaborative culture of innovation, collaboration among universities can make a region an innovation hub and increase innovation efficiency (Fan et al. 2020; Xin 2020). This attracts further business, investment, and skilled labor and strengthens the region's position. According to Pippel and Seefeld (2016), UI collaboration has also a positive impact on firms' product innovation and process innovation performance. Robin and Schubert (2013) confirm at least the positive impact on product innovation. Hence, understanding obstacles and barriers to research collaboration are important for improving the innovativeness in less innovative regions.

2.2 Perspective of the companies

In principle, a company can cooperate horizontally (competitors), vertically (suppliers and customers), or institutionally (research institutions) (Badillo et al. 2017). Companies particularly benefit from collaborating with research institutions as it gives them access to distant research knowledge that enhances in-house knowledge

(Bozeman et al. 2013; Cassiman and Veugelers 2002; Wirsich et al. 2016). Collaboration with research institutions is an important tool for knowledge and innovation transfer, which is essential in a competitive regional and/or national business environment (Goduscheit and Knudsen 2015; Kadlec and Blažek 2015). According to Bolli and Woerter (2013), a company is only willing to enter into a research collaboration if the benefits for the respective company exceed the costs of the collaboration (return on investment). Through the synergy effect, the collaboration can lead to an increase in innovation productivity.

Numerous studies have already been conducted on the topic of UI collaboration (Eg: Figueiredo and Ferreira 2022). Many determinants of UI collaboration have been described in the literature: Company size (Eom and Lee 2010; Fontana et al. 2006; Kleinknecht and Reijnen 1992; Laursen and Salter 2004); sales profile, location, absorptive capacity (Hewitt-Dundas 2013); degree of internationalization; ownership, group of companies, export orientation (Iammarino et al. 2012; Rõigas et al. 2018); external knowledge search, internal research and development efforts (Gallego et al. 2013); R&D intensity (Lhuillery and Pfister 2009; Parisi et al. 2006); firm age (Cohen et al. 2002); industry (Eom and Lee 2010; Fontana et al. 2006; Fritsch and Lukas 2001; Tether 2002; Veugelers and Cassiman 2005); degree of interconnectedness in the knowledge network (Lim 2009); openness and culture, external information seeking (Cassiman and Veugelers 2002); founder characteristics (Okamuro et al. 2011); independence of the firm (Mohnen and Hoareau 2003); technological relatedness and trust (Petruzzelli 2011); type (and definition) of innovation (Tether 2002); business strategy (Fernández López et al. 2015); and country (Marzo-Navarro 2007; Rõigas et al. 2018).

The barriers to UI collaboration can be derived in part from the determinants described earlier. However, there are also additional barriers that cannot be derived directly from the determinants. We divide the research collaboration barriers from the perspective of companies into internal company barriers and barriers that arise during interaction.

One **internal** barrier to UI collaboration that can be derived from the determinants are resource barriers, which particularly affect smaller companies (Cristo-Andrade and Franco 2019). Smaller companies in particular often lack qualified personnel, technical expertise, and also financial resources. There are also adaptation and implementation difficulties (Merritt 2015; de Moraes Silva et al. 2020). Accordingly, Azagra-Caro et al. (2006) find that a strong dominance of SMEs in a region is a barrier to UI collaboration. Corporate lack of information (including research results) are also considered as reasons (de Moraes Silva et al. 2020; Schartinger et al. 2001). Intra-company bureaucracy, no or even an anti-innovation strategy, and a lack of will to cooperate are further obstacles to UI collaboration (de Moraes Silva et al. 2020).

Many barriers appear in the **interaction** between partners. Generally, bureaucratic hurdles and especially university bureaucracy are considered barriers in the interaction between collaborative partners (Figueiredo and Ferreira 2022). Moreover, in the literature, geographical proximity is considered helpful for collaboration between organizations; on the other hand, geographical distance can act as a barrier (Gertler 2003; Lawson and Lorenz 1999; Pan et al. 2012; Petruzzelli 2011; Storper

and Venables 2004). López-Martínez et al. (1994) state that cultural and ideological differences between collaborative partners can act as barriers. Differences between the "cultures" of the two fields are also seen as reasons for inadequate UI collaboration (de Moraes Silva et al. 2020; Schartinger et al. 2001). Azagra-Caro et al. (2006) emphasize the lack of tradition in collaboration and the associated low level of experience as an important component. Lack of organizational support, insufficient communication and interaction among stakeholders, different expectations and goals, and difficulties in adapting research results to business needs are other barriers to UI collaboration (Franco and Haase 2015; de Moraes Silva et al. 2020). Lack of mutual or interorganizational trust also appears to be a significant barrier to UI collaboration (Lopes and Lussuamo 2021; Parmentola et al. 2021). A severe lack of trust and an accompanying high fear of knowledge loss, especially on the part of companies, often makes them reluctant to engage in research collaboration (O'Dwyer et al. 2023).

In addition, converting research knowledge formulated at universities into a practical context for enterprise applications is a major obstacle for organizations (Gilsing et al. 2011; Un and Asakawa 2015). University intellectual property policies are also perceived as an obstacle by companies (Okamuro and Nishimura 2013). Companies fear that competitively relevant knowledge is intentionally leaking to universities (Gilsing et al. 2011).

Regional barriers, such as bureaucracy and framework conditions or insufficient organizational support, are discussed in Sect. 2.3.

2.3 Public research perspective

In addition to the socio-political mandate of the Third mission, research institutions depend on collaboration with industry and companies, because research collaboration brings several advantages to research institutions. First, collaboration with companies gives research institutions access to additional resources and funding. This can help research institutions expand their research capabilities and realize their projects. Second, by working closely with industry partners, research institutions can ensure that their research results and findings are relevant and applicable. Third, research institutions benefit from sharing knowledge, experiences and innovations. They gain internal company insights, data, industry-specific expertise and hands-on experience that enable practice-oriented research. Fourth, companies can increase their visibility and standing in the scientific community. Connecting with successful companies and jointly publishing research results contribute to the recognition and reputation of research institutions (Etzkowitz and Leydesdorff 2000; Perkmann and Walsh 2008).

