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Article

Regional resilience and innovation: paper profiles and research agenda

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Regional resilience and innovation: paper profiles and research agenda

Regional
resilience and
innovation

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Abstract

Purpose – The paper describes patterns of study on innovation in the regional economic resilience literature regarding methods and findings.

Design/methodology/approach – This study is a descriptive one and it uses, as a method, the scoping review based on Scopus and Web of Science databases. Forty-eight theoretical-empirical papers were thematically coded, and analyses were conducted using R packages and MaxQDA.

Findings – Innovation has been used narrowly in the regional resilience literature, considering the variables, the types of shocks and the analyzed loci. From the sampled papers, this study suggests that, depending on the operationalization, the addressed relationship can be positive or negative, which still needs further investigation. In addition, the study identified two lines of research. The first, characterized by quantitative research, secondary sources and multivariate analyses, focuses on testing predictive regional resilience models based on innovation-related variables. The second, characterized by qualitative or multi-method approaches, is more concerned with explaining the knowledge accumulation and the learning capacity related to regional innovation.

Research limitations/implications – The paper's findings show a restricted view of the innovation-resilience relationship. Although this study does not present a meta-analysis, it reveals gaps for future research. Some suggestions can be highlighted, such as (1) expanding knowledge about innovation as a predictor of resilience, (2) the theoretical development of this relationship to guide empirical investigations and (3) studies that consider the meso or micro level, approaching the role of actors in fostering innovation in the regional resilience process.

Originality/value – This paper fulfills an identified need to investigate how innovation has been operationalized in regional resilience empirical research.

Keywords Resilience, Regional resilience, Innovation, Scoping review

Paper type General review

1. Introduction

Regions are susceptible to the occurrence of events with adverse economic effects. For example, the 2008 global economic and financial crisis affected industries and regions in different countries. In Sweden, AstraZeneca announced the closure of facilities in two regions between 2009 and 2012, affecting several workers (David, 2018). In Oulu, Finland, thousands

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of people lost their jobs between 2009 and 2014 due to the collapse of Nokia's mobile phone business (Simonen, Herala, & Svento, 2020). Between 2015 and 2016, Brazil went through a political-economic crisis with a worsening fiscal situation and increased uncertainty, ending a period of expansion (Tupy, Silva, Amaral, & Cavalcante, 2021). We can also add to this list the negative economic impacts caused by the COVID-19 pandemic. The regional literature on resilience emerged as an offshoot of efforts to address challenges like these.

Resilience applied to regions refers to their economic capacity to face or recover from market, competitiveness and environmental shocks for their developmental trajectory through adaptive changes (Martin & Sunley, 2015). The regional literature on resilience presents the equilibrium-centered and evolutionary perspectives as the two main theoretical frameworks for studying the phenomenon. From a perspective centered on equilibrium, resilience can be understood as a return to the pre-shock growth trajectory and partial absorption of shock without significant structural changes, generating new growth trajectories (Modica & Reggiani, 2015). From an evolutionary perspective, resilience is the regional capacity for a continuous adaptive process regardless of the incidence of shocks (Martin & Sunley, 2015).

Although there is still no consensus on the concept of regional resilience, the literature has converged on some trends. First, there is a growing understanding of regional resilience as a multifaceted phenomenon, encompassing resistance and recovery as well as vulnerability and reorientation (Evenhuis, 2017; Martin & Sunley, 2015). Second, resilience can vary across aspects of the economy, such as jobs or wealth-generated proxies (Sensier, Bristow, & Healy, 2016; Xiao & Drucker, 2013). Third, the nature of shocks plays a significant role, as it guides responses to the resilience of what, to what and for whom (Hu, Li, & Dong, 2022). Fourth, experts see resilience as a multi-scalar phenomenon dependent on regional endowments, context and regional actors (Bristow & Healy, 2018; David, 2018; Hu *et al.*, 2022). Moreover, a key research topic in this literature concerns the diversified performance of regional economies to shocks.