From the perspective of research institutions, there are some **internal barriers** that prevent or impede research collaboration. Ramos-Vielba et al. (2016) describe certain scientific barriers, such as autonomy and credibility of science. Rosenberg and Nelson (1994) summarize that university incentive systems for scientific careers and publications do not make application-oriented collaboration with industry particularly attractive. Moreover, research institutions often have limited financial and human resources, especially compared to large industrial companies (Ramli and

Senin 2015). Vom Brocke and Lippe (2015) note that a lack of project management skills, especially on the part of bureaucratic universities, can make collaboration difficult.

As briefly indicated in Sect. 2.1, research institutions and companies also have significant differences in their worlds of thought, knowledge backgrounds, time horizons, cultures, goals, social conventions, languages, opinions, norms, assumptions, and interpretations that can function as **interaction barriers** between the two actors (Hewitt-Dundas 2013; Wit-de Vries et al. 2019). Estrada et al. (2016) highlights differences between routines (e.g.: behavior patterns) and differences in orientations (e.g.: goals and expectations). Different incentive systems of companies and research institutions (e.g., commercialization vs. scientific publication) can conflict and influence the measurement of success (Gilsing et al. 2011). Companies seek "sticky" knowledge that helps with product development and maximizes long-term profits. Universities seek "leaky" knowledge that can be published and is new (Bruneel et al. 2010; Ramli and Senin 2015). Different time frames are another problem: industry thinks in short time frames to compete in the marketplace with quick results. Research institutions think in longer time frames and funding periods (Ramli and Senin 2015).

The business structure in the region is important (e.g., many SMEs in the region) to ensure connectivity. Other regional factors are discussed in the next chapter.

2.4 Regional perspective

As already indicated at various points in Sects. 2.1 and 2.2, companies and research institutions are exposed to certain regional research collaboration barriers. These barriers are explained in the following and summarized in Table 3. From a systemic point of view, in RIS with few innovative actors (organizational thinning), there is significantly less research collaboration, which has further negative effects on the region and the existing actors (Tödtling and Trippl 2005). Lopes and Lussuamo (2021) argue that the weak growth of the business structure is also a barrier to UI collaboration, few available actors in the region function as a hindrance. Often, the location of public research institutions is obligated to policy makers, who create the framework conditions of a region. In general, there is widespread agreement in the literature that geographic proximity is helpful for collaboration between organizations and that, on the other hand, geographic distance can also act as a regional barrier (Gertler 2003; Lawson and Lorenz 1999; Petruzzelli 2011; Storper and Venables 2004). The positive effects of geographic proximity include a potential competitive advantage and personal local contacts that can reduce coordination costs and, in particular, facilitate knowledge transfer. Small and medium-sized enterprises (SMEs) are assumed to benefit especially from geographic proximity to R&D institutions (Davenport 2005). Universities seem to have a positive effect on the openness of companies, because the more universities there are in the company's region, the more willing companies are to cooperate with universities. Legal frameworks (patent system, liabilities, confidentiality obligations, etc.) as well as bureaucratic hurdles, lack of organizational support (support infrastructure), and insufficient regional networks for communication and interaction between stakeholders are other regional barriers to research

Table 1 Overview about research barriers from three perspectives: companies, research institutions and regional barriers

Company barriers	Interactive barries	Bureaucracy
		Geographical distance to other companies and research institutions
		Difference in interest and attitude towards the survey Cultural, idiological differences Different goals Different language/level of abstraction Lack of organizational support Insufficient communication and interaction
		Missing tradition of collaboration Low level of experience
		Missing trust Protection of intellectual property
	Internal barriers	Lack of financial resources (especially SMEs) Lack of human capital (especially SMEs)
		Wrong corporate structure Wrong corporate culture/ideology Wrong corporate orientation/strategy Internal bureaucratic hurdles Little internationalization Personality traits of company leaders/founders
		Adaptation and implementation difficulties
		Lack of information about potential partners
Research institutions barries	Interactive barriers	Different level of abstraction is used
		Geographical distance
		Different interest, goals and orientation Focus on profit (quick results) Cultural and ideological differences (language)
		Low level of experience Lack of tradition of collaboration Poor conflict management
	Internal barriers	Lack of financial resources Lack of human capital
		Autonomy and credibility of science Publication target Intellectual property Lack of entrepreneurial talent at university
		Bureaucratic hurdles
Regional barriers		Attitudes towards risk, trust, entrepreneurship and collaboration
		Business structure in the region (e.g. many SMEs in the region) Low absorption capacity of the region
		Bureaucratic hurdles Legal framework Lack of organizational support Lack of support infrastructure
		Insufficient region network and communication

collaboration (Franco and Haase 2015; de Moraes Silva et al. 2020). The prevailing culture in the country regarding risk appetite, trust, and business creation/spin-off also play an important role in the transfer of knowledge and research collaboration (de Moraes Silva et al. 2020). Table 1 summarizes the research collaboration barriers described above from the various perspectives and provides an overview.

3 Methodical approach

We analyse the relevance of missing research institutions for UI collaboration in a region in more detail. Expert interviews are well suited to detect reasons and motives. To not preframe the content of the interviews, we conduct the interviews on the general topic of innovation barriers and the relevance of collaboration. A total of 77 interviews were conducted from ten different German labour market regions. The details of the selected regions, the interviews and the evaluation are described below.
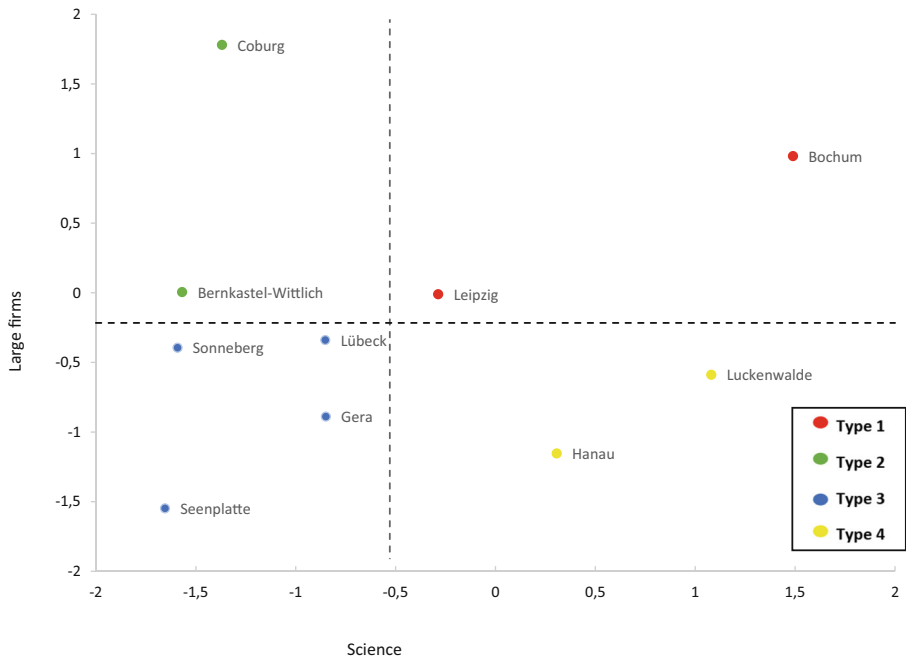

Fig. 1 The study regions' endowment with large companies and publications per person and the respective variable average ("– – –") as well as the classification into four types based on these endowments (Type 1 (*red*): large firms and science above average; type 2 (*green*): large firms above and science below average; type 3 (*blue*): large firms and science below average; type 4 (*yellow*): large firms below and science above average) (databases: INKAR & Web of Science)

3.1 Regions

This paper is part of a larger study on the various reasons for the low economic and innovation performance of regions. As a consequence, we explicitly asked for these reasons in the interviews and moved to the questions on the lack of research collaboration later in the interviews. This setting does not fit regions with a high innovation performance. Hence, we excluded them to have a sample with the same setting in the interviews. Besides this, the aim of this study was to include a wide variety of regions. We use the classification of regions provided by Hertrich and Brenner (2023) and selected for each archetype they mentioned in their study one or two regions that represent the average of the specific archetype quite well. We also had a look at the location in Germany to create a geographically diverse sample. Most of the regions show low innovativeness and weak economic structure, but also some heterogeneity. Labour market regions are conceived according to the idea that most people work and also live in this region, which is, therefore, in our opinion, the most appropriate level of analysis for our study.

For the analysis below, we use the average number of journal publications in the Web of Science and the number of large companies (> 250 employees) to sort the 10 regions into 4 groups (Fig. 1). The average values in our sample are used as thresholds to build the groups (Fig. 1). The resulting assignment is shown in Fig. 2.
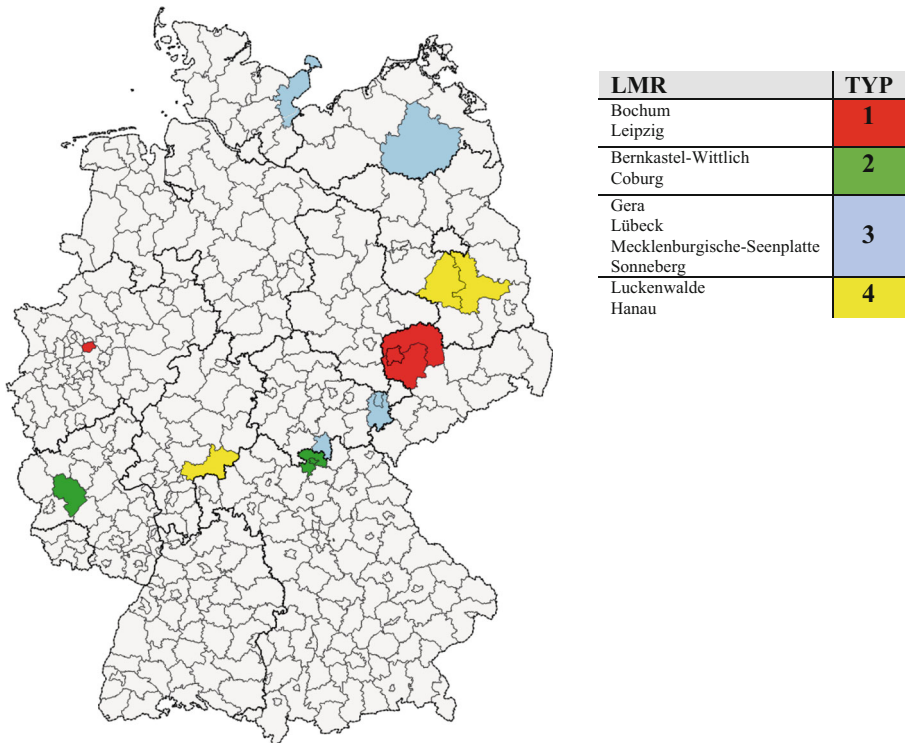

LMR	TYP
Bochum Leipzig	1
Bernkastel-Wittlich Coburg	2
Gera Lübeck Mecklenburgische-Seenplatte Sonneberg	3
Luckenwalde Hanau	4

Fig. 2 The 10 study regions in Germany and their subdivision into region types

3.2 Interviews

We conducted guided semi-structured expert interviews. The aim was to ensure data collection that was as comparable as possible with an orderly interview process, while at the same time not losing flexibility concerning new or as yet unknown topics. The guiding questions in the questionnaire were designed deductively from theory and are based on the research interest. Overall, the questionnaire was divided into 4 thematic blocks, two of which are of relevance to this paper. In the first thematic block, questions were asked about the general economic situation. We asked the experts the following two questions, among others:

1. *What are the reasons you perceive for the rather below-average economic structure in the region?*
2. *Is the region particularly innovative in your eyes? If not, what are the causes you perceive that prevent higher innovativeness in the region?*

In the more general questions from topic block 1 about barriers to innovation, the applicable reasons for research collaboration barriers were not always mentioned. Therefore, in the further course of the interviews, we explicitly asked about research collaboration barriers. Among other things, the following question was asked:

3. *What are the perceived causes (by you) for the lack of research collaboration in the region?*

For the largest part of the evaluation, the answers to questions 1.) 2.) and 3.) were grouped together and the region type-specific reasons for the lack of research collaboration were extracted from them. Since not every actor answered all questions in the interviews, the number of relevant actors varied depending on the question and topic. We did not define research collaboration per se in the interviews. However, we speak in the interviews of "collaboration projects in innovative fields". In this sense, research collaboration in this paper can be understood as active participation in joint innovation projects with other organizations.