From literature reviews on sources and determinants of regional resilience (Evenhuis, 2017; Miranda & Hoffmann, 2021), we know that both the equilibrium and the evolutionary perspectives have strongly associated resilient regional capacity with its innovative (Simmie, 2014) and entrepreneurial performances (Huggins & Thompson, 2015). We also know that innovation and learning capabilities are essential sources of reorientation of industrial and technological structures over time (Bathelt, Munro, & Spiegel, 2013; Stognief, Walk, Schöttker, & Oei, 2019). In addition, we know that innovative regions tend to be more resilient during and after an economic crisis (e.g. Filippetti, Gkotsis, Vezzani, & Zinilli, 2020; Hu *et al.*, 2022; Martini, 2020; Wang & Li, 2022), although the relationship between innovation and resilience cannot be taken for granted (Bristow & Healy, 2018; Calignano & De Siena, 2020; Romão, 2020). Furthermore, we also know that Schumpeter's (1947) creative response—encompassing both the capacity to innovate and the cumulateness of knowledge (characteristics of creative accumulation) and the role of new and innovative entrepreneurs (marks of creative destruction)—is conducive to resilience (Filippetti *et al.*, 2020).

However, the way innovation has been operationalized in empirical research on regional resilience is still an open question, and awareness of it is essential in theory and practice. It is so because the evidence provided in the literature on how innovation is positively associated with the resilience of regions comes from specific methodological approaches—and, consequently, from inherent epistemological assumptions. This paper sheds light on this topic by describing patterns of study on innovation in the regional economic resilience literature regarding methods and findings. We carried out a scoping review based on peer-reviewed research published over a decade, from 2007 to 2020. In total, 48 papers were thematically coded. Analyses were conducted using R packages and MaxQDA.

Two contributions stand out. First, the paper identifies how innovation has been operationalized in regional resilience literature and its main results. This identification can

serve as a subsidy for developing econometric models and theories besides guiding the work of researchers, professors and managers. The second contribution is related to pathways for future research. Among suggestions, we highlight a need to expand the boundaries of knowledge about innovation as a possible predictor of regional resilience and further develop this relationship to guide empirical investigations. Furthermore, studies addressing the meso or micro level are recommended, considering different contexts and the role of actors in promoting innovation in the regional resilience process.

2. Method

We have conducted descriptive research through a scoping review, an appropriate method for mapping evidence, describing investigation patterns, identifying knowledge gaps and defining research agendas (Munn *et al.*, 2018). Having defined the research issue, we followed the steps: data collection, analysis and results description.

2.1 Data collection

The search terms were defined based on the research objective, out of reviews on regional resilience (Miranda & Hoffmann, 2021; Silva & Exterckoter, 2016) and papers on the theme (e.g. Boschma, 2015; Martin & Sunley, 2015; Simonen *et al.*, 2020), identifying the use of terms in titles, abstracts or keywords. The string of characters adopted was: [“regional resilience,” “regional economic resilience,” “resilient region” or (“regional development” and “resilience”) and (innovation)]. The search was performed on Scopus and Web of Science (WoS), representing two of the central academic databases (Aria & Cuccurullo, 2017).

Scanning was performed in May 2021, considering titles, abstracts and keywords, in addition to keywords-plus in WoS. We defined 2020 as the final year of publication, assessing the timeliness of the research process and replicability. Even so, a paper published in 2021 (Capello & Caragliu, 2021) was retrieved due to the release of immediate access in 2020. Only papers published in journals were selected, as they were considered the most useful for literature reviews (Saunders, Lewis, & Thornhill, 2019). Due to the multidisciplinary nature of studies on regional resilience (Christopherson, Michie, & Tyler, 2010), all areas of knowledge were considered in the search.

We performed the data screening using Bibliometrix (Aria & Cuccurullo, 2017), an R language package. Data from the two databases were combined, totaling 117 records, 42 from Scopus and 75 from WoS. Then, 29 duplicate documents were removed, resulting in 88 papers. Data were also filtered, considering quality criteria and selecting those papers published in journals indexed in Citescore or Journal Citation Reports (JCR)—since they consider citations in Scopus and WoS, respectively. Ten papers were removed, resulting in 78 papers. Then, the title, abstract and keywords were read to verify their eligibility for the topic. Nine papers were removed, resulting in 69 papers. Subsequently, all documents were read in whole to determine eligibility. We considered only papers that addressed regional resilience. Thus, nine removals were carried out, totaling 60 papers. Considering our objective, we also removed 12 nonempirical papers, so 48 documents formed our final analysis *corpus*. The 48 sampled papers were published between 2007 and 2020, in addition to the paper by Capello and Caragliu (2021).

2.2 Data analysis

The papers were tabulated considering nature, approach, design, data source, method, type of shock and *loci*. We then used multiple correspondence analysis (MCA) to identify profiles of similarly categorized papers (Kassambara, 2017). The R language packages FactoMineR (Lê, Josse, & Husson, 2008) and Factoextra (Kassambara & Mundt, 2020) were adopted.

We did not consider the type of shock and the *loci* in the MCA, as there was no correspondence between these categories and the research profiles. However, we used them for descriptive analysis. Furthermore, as MCA is a technique sensitive to atypical cases (Hair, Black, Babin, & Anderson, 2018), data from the paper by Xiao and Drucker (2013) were removed from the database before proceeding with the analyses. The reasons are explained in the next section.

In addition, the variables used to operationalize innovation were divided into four categories used in the development of the regional innovation scoreboard (RIS) indicator (European Commission, 2019): (1) framework conditions, (2) investments in innovation, (3) innovation activities and results and (4) impacts of innovation. A residual category was also created to contemplate general indicators such as the RIS itself. Finally, we performed a content analysis using the MaxQDA software to highlight the empirical findings of the papers.

Our options present some limitations. First, identifying broad patterns in research on innovation and regional resilience may only partially represent some of the papers in the sample. Yet, it allows for examining the research profiles that deal with the themes. Second, we list variables used explicitly to operationalize innovation or the ability to innovate. Thus, other related variables must be categorized, especially regarding structural conditions. Third, our paper is also limited in not presenting a meta-analysis. Nevertheless, while we recognize this limitation, we understand that the mapping performed is helpful for both researchers and managers.

3. Results

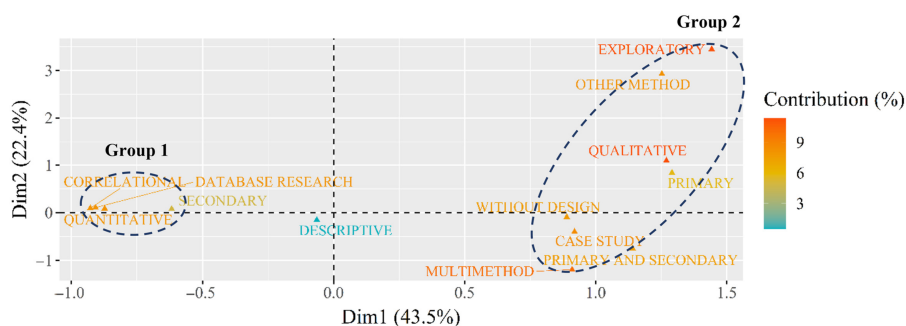
3.1 Characterization of papers on innovation and regional resilience

We started this section with the categories used to classify the papers. Most papers are descriptive—a trend pointed out in the literature on regional resilience (see Fingleton, Garretsen, & Martin, 2012), two are exploratory (Bellini, Grillo, Lazzeri, & Pasquinelli, 2017; Lee, Moon, Cho, Kang, & Jeong, 2014) and one is explanatory (Xiao & Drucker, 2013). In addition, there is a prevalence of quantitative studies using secondary data (more than 55%), particularly with correlational design and multivariate analysis techniques. This result aligns with more comprehensive reviews on regional resilience (Miranda & Hoffmann, 2021; Silva & Exterckoter, 2016). Furthermore, the most studied type of shock was the economic one, emphasizing the 2008 crisis, considering European regions.

By categorizing the papers and the MCA, it was possible to create a perceptual map, highlighting the existence of two large groups (Figure 1). Group 1, on the left of the map, has a well-defined profile, considering the distance between the subcategories (see Kassambara, 2017). A quantitative approach, secondary data, database research and correlational design characterize it. Group 2, on the right of the graph, is more heterogeneous and characterized by case studies and other methods based on a qualitative or multi-method approach and research without experimental or correlational design.

The first dimension retains more than 40% of the total data inertia, with the two dimensions having 65.9%. While the first dimension is responsible for separating the profile of papers into two groups, the second presents the heterogeneity of Group 2. In addition, the subcategory referring to descriptive research is not well represented on the perceptual map because it is close to the origin of the graph (see Kassambara, 2017), due to the high frequency of studies of this nature in both mapped groups. Through the colors, it is also possible to observe the contribution of each subcategory. Except for the descriptive research, the others are well represented on the perceptual map.

It is worth highlighting the variables used to operationalize innovation (Table 1). Papers are listed in ascending order of year of publication, while variables are listed in descending order of frequency, from left to right. In addition, variables also have information about the category to which they belong, indicated between parentheses.