A total of 77 interviews with a total of 78 experts from the 10 regions were conducted, transcribed and analysed. The respective experts were selected based on their professional function and thus their knowledge and specific experience (Hopf 2019; Kruse and Schmieder 2014; Mayer 2013; Table 2).

The criteria for selecting experts was based on administrative/institutional responsibility, residence in the region and the associated important function in the

Table 2 Number of interviews in the corresponding LMR

LMR	Leipzig	Lübeck	Bochum	Mecklenburgische Seenplatte	Coburg	Luckenwalde	Gera	Hanau	Sonneberg	Bernkastel-Wittlich
Number of interviews	10	8	7	6	11	6	9	7	7	6

Table 3 Number of experts for each group

Expert group	Chambers	Companies	Development	Research	Others
Number of experts	15	16	19	9	19
Percentage	19.23%	20.51%	24.36%	11.54%	24.36%

RIS. Anonymisation of the data is important and necessary and was assured to the interviewed experts (Kruse and Schmieder 2014; Mayer 2013).

We intended to include very different views into our analysis, so that the interviewed experts come from the following diverse groups of actors: Chamber of Industry and Commerce and Chamber of Crafts (Chambers), companies, regional economic development institutions (Development), research institutions (Research), and others (politics, innovation promotion office, regional management office, Federal Employment Agency). Table 3 shows the number of experts for the respective groups.

3.3 Analysis

To ensure a systematic data analysis, a qualitative content analysis was conducted using the interview transcripts according to (Mayring 2019, 2022). The transcribed expert interviews were analysed using MAXQDA (Kelle 2019). A category system was created mainly deductively from the theory and identified categories above (Sects. 2.1–2.3), with some inductive changes according to the interview responses (Kromrey et al. 2016). The used categories are listed in Table 5. They match the categories build in Tables 1, 2 and 3 mainly with a few exceptions: The lack of technical knowledge in firms and the culture in the country are not mentioned in the interviews. Missing experience with collaboration is mentioned in connection with other barriers and experience with collaboration is rather seen as tool to overcome barriers. Geographic distance is rather mentioned as missing partners in the region. Various aspects, such as trust and bureaucracy are included into the class 'different culture'. We added the class 'different topic'. The text passages from the expert interviews are assigned to the various categories from the category system, while also forming new categories. The uniform coding procedure enables us to conduct comparative evaluations of the material and also quantitative analyses (Kelle 2019; Mattissek et al. 2013). To reduce subjectivity, which results from the subjective assessment of the analysing researcher, mainly top categories are analysed. Main categories and thus themes are usually clearer and give a good overview. Excerpts from selected interviews reflect the qualitative part of the analysis.

The research project is part of a larger study. A total of over 6000 codes were assigned to the 77 interviews with 78 expert groups. However, since the interviews covered several topics and not every interview partner answered or was able to answer every question or is an expert in the respective topic, the number of question-specific codes and relevant interview partners is smaller. The relevant interview partners and the number of codes are provided for each analysis separately in the next section.

4 Results

The presentation of our results is partitioned in two parts. Section 4.1 focuses on the different perceptions of barriers to collaboration by different actors. Section 4.2 focuses on the differences and relevance of research collaboration barriers, taking into account the regional availability of research institutions and large companies.

4.1 Differences according to type of expert

One aim of the paper is to analyse differences and similarities in the perception of research collaboration barriers between the groups of actors. We sort the research collaboration barriers that are stated by the experts into four groups, which are considered in turn below.

4.1.1 Matching problems

Across all groups of actors, matching problems are stated most often. However, the actor groups differ in the description of the matching problems. Missing partners are mentioned by all groups of actors. For intermediaries and universities, the insufficient number of innovative companies (and industries) in the region is a barrier to research collaboration, as described, for example, by an actor from a regional economic development institution:

> "And the other point is that in the economic structure of the region itself, they may not have so many industry segments that have an affinity for research, yes" (Interview_Regional Economic Development Institution 2021a, 65)

An actor from a research institution describes the lack of innovative partners in the region as follows:

> "There is still a great need to expand the transfer of knowledge and technology from the universities. Work more closely with the regional economy. The problem is that the absorption capacity is very low as far as medium-sized businesses (Mittelstand) are concerned" (Interview_Research Institution 2021a, 20).

On the other hand, intermediaries and also companies often see the poor endowment with regional research institutions as a barrier to research collaboration. Within the group of intermediaries, actors from regional economic development institutions in particular argue more strongly that research facilities need to be expanded in the respective region. For example, an economic developer states:

> "But this requires certain structures that are, let's say, not available here in the district. I'll say the lack of a university" (Interview_Regional Economic Development Institution 2021b, 13).

A frequently mentioned reason is that regional companies would have to overcome longer distances in research collaboration due to the lack of a university in the region, and thus the collaboration does not take place or does not take place sufficiently. One intermediary describes the problem as follows:

"Of course we have many universities in the surrounding area. But they are just outside our own, let's say, territorial political borders. And so the willingness to get involved more closely with them and to engage in any kind of activities with them decreases amazingly quickly, I always find it fascinating, but it is like that" (Interview_Chamber of Industry and Commerce 2021b, 65).

It is interesting to note that other aspects of the matching problems are stated less frequently by intermediaries. This is different for the other groups of actors. Universities and research institutions in particular frequently refer to the different culture of universities and companies as a significant barrier to research collaboration. Universities of applied sciences complain that (compared to universities) the political mandate and the culture are not necessarily designed for research collaboration. One actor from a higher education institution describes:

"Collaboration with companies is not always easy because companies have very different success factors, very different ways of thinking and that is not always compatible with universities" (Interview_Research Institution 2021e, 36).

Surprisingly, the problem of different cultures is not so present among companies and intermediaries, who state other aspects more often. Nevertheless, all groups of actors, including actors at the research institutions themselves, are stating that universities are (too) slow and companies move much faster in comparison. This has organisational and structural (e.g. resources) reasons. One intermediary describes the different speeds with an example:

"We often find that companies want short, fast, crisp projects, and researchers often want to do long research projects and have another project and a different perspective on certain things. So that's actually sometimes the case that you have to bring together the language of the researchers and the language of the companies to a certain extent" (Interview_Chamber of Industry and Commerce 2021d, 74).

Due to the very different starting points—"Probably one is research and the other is practice, it is always difficult to bring these together" (Interview_Chamber of Industry and Commerce 2021a, 10)—and the different goals and ways of thinking, UI collaboration is also difficult:

The different cultures between companies and universities seem to be much greater, especially among SMEs. An intermediary specifies the problem of different mindsets by saying:

"The problem, however, is that this thinking of the five-man company, the managing director, who at the same time acquires orders, manages his staff and then also places himself at the plant and screws along somewhere. This way of thinking is simply not perceived at all in these institutional facilities and is not understood" (Interview_Chamber of Industry and Commerce 2021f, 78).

Missing information about possible partners is another matching problem mentioned by all groups of actors, but only in some interviews. The problem of missing information is complex, as one intermediary explains:

"In many cases it is simply not knowing. Firstly, not knowing that it makes sense [to cooperate] and secondly, that there could also be a very simple access. On the other hand, it is also sometimes the issue that we ourselves are not even aware that in a situation of strength we can perhaps also generate advantages for the future through collaboration" (Interview_Regional Economic Development Institution 2021c, 40).

The different actors agree that the missing information is present mainly on the side of companies:

"So it's always interesting when you walk around the campus with entrepreneurs or other people and show them what we do here (...). And then they always say, I didn't know all that existed here" (Interview_Research Institution 2021d, p. 87).

The lack of knowledge is partly due to the fact that companies expect the university (keyword third mission (Chatterton and Goddard 2000; Holland 2001)) to approach them with concrete projects and opportunities. The interviewed actors from companies miss the initiative and the communication of the possibilities of the regional university:

"What I also said earlier is the topic of communication or open communication, transparent communication, that means, or open communication, transparent communication, that means, when I submit projects, I go into communication and actively look for a project partner from the region and don't maybe look for someone from Cologne or something" (Interview_Company 2021b, 6).

This could be interpreted to mean that research institutions do not sufficiently fulfil their third mission because they are structurally incapable, are often poorly staffed (specialists and resource problems) and often have changing personnel structures (contact persons change). But it could also be due to the fact that companies shift the responsibility for their lack of engagement onto other actors—it is always easier to say that the "others" are to blame for their own lack of information. The lack of knowledge about research collaboration opportunities is especially relevant for political actors. Companies could be supported in finding partners by certain political institutions. On the other hand, companies should also rethink their inactivity and realise that acting proactively is in their own interest (see "lack of will").

4.1.2 Regional institutions

This is where the second innovation collaboration barrier comes in: Regional institutions. A lack of or insufficient policy support is frequently stated by companies and research institutions, less so by intermediaries. Research institutions perceive political/legal framework conditions, such as the modularity of the state benefit law and the funding bureaucracy, as obstacles. One actor from a research institution describes the problem with the state benefit law:

"So that's another difficulty, which I think always really somehow ties us up are just these problems of state benefit law (...) at the moment when they have founded, they are no longer allowed to talk to them at all, so at least no longer advise, because that is then somehow a service under state aid law. They are only allowed to be active in the pre-economic area, but to advise a company that has been founded, e.g. with regard to points of support, simply as a university, that is not permitted" (Interview_Research Institution 2021d, 89).

For companies, research projects are associated with time-consuming processes and bureaucratic hurdles in the run-up to (and during) a research project, as a result of which they then partly avoid funded projects:

"The lack of a legal structure or legal certainty for collaboration between science and institutes as well as for research collaboration. The lack of financial security for risky projects" (Interview_Company 2021d, 32).

Overall, the actors from companies and research institutions in particular are calling for more and unbureaucratic support from politics. Bureaucracy is a major obstacle to research collaboration, especially for SMEs.

4.1.3 Lack of ressources

Lack of resources at the companies as well as at the research institutions themselves is perceived by researchers as a significant barrier to research collaboration. Actors from the companies and intermediaries, on the other hand, do not perceive the resource barriers in the research institutions at all or hardly at all. Experts from research institutions primarily mention resource barriers in the form of lack of time, lack of human capital and lack of funding in research institutions. Among other things, they refer to the poor financial resources of the research institutions:

"The universities themselves also have few resources to advance their regional networking as a third mission. These are the challenges that are currently hanging in the balance" (Interview_Research Institution 2021a, 20).

In general, an expert from a university described the difficult situation of research institutions as follows:

"What we do experience is that companies approach us and say: we have a problem now and would like to have this or that worked on or thought over. And then we have to say that we don't have anyone who could do it at the moment. And if you give us a job, we can hire someone, but that takes half a year and in six months we can start thinking about it. Then the company is usually gone again" (Interview_Research Institution 2021f, 79).

We conclude from this that, especially in the case of public research institutions, funding is important and necessary for collaboration to take place. In combination with the above finding that firms often expect research institutions to approach them, the lack of financial resources in research institutions also prevents getting in touch with firms:

In fact, a lot depends on funding. Because the companies don't just say on their own that we're looking for someone with whom we can do something together (Interview_Research Institution 2021b, 7).