Note(s): Without design = without experimental/correlational design

Source(s): Elaborated by the authors

Figure 1.
Perceptual map of the
analysis subcategories

Innovation was often operationalized through four variables: undergraduate degree, patents, research and development (R&D) spending, and employment in knowledge-intensive activities (KIAs). In addition, some papers sought to expand the limits of knowledge by introducing new variables. Aside from the case of [Pinto \(2015\)](#), no other document in the sample used scientific publications or new foreign companies as proxies for innovation. Employment in the creative class was only identified in another paper, whose first author is also Hugo Pinto. Only [Guan et al. \(2018\)](#) used science and technology (S&T) institutions or projects and the output value of new products. In addition, other variables were used for the first time in the last two years covered by this research (2019–2020), such as new products or processes, adult literacy rate, training and development and trademarks.

3.2 Overview of the main findings of the papers

We have divided the presentation of the papers' main findings into two subsections, considering the perceptual map ([Figure 1](#)).

3.2.1 Determinants of regional economic resilience and innovation resilience. Considering Group 1 ([Figure 1](#)), we initially approached studies that deal with innovation as a possible source of regional resilience. The results are mostly positive and significant, with a concentration (over 60%) on three variables: patents, R&D spending and graduates. In the few studies that used resistance and recovery indexes, patents were related to both dimensions in European regions ([Filippetti et al., 2020](#)) and only to recovery in Chinese cities in the Pearl River Delta ([Du, Zhang, Ye, Jin, & Xu, 2019](#)). These findings suggest differences in the relationship between patents and dimensions of resilience in different institutional contexts. Furthermore, although R&D spending results were often positive, this variable was negatively related to regional resilience in [Romão \(2020\)](#), which focused on European regions where tourism is a priority.

We highlight human capital as a possible source of resilience, with the degree of qualification being relevant. High school was negatively associated with regional resilience ([Svoboda & Klementova, 2014](#)). However, technical education and undergraduates showed a predominant positive link (e.g. [Duschl, 2016](#); [Eraydin, 2016a, b](#); [Rios & Gianmoena, 2020](#); [Rizzi, Graziano, & Dallara, 2018](#); [Svoboda & Klementova, 2014](#); [Xiao & Drucker, 2013](#)). The argument is that the endowment of human capital enables the adoption of strategies aimed at better performance in the event of shocks ([Rios & Gianmoena, 2020](#)). However, [Romão \(2020\)](#) identified a negative relationship between the percentage of undergraduates and regional resilience. [Muštra, Šimundić, and Kuliš \(2020\)](#) also pointed out that the increase in the number of people with higher education was related to a lower probability of a European region

	Output value of new products (Im)	Trademarks (R)	Training and development (Iv)	New foreign companies (F)	Scientific publications (F)	S&T institutions or projects (F)	Adult literacy rate (F)	New product or process (R)	Employment in the creative class (F)	RIS (O)	ICT infrastructure and digitalization (F)	Secondary or technical education (F)	External connections (F)	Employment in KIAs (Im)	R&D spending (Iv)	Patents (R)	Undergraduate degree (F)
Clark <i>et al.</i> (2010)																	
Xiao and Drucker (2013)																	
Svoboda and Klementova (2014)																	
Balland <i>et al.</i> (2015)																	
Pinto (2015)																	
Duschl (2016)																	
Eraydin (2016a)																	
Eraydin (2016b)																	
Holl and Rama (2016)																	
Bristow and Healy (2018)																	
Guan <i>et al.</i> (2018)																	
Rizzi <i>et al.</i> (2018)																	
Du <i>et al.</i> (2019)																	
Lee <i>et al.</i> (2019)																	
Li <i>et al.</i> (2019)																	
Pinto, Healy, <i>et al.</i> (2019)																	
Stognief <i>et al.</i> (2019)																	
Brown <i>et al.</i> (2020)																	
Calignano and De Siena (2020)																	
Filippetti <i>et al.</i> (2020)																	
Martini (2020)																	
Muštra <i>et al.</i> (2020)																	
Rios and Gianmoena (2020)																	
Romão (2020)																	
Simonen <i>et al.</i> (2020)																	
van Aswegen and Retief (2020)																	
Capello and Caragliu (2021)																	

Note(s): Categories: F = Framework conditions; R = Activities and results of innovation; Iv = Investment in innovation; Im = Impact of innovation; O = Others; R&D = research and development; KIA = knowledge-intensive activity; ICT = information and communications technology; S&T = science and technology

Source(s): Elaborated by the authors

Table 1.
Variables used to operationalize innovation in the sampled articles

presenting higher levels of resilience in the face of the 2008 financial crisis. Furthermore, a quadratic relationship between human capital and regional resilience was pointed out (Xiao & Drucker, 2013).

We also found positive results for other variables in the relationship with regional resilience, such as employment in KIAs (Eraydin, 2016a; Li, Zhang, & Li, 2019; Rizzi *et al.*, 2018;

Svoboda & Klementova, 2014), external connections (Eraydin, 2016a, b; Rios & Gianmoena, 2020), information and communications technology (ICT) infrastructure and digitalization (Eraydin, 2016a), RIS (Muštra *et al.*, 2020) and trademarks (Filippetti *et al.*, 2020). On the other hand, employment in the creative class was negatively associated with gross domestic product (GDP) growth and positively linked with unemployment growth, which suggests a severe impact on the creative sectors due to the 2008 economic shock (Pinto, Healy *et al.*, 2019). Furthermore, there is a contrast to be noted. In Calignano and De Siena (2020), covering 110 Italian provinces (NUTS3), employment in KIA had a negative (nonsignificant) link with employment resistance. However, in Martini (2020), with regions in the same country (NUTS2), patents and R&D spending were positively (significantly) related to regional resilience, measured by the GDP growth rate (2008–2012).

It is also noteworthy that some variables may be weakly related to regional resilience but be complementary to other possible predictors (Rios & Gianmoena, 2020). This result reinforces the understanding that no single ideal path exists for all regions to innovation as a source of regional resilience (Bristow & Healy, 2018). The substitutability amongst variables can also be considered, as in the case of external connectivity and the quality of government—identified as one of the most robust sources of regional resilience by Rios and Gianmoena (2020). The justification is that a lower quality of public services and elevated levels of impartiality and corruption are barriers to foreign trade (Rios & Gianmoena, 2020).

Still considering Group 1, other papers addressed innovation resilience, focusing on the ability to produce knowledge in times of shock. In Pinto (2015), the dependent variable “patents” was positively linked to R&D spending, regional clusters’ capacity, and the GDP level. Balland, Rigby and Boschma (2015) showed that cities in the United States with access to innovative technologies were less vulnerable and presented a greater capacity for resistance and recovery. Another study found that Spanish companies with more patent applications were less likely to halt R&D spending, revealing a regional effect on innovation spending (Holl & Rama, 2016). Pinto, Healy *et al.* (2019) point out among the sources of innovation resilience, measured by the growth of spending on R&D: patents, employment of the creative class and participation in the Eurozone. Furthermore, Lee, Chen, Lin and Su (2019) identified high-quality collaboration and diverse technical knowledge as predictors of technology resilience.

3.2.2 An in-depth looking. Considering the papers that investigated the process of regional resilience in greater depth (Group 2), a point worthy of highlighting is the role of different actors in promoting resilience. For instance, David (2018) reported how two regions in Sweden (Lund and Södertälje) responded differently to the shock caused by the discontinuation of AstraZeneca’s R&D units. While in Lund an adaptation strategy was adopted, with no rupture with the initial purpose of the facilities, in Södertälje the new park focused on three sectors (food, sustainable manufacturing and biotechnology) with the capacity to promote adaptability (David, 2018). In Oulu, in reaction to the “Nokia shock,” workers, companies and other organizations promoted Schumpeterian creative destruction, enabling what the authors called “creative resilience” based on knowledge creation, entrepreneurship and community spirit (Simonen *et al.*, 2020, pp. 15–16).

A second point—derived from the first one—refers to the role of relationships in promoting knowledge and innovation (David, 2018; Hervas-Oliver, Jackson, & Tomlinson, 2011; Luthé, Wyss, & Schuckert, 2012; Simonen *et al.*, 2020; van Aswegen & Retief, 2020). It has also been pointed out that the relationship between actors can be driven by shocks and can only be temporary (David, 2018). In addition, opportunities for improvement were identified, corroborating the practical nature of the debate on regional resilience. Brown, Kalafsky, Mawson and Davies (2020) suggest that support organizations should play an active role in responding to shocks, given the low demand for support from these organizations and the strategic inaction of several Scottish SMEs due to Brexit. In the

regional innovation system of the Algarve, Portugal, the low internal density of the network and dependency on few intermediaries made it more vulnerable, which points to the promotion of cooperation for innovation (Pinto, Nogueira *et al.*, 2019).