An actor from a company comes to the conclusion that due to the restrictive, very bureaucratic and resource-intensive hurdles for funding and the associated uncertainties and high up-front costs, universities should be financed less by third-party funding and more by their own funds for research:

"In my opinion, the universities should have their own pots from which they can conduct research with existing companies or have their own budgets … which they can use to conduct targeted research and development with the companies. So, so to speak, that it is not administered by a third party, but rather that it is administered by the universities" (Interview_Company 2021e, 43).

While companies and intermediaries, except one person, are not aware of the lack of resources in research institutions, all kinds of actors see a lack of resources in companies. Resource problems seem to be particularly the case with SMEs, since they have hardly any opportunities for research collaboration due to their size. They are also too busy with the tasks of day-to-day business:

"This is the case with smaller companies that have 50 employees, where in the end 5 work in the office, maybe one of whom is responsible for sales and product, who does not have the time to go down these paths in order to deal more intensively with these people" (Interview_Company 2021a, 6).

The interesting finding is that research funds are only well suited to solve part of the resource problems. On the one hand, it delivers additional financial resources that are needed in SMEs as well as in research institutions. On the other hand, SMEs lack the staff capacity to engage especially in the often time-consuming application process and research institutions need time to get research started, so that only funds with a longer time horizon are helpful. This might be one reason for the path-dependence in UI collaboration with mainly established collaboration teams applying for funds again.

4.1.4 Lack of will

Actors from research institutions perceive research collaboration barriers significantly more often overall than other actors. This could be because they are particularly close to research and this is their political mandate. Another explanation is that the lack of will and necessity to engage in research collaboration primarily affects companies. All actors emphasise that companies in particular underestimate the importance of and the need for research collaboration. This is probably due to many reasons, but also mainly to the fact that the relevance of innovation is not sufficiently seen by companies in times with full order books:

"It's just that sometimes there is a lack of insight into the necessity on the company side, because why should you innovate because the business is humming like hell anyway and you don't even know how to get the work done" (Interview_Research Institution 2021d, 111).

But also actors from companies and especially intermediaries mention this view several times. For example, an actor from a company says in this regard:

"But the first thing is, I don't see any starting points where I say we have to do something there" (Interview_Company 2021c, 51).

Other (possible) reasons such as lack of trust, competitive thinking and secrecy obligations are also mentioned. Some companies, especially large ones, do not depend on external research collaboration because they have their own research capacities and departments:

"[Large companies] have the ideas, the people who can implement them in terms of numbers and they have the financial resources to do the whole thing. And from my point of view, they don't need to cooperate at all, they can do it quite well and they have the networks they need anyway" (Interview_Company 2021g, 55).

The lack of will combined with the missing of information about potential collaboration possibilities in companies confirms the need for initiatives from research institutions. However, except for institutions that are used to approach firms, there are neither the habits nor the resource to do this. A policy option might be to support

Table 4 Actor-specific view of research collaboration barriers

Research collaboration barriers		Research (n=9)		Companies (n=15)		Intermediaries (Chambers & development) (n=31)	
		Docs	%	Docs	%	Docs	%
Matching problems	*Missing partners*	6	66.67	5	33.33	20	64.52
	Uninformed	3	33.33	3	20.00	8	25.80
	Different culture	5	55.56	3	20.00	11	35.48
	Different topic	4	44.44	2	13.33	3	9.68
Regional institutions	*Policy support*	5	55.56	5	33.33	6	19.35
	Lack of network	4	44.44	2	13.33	5	16.13
Lack of resources	*General*	0	0.00	1	6.67	4	12.90
	In companies	5	55.56	3	20.00	6	19.35
	In research	7	77.78	1	6.67	0	0.00
Lack of will	*General*	1	11.11	0	0.00	4	12.90
	In companies	4	44.44	4	26.67	10	32.26
	In research	1	11.11	0	0.00	2	6.45

research institutions independent of specific collaboration projects for approaching companies and searching for joint research options.

To sum up, Table 4 provides an overview of the different groups of actors analysed and the actor-specific relevance of the research collaboration barriers.

4.2 The importance of barriers to UI collaboration

As described in Sect. 3.1, the regions were divided into four types of region according to their endowment with large companies and scientific output in the form of publications (Fig. 1). In the first part of our expert interviews, we asked general questions about economic strength and economic structure (see Sect. 3.2) and asked about the reasons for the mediocre to low innovation activity. It is to be expected that the reasons here differ significantly between our four region types due to the different endowments.

4.2.1 Innovation barriers

The interviews show, however, that irrespective of the region types, almost all relevant interviewees (approx. 89%) mention the local firm population and sector composition as a central obstacle to innovation. However, the reasons differ between the respective region types: For actors from region type 1 (above-average number of large firms and research activity) these are mainly the low number of important corporate headquarters and parent companies and the industrial structural change, which makes sense especially in the case of Bochum (Opel, mining, …). There are important large companies, but often only production takes place in the regions. An actor from region type 1 describes it as follows:

> "The challenge here in the Leipzig region, or Saxony in general, is that they have few company headquarters and often the decisions about such things are made in a very centralised way in other, let's say, federal states, and in the end we always have the extended workbenches here" (Interview_Company 2021h, 4).

Actors from region type 2 (below-average research, above-average number of large companies) put forward especially the orientation towards (today) non-innovative industries and the industrial structural change in the regions. Actors from the regions of region type 3 (below-average number of large companies and research) perceive above all the small-scale economy as an obstacle, entire sectors are missing or are hardly developed (critical company mass is missing). A small-scale economy with few large companies is less innovative because it has less capacity for research. One actor describes this as follows:

> "Overall, I believe that this structure, this whole small and medium-sized business thing, is an issue. Large companies can simply produce more innovation because they have the corresponding capacities. Because they have their own R&D departments, because they have money" (Interview_Research Institution 2021c, 22).

Table 5 The three most important barriers to innovation and their significance for the respective region type

	Barriers to innovation on the following focus areas:	Region type 1 (n = 12)		Region type 2 (n = 16)		Region type 3 (n = 29)		Region type 4 (n = 13)	
		Docs	%	Docs	%	Docs	%	Docs	%
1	Regional company and industry endowment	10	83.33	15	93.75	26	89.66	11	84.62
2	Size, location, heterogeneity and image of the region	6	50.00	14	87.50	21	72.41	7	53.85
3	Research Collaboration & Collaboration	5	41.67	11	68.75	22	75.86	7	53.85

Actors from region type 4 (above-average research and below-average large companies) primarily perceive that there are no company headquarters in the region and that production is the main activity (analogous to type 1) and that the industries that exist today are not innovative (analogous to type 2). In summary, it can be said that companies play a central role in the regional innovation system and are fundamentally important for innovation performance, which is also explained in many scientific works, especially on the regional innovation system (e.g. Asheim and Gertler 2011).

In addition to size, location, heterogeneity and image of the region, insufficient research collaboration is very frequently mentioned as a barrier to innovation in all region types (Table 5). However, this plays a lesser role overall than the existing companies and there are clear differences between the region types here, even though they are mentioned in all region types. While in region types 2 and 3 the lack of innovation collaboration is frequently mentioned, it plays a somewhat lesser role in region type 4 and especially in region type 1. This will be analysed in more detail below by looking at the arguments.

4.2.2 Missing partners

Interestingly, the differences between the individual region types in arguing whether and why research collaboration is not sufficiently established smaller than expected. It would be assumed that regions with many research institutions and innovative companies would perceive research collaboration barriers less strongly; this is not the case. However, there are some differences in the arguments.

Actors from region type 1 and 2 rarely mention missing partners, as these regions have an above-average number of large companies and, in case of type 1, also research institutions. In comparison, actors from region types 3 and 4 very often perceive missing partners as a barrier. Interestingly, the lack of large innovative companies seems to be more severe than the lack of research institutions. Often, it is argued that only production is carried out in these regions (extended workbench), but not research. In addition, an SME-dominated structure as another obstacle to collaboration.

"However, if the entrepreneur's business model does not consist of R&D, there is no demand for collaboration needs, if they should be sought, they are there and can also be used" (Interview_Chamber of Industry and Commerce 2021c, 2).

Region type 4 is characterised by an above-average output of scientific publications and should therefore be sufficiently equipped with corresponding actors. Interestingly, both studied regions of type 4 are close to major cities (Berlin, Frankfurt am Main). Research institutions could therefore get to suitable research collaboration partners (companies) not too far away. Nevertheless, an actor from the Hanau region (region type 4) states:

"Well, I'll say it like this: If you want, let's say, certain funding when it comes to development, innovation, there is also in Hesse, but then you always have to have a university with you, we don't have that on site" (Interview_Regional Economic Development Institution 2021b, 21).

Although there are research institutes in the region, the lack of a university is perceived as a problem, which is not counter-balanced by the nearby university in Frankfurt. The short distance seems to be too far for some actors. However, it is noticeable that actors from region type 4 almost exclusively perceive matching problems. In this context, the different culture is also stated frequently. This is particularly true for SMEs:

"[There are] strong cooperative relationships in the direction of the universities, but I don't yet see that with the smaller and medium-sized companies. Probably one is research and the other is practice, it is always difficult to bring these together and I think the smaller ones simply don't have this on their radar" (Interview_Chamber of Industry and Commerce 2021a, 10).

For region type 3, it was to be expected that actors very often perceive missing partners of both kinds as a barrier, because these are the regions that have neither many large companies nor a noteworthy scientific output. The actors interviewed, often intermediaries, hope that the establishment of research institutions will not only lead to research collaboration but also stimulate the economy in the regions (incubator function of research institutions). Hence, although the lack of adequate companies is the more severe obstacle, especially intermediaries focus on research institutions as a solution to the problem:

"This is simply due to the lack of large companies and research and university institutions, which makes it difficult. I see this in comparison to the district of Vorpommern-Greifswald, the rest of the district is also very structurally weak, but as soon as you get to the region around Greifswald, it is completely different, because everything is represented there from research institutions" (Interview_Innovation Promotion office 2021, 6).

Actors from region type 2 and especially type 1 often put forward the different culture between companies and research institutions as a barrier to collaboration. This is probably related to the fact that with increasing options, the different culture

of the actors becomes more noticeable and more important. In the light of the above identified similar relevance of a missing of innovation collaboration among the region types (especially between types 1 and 4 as well as between types 2 and 3), one might draw the following conclusion: The lack is explained with the lack of collaboration partners in the region. If this is not the case it is explained by a mismatch of topics or by the difference of cultures. Hence, independent of the availability of partners, collaboration is not taking place sufficiently because of other obstacles and the will is not sufficiently strong to overcome them.

4.2.3 Lack of resources and will

Actors of region type 2 perceive above all the lack of resources and the lack of will as main barriers. The lack of will has many causes. One reason mentioned exclusively in region type 2 is that the large local companies try to pursue innovation exclusively internally, as one actor from a large company describes:

> "But currently it's still on the level of understanding that I have, where I transfer a lot of external requests to the internal house. It's often the case that you still get the feedback that we'd rather do it ourselves" (Interview_Company 2021f, p. 73).

Of course, large companies with their R&D departments are able to innovate without research collaboration. However, this contrasts with the arguments presented above that in region without large companies their absence is seen as a main cause for the lack of research collaboration. Companies in region type 2 seem to have become used to innovating without access to a regional research institution. In this respect, it is not surprising that they may be more closed towards such research collaboration. The increased closedness of the companies is also reflected in the lack of trust as a resource, which is mentioned quite often in this type of region:

> "I think the Coburg companies would prefer to do their thing alone, because they are afraid—otherwise someone else will profit from secret lists or disclose something" (Interview_Chamber of Industry and Commerce 2021e, 65).

This is a further indication for a strong path dependence in research collaboration. Actors who have been engaged in collaboration activities in the past are quite likely to do so also in the future, while for actors who are not used to such activity face many obstacles in establishing research collaboration for the first time. Policy intervention seems especially needed in this first establishment.