As a third point, it is worth mentioning the external connections of a region. Hervas-Oliver *et al.* (2011) showed that, in addition to the horizontal relationship between local companies, the North Staffordshire ceramics industrial district could benefit from external sources of knowledge (global pipelines). Another case refers to the manufacturing industry of Canada's Technological Triangle, which managed to adapt in response to the economic shock of 2008, creating process and product innovations through the recombination of resources, retention of human capital in the region, and access to international producers and customers (Bathelt *et al.*, 2013). Furthermore, in peripheral Norwegian regions with negative growth trajectories, Carlsson, Steen, Sand and Nilsen (2014) report how restructuring programs, which function as policy instruments to promote resilience, could benefit even more from external linkages.

4. Discussion and future research

Our findings show a limited view of innovation in the literature on regional resilience. There is a concentration of papers on European regions and the 2008 financial crisis. Innovation—or its capability—has predominantly been operationalized through four variables: undergraduate degree, patents, spending on R&D and employment in KIAs. In comparison, innovation as a new or improved product or process (OECD, 2018) was not examined as a possible predictor, although it was used descriptively. Considering that the very nature of the shock is a starting point for understanding regional resilience (Hu *et al.*, 2022), at this stage, it may be premature to draw broad conclusions about the addressed relationship without emphasizing the researched contexts. Additionally, it is not only the listed proxies that capture innovation.

We suggest the existence of two research lines from the sampled articles. The first one, characterized by quantitative research, secondary sources and multivariate analyses, focuses on testing predictive models of regional resilience based on innovation-related variables. It carries an implicit assumption of data availability, which may help explain the low frequency of studies in regions of developing countries. The results are mostly positive, focusing on patents, R&D spending and graduates, further narrowing the range of variables. The second line of research, characterized by qualitative or multi-method approaches, is more concerned with explaining the process of knowledge accumulation and learning capacity related to regional innovation.

Spending on R&D and patents need some reflection. First, these variables are proxies of technological innovation and capture different moments of the innovation process. The first—R&D—refers to the inflow of financial resources, and the second—patents—refers to successful results. Second, these variables may not capture innovation in service sectors or incremental changes in products and processes (Calignano & De Siena, 2020; Pinto, 2015). Third, spending on R&D as a proxy for innovation is related to the understanding that basic research precedes product development and the relationship with markets (Pinto, 2015). Fourth, patents are considered a “noisy” proxy because not all innovations are patented, with their propensity being affected by the effect of industry, size and business strategies (Clark, Huang, & Walsh, 2010, p. 126). For example, firms may choose to protect technologies through trade secrets (Lee *et al.*, 2019).

The link with regional resilience often conceived linearly regarding human capital may have a nuanced aspect. For instance, there may be diminishing returns from high educational levels in some regions, such as university towns (Xiao & Drucker, 2013). Furthermore, there is a suggestion that the high level of human capital may drive emigration and produce adverse short-term effects (Muštra *et al.*, 2020). Thus, although low levels of education may not bring

benefits in times of shock (Svoboda & Klementova, 2014), human capital should not be seen as a “magic bullet” for regional resistance and recovery (Muštra *et al.*, 2020, p. 966).

Our findings also suggest that operationalization can have different outcomes in the association between innovation and regional resilience, as seen in Calignano and De Siena (2020) and Martini (2020). Sensier *et al.* (2016) have shown that using employment or GDP data to measure regional resilience can yield different results. Adding distinct variables for innovation at different scales produces unique relationships, which must be appropriately interpreted to inform management practice. Thus, we suggest that the innovation–resilience relationship can be positive or negative depending on the scales and variables under analysis. Notably, this result refers to the sampled studies, whose findings are derived from the investigated contexts. As such, further studies are needed to clarify this relationship. Under any circumstances, using innovation-related variables as possible predictors of regional resilience should bring a clear warning about the operationalization of the constructs. Furthermore, we highlight that the lack of a consensual index in the literature to measure regional resilience makes meta-analysis studies a challenge.