4.2.4 Regional institutions

Barriers with regard to regional institutions are very diverse. The actors in region types 1 and 3 state especially a lack of policy support. Among the many reasons of too much bureaucracy for business support, too little assistance (e.g. in the form of managers, innovation managers, etc.), legal state aid problems, infrastructural deficiencies ("It all depends on the infrastructure"; Transkript_6_10.06.21_U_1, Pos. 2),

Table 6 Distribution of research collaboration barriers by specific region type (most frequently perceived barriers for each type are highlighted)

Research collaboration barriers			Region Type 1 (n=13)		Region Type 2 (n=16)		Region Type 3 (n=30)		Region Type 4 (n=12)	
			Docs	%	Docs	%	Docs	%	Docs	%
Lack of resources			**5**	**38.46**	**8**	**50.00**	11	36.67	1	8.33
Lack of will			4	30.77	**8**	**50.00**	8	26.67	2	16.67
Matching problems	*Missing partners*	Lack of research institutions	1	7.69	4	25.00	**15**	**50.00**	**6**	**50.00**
		Lack of innovative companies	2	15.38	4	25.00	9	30.00	**6**	**50.00**
	Uninformed		2	15.38	4	25.00	6	20.00	2	16.67
	Different culture		5	38.46	5	31.25	7	23.33	4	33.33
	Different topic		1	7.69	4	25.00	2	6.67	2	16.67
Regional institutions	*Policy support*		4	30.77	3	18.75	11	36.67	1	8.33
	Lack of network		4	30.77	5	31.25	4	13.33	1	8.33

it stands out that in some regions past political mistakes have a strong influence on the composition of the current economic actors:

> Of course, there was also a great deal of incompetence and ideological aspects of some who remained in the house and are perhaps even in it to this day. This time could have been shaped differently for Gera, we didn't have much luck with the elected mayors (Interview_Politics 2021, 21).

Especially in the case of regional institutional barriers, political actors can have a formative effect. Politicians and actors in economically isolated regions could be given expert support, e.g. through political and economic consultancy, to make the regions more economically sustainable and innovative. It may also be possible to create structures that have a stabilising effect on the regions.

4.2.5 Region type and innovation collaboration

Overall, it can be deduced from the statements that if companies or research institutes are missing or do not fit, this is perceived as a research collaboration barrier; if not, other research collaboration barriers are in focus (see Table 6). In this respect, it is not necessarily the lack of one or more research institutions in the region that is really the decisive point, but probably rather the associated large initiation effort, the low level of willingness, the overlooking of the need for collaboration, reservations and prejudices towards collaboration partners and the lack of management of a network in the regions (establishing connections, etc.). Of course, geographical distance is also a determinant that negatively influences these factors, which has already been well elaborated in the literature (e.g. Boschma 2005; Lopes and Lussuamo 2021). Nevertheless, initiating research collaboration is always a difficult undertaking. The presence of the actors only means that policy can better intervene because other barriers can be addressed.

5 Conclusions

Research collaboration is important for the companies and their innovation performance on the one hand, and for the region and its development on the other. We examined the barriers to research collaboration in ten regions and obtained a lot of detailed insights. They can be summarized into two main findings that go beyond the existing literature. First, we find no major differences in the overall relevance of a lack of research collaboration for the innovativeness of the region between region with or without many large firms or research institutions. We conclude that if companies or research institutes are missing or do not fit, this is perceived as a research collaboration barrier, if not, other research collaboration barriers are in focus. Hence, research collaboration is always not done as much as it could be done independent of the regional endowment. Second, we show that different stakeholders have different interests and face different barriers, but that there is a division of labor in innovation processes on the regional level. As a consequence, the quality of regional innovation systems strongly depends on how easy it is to establish cooperative relationships and the ability to manage research collaboration barriers within the regional network.

In more detail, we were able to identify the following differences and similarities between the actor groups and region types. **Firstly**, matching problems are perceived as the dominant collaboration barrier by all kinds of actors. However, the reasons for the matching problems differ. Actors from regions with many large companies (types 1 and 2) rarely perceive missing partners as a problem, while actors from region without large companies (types 3 and 4) often state missing partners as a main issue. The presence of large companies seems more relevant for this barrier than the presence of research institutions, although intermediaries in particular emphasise research facilities as a solution to the problem of low research collaboration. **Secondly**, the lack of resources in research institutions is (almost) exclusively perceived by them as a dominant barrier. The lack of will, on the other hand, is more of an issue for companies. We conclude from this that it is primarily public research institutions that need to be supported through funding so that collaboration is carried out. Intermediaries and universities in particular accuse companies of not recognising the necessity and relevance of research collaboration and therefore remaining inactive. This results in a strong path dependence in collaboration activity. **Thirdly**, across all groups of actors and types of region, different culture between universities and companies is perceived as a significant barrier to research collaboration. Universities are slower and more sluggish than companies, have a different focus, different success factors and goals (theory vs. practice). This difference in culture seems to be more severe for SMEs and research institutions. **Fourthly**, policy support is difficult, especially for companies and research institutions. This is due to high bureaucratic hurdles (for funding projects), modularies of state aid law, lack of legal certainty for collaboration between science and institutions as well as for research collaboration and a lack of financial security for risky projects. Interestingly, this is mainly a theme in the well-resourced (Type 1) and poorly resourced (Type 3) regions. SMEs are particularly affected by this and suffer from these barriers.

The different relevance but also the commonalities in the perception of the different groups of actors help to better classify and understand the manifold research

collaboration barriers. They are of utmost relevance for policy makers. Policy actors can create better framework conditions for research collaboration; the actor-specific approach invites them to do so. For example, policy actors could improve the resource side for research collaboration at research institutions or push for information procurement/transfer between companies and research institutions. We also find that the presence of research institutions in the region is less important than is generally assumed. This finding shows, on the one hand, that simply locating a research institution in the region (as so many business promoters in our sample regions would like to see) is not the saviour per se, at least in terms of research collaboration. On the other hand, this also represents an opportunity and a call for intermediaries and policy makers to reduce the effort involved in initiating collaboration as much as possible through targeted measures and assistance. Targeted funding programmes could also reduce the effort involved in initiating new projects, including projects with distant partners, and support research institutions generally in their effort to create contacts with companies.

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