There are also indications of a sectoral effect between innovation and regional resilience. Unlike other studies, Romão (2020) addressed only European regions where tourism is a priority, which may explain the negative associations found. Tourism has been integrated into European creative sectors such as fashion and luxury (Bellini *et al.*, 2017). Employment in these sectors was negatively impacted by the 2008 financial crisis (Pinto, Healy *et al.*, 2019). Romão (2020) pointed out a convergence process—with more developed regions showing lower economic growth and lower R&D spending but being more resilient than less developed regions. However, other studies challenge the convergence thesis. The argument is that economic constraints directly affect the innovation capacity of less developed regions, increasing divergence and reducing resilience (Martini, 2020; Muštra *et al.*, 2020; Pinto, Healy *et al.*, 2019). Thus, a recursive interaction between innovation and regional resilience is suggested.

Other findings refer not only to capacity but to the process of regional resilience. In this context, the sampled papers highlighted the roles of different actors and their relationships in promoting knowledge and innovation. These relationships may involve intra- and extra-regional actors. Even so, little is known about the processes of adaptation and adaptability of the regions in terms of innovation. In short, while the perspective of the first line of research sheds light on measuring the resilient capacity of regions in terms of performance considering innovation indicators, the second emphasizes the factors that shape innovation, using the concept of resilience broadly. In both views, the notion of resilience is still quite fuzzy.

It is worth highlighting other paths for future research. First, we suggest studies to push forward the knowledge limits about innovation as a source of regional resilience. It could lead to a greater understanding of this relationship, providing effective measures of innovation to guide policymaking (Muštra *et al.*, 2020). We emphasize the lack of studies using variables related to (1) regional research systems, (2) other investments in innovation and (3) innovation activities and results, such as the introduction of new or improved products or processes. Authors could also use different resilience proxies in addition to employment and GDP data (Romão, 2020). Other types of shocks and *loci* such as regions in developing countries, should also be examined. Furthermore, future studies could deal with predictors of innovation, increasing our understanding of critical sources of shock response and regional adaptability (Bristow & Healy, 2018), as well as with channels through which innovation functions as a source of regional resilience (Muštra *et al.*, 2020).

Even so, there is a need for theoretical development on regional resilience (Guan *et al.*, 2018; Pinto, Healy *et al.*, 2019), particularly on the relationship addressed. For instance: how does the content of innovation (e.g. incremental or radical) relate to the resilience of regions?

How do the regimes of creative accumulation or creative destruction work on this phenomenon? In this context, [Simonen et al. \(2020\)](#) recommended comparing successful and unsuccessful regions that pursued creative destruction. [Filippetti et al. \(2020\)](#), approaching [Schumpeter's \(1947\)](#) notion of creative response, consider that creative accumulation and creative destruction are not divergent regimes, conceiving both the innovative capacity and the reaction to a shock. However, the notion of response was operationalized as the dimension of recovery. In that case, we wonder if there is nothing to do but absorb the shock during the recession. Does the creative response only come after hitting the valley?

Furthermore, future research spanning the micro or meso levels is suggested ([David, 2018](#); [Eraydin, 2016b](#); [Fromhold-Eisebith, 2015](#); [Li et al., 2019](#)). While studies at the meso level allow an approximation with themes more developed in the economics and management literature (such as clusters and industrial districts), studies at the micro level capture the actors' roles in innovation and resilience. Research on both scales can benefit from a qualitative or multi-method approach that captures the actors' reactions to shocks ([David, 2018](#); [Filippetti et al., 2020](#); [Lee et al., 2019](#)) and the relationship between these responses and the outcome time horizon ([Filippetti et al., 2020](#); [Pinto, Healy et al., 2019](#)). Given the multiple levels of the source of innovation considered as a possible predictor for the resilience of regions (intra-firm, inter-firm and network level), one must ask: whose innovation? Thus, we suggest investigating which regional actors foster innovation in different contexts.

5. Conclusion

Given the growing interest in understanding what drives regional resilience, our scoping review has provided a comprehensive view of regional resilience and innovation spanning 14 years. We analyzed the intersection between the two themes through a methodological lens and provided insights based on the papers' findings. In line with [Bristow and Healy \(2018\)](#), we highlight that the relationship between innovation and regional resilience should not be taken as a simple causality, especially in the short term. Innovation has been operationalized narrowly in a relationship with regional resilience, which still lacks a consensual concept. Although there are efforts to conceptualize regional resilience, considered by many to be a confusing phrase, we conclude that the innovation background has not helped much in clarifying existing concepts. We have seen that innovation has been used generically and as a panacea for regions to achieve supposed resilience. In this way, we question whether regions are resilient because they innovate or innovate because they are resilient.

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