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Review article

Beyond the Original BRIC Model: Gaps, Limitations, and Adaptation of Community Resilience Indicators for Local Contexts

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ABSTRACT

This paper reviews the development and adaptations of the BRIC (Baseline Resilience Indicators for Communities) method for measuring local community resilience to disasters, grounded in the DROP (Disaster Resilience of Place) theoretical framework. The point of departure is the analysis of the DROP framework, which defines resilience as a dynamic process conditioned by pre-existing social, economic, institutional, and infrastructural conditions, as well as their interaction with natural systems. The first part of the paper discusses the theoretical value of this framework, as well as the practical challenges of its application arising from the limited availability of reliable data and the lack of standardized methodological approaches. The second part of the paper presents a detailed analysis of the development of resilience dimensions in contemporary literature, including socio-demographic structure, well-being and social capital, economic stability, institutional capacities, infrastructure, geographical and spatial characteristics, cooperation, and risk analysis. Through a comparative approach, it is shown that, although differently labeled, these indicators essentially converge on the same conceptual cores and reveal developmental discontinuities relative to the original DROP framework and the initial BRIC method. The central part of the paper examines the evolution of the BRIC method and its adaptations across different national contexts, including analyses of indicator applications in Norway, England, Nepal, Hungary, and Australia. Particular attention is paid to the role of the OECD methodological guidelines in indicator selection, with an emphasis on their frequent partial implementation, especially in areas related to handling missing data, relia-

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bility testing, and sensitivity analyses. In conclusion, the paper demonstrates that the BRIC method possesses high conceptual potential and broad applicability; however, without deeper contextual adaptation, stricter methodological discipline, and the integration of spatial and local approaches, its validity and operational usefulness in community resilience planning may remain limited.

KEYWORDS

Community resilience; BRIC method; DROP framework; resilience indicators; adaptation of the BRIC method; resilience measurement methodology.

1. Introduction

Disaster resilience indicators have undergone a clear trajectory of development and refinement. Over successive phases, indicator definitions became more precise, moving beyond conceptual articulation toward the specification of quantitative parameters that support more robust measurement and comparative appraisal of community resilience (Milenkovic & Cvetkovic, 2025). The BRIC methodology is grounded in the Disaster Resilience of Place (DROP) model, a theoretical framework developed in 2008 by researchers at the University of South Carolina. DROP was conceived to strengthen comparative analysis and assessment of disaster resilience at the local community level. It brings together prevention, global change, natural hazards, ecological and nature-based perspectives, and integrated planning into a unified conceptual structure for understanding disaster resilience. Importantly, the model analytically distinguishes resilience from vulnerability, defining resilience as the "ability of a social system to respond to and recover from disasters and includes the primary conditions that enable the social system to absorb impacts and cope with the disaster, as well as to adapt through post-disaster processes that will facilitate the organization of society to function, change, and learn how to respond to the threat" (Cutter et al., 2008, p. 599).

Within the DROP theoretical framework, communities are conceptualized as "all interactions of the social system within a defined geographic space such as a neighborhood, census tract, city, or county" (Cutter et al., 2008, p. 599). Although the framework was originally developed to assess resilience to natural hazards, it is also applicable to other "sudden-onset" shocks as well as longer-duration hazards, including droughts and pandemics. DROP explains how pre-existing conditions in a given place, once it is confronted by a disaster, shape the magnitude and character of impacts experienced by the community. In this logic, a more resilient community is better positioned to deploy effective response mechanisms that mitigate adverse consequences. Accordingly, hazard impacts are modeled as a function of (i) pre-existing conditions, (ii) the nature of the event itself, and (iii) the response mechanisms available and activated. A disaster is understood to occur when the absorption capacity at a given location is exceeded. At that point, resilience becomes visible as a dynamic process, influencing both the extent of recovery and the level of preparedness for subsequent events.

A core assumption of DROP is that the social resilience of a place emerges from the interconnectedness of natural systems, social systems, and the built environment. These domains operate as interdependent subsystems, such that deficiencies in one subsystem can materially reduce the community's overall capacity to absorb and mitigate disaster impacts (Miles, 2015). For instance, degradation of ecological resources (e.g., loss of wetlands or increased soil erosion) can weaken natural flood protection, thereby increasing reliance on infrastructural and institutional resources. Conversely, interventions that strengthen natural systems—such as riverbed restoration or the deployment of green infrastructure—can substantially reduce vulnerability, consistent with a broad body of climate adaptation research (Lizarralde, Chmutina, Bosher, & Dainty, 2015; Meerow, Newell, & Stults, 2016). DROP also foregrounds pre-existing conditions as a central predictor of a community's recovery capacity. In contrast to simplified approaches that operationalize resilience primarily through response capacities, DROP incorporates historical context, embedded social structures, and institutional practices (Cutter, Burton, & Emrich, 2010). This enables a clearer explanation of why two communities with comparable economic capacity may experience markedly different outcomes following the same event. Historical experience, including prior disasters, may serve as "learning catalysts," yet it can also produce durable social and infrastructural weaknesses when underlying issues remain insufficiently addressed (Aldrich, 2012).

The theoretical strength of the framework also lies in the integration of quantitative indicators with a qualitative understanding of social processes. The model operationalizes resilience across six dimensions, represented by a total of 29 indicators. These indicators capture distinct facets of resilience for analytical purposes; however, DROP emphasizes that they should not be interpreted as independent measures, but as elements embedded within an interactive, mutually influencing system. This holistic approach, although theoretically sound, poses challenges in practice for the collection of reliable, comparable data (Rufat, Tate, Burton, & Maroof, 2015). For this reason, some researchers propose integrating the DROP framework with spatial GIS analyses and dynamic simulation models to achieve greater temporal and spatial precision in resilience assessment (Cai et al., 2018). "The model represents resilience as a dynamic process that depends on pre-existing conditions, the severity of the disaster, the time between hazard events, and the influence of external factors. Although it is conceptually dynamic, immediately prior to a disaster, the degree of recovery leads to a static representation of pre-existing conditions" (Cutter et al., 2008, p. 604).

One advantage of the DROP model over other conceptual frameworks is its ability to encompass both material and immaterial resilience factors. For example, economic resources are measured by asset values and income. At the same time, social cohesion, trust in institutions, and access to information are also taken into account, which significantly contribute to a community's overall capacity (Patel, Rogers, Amlôt, & Rubin, 2017). This interdisciplinary nature of the model enables its application in different geographic and cultural contexts, making it a flexible tool for resilience assessment and planning. It stands out as one of the more comprehensive approaches to understanding community resilience, integrating multiple disciplines, from sociology and geography to ecology and urban planning. The key value of the model lies in the fact that it does not treat resilience exclusively as a "state" or "capacity," but rather as a dynamic process that changes over time depending on internal and external factors (Cutter et al., 2008; Lam, Reams, Li, Li, & Mata, 2017).

In this manner, DROP provides a conceptual bridge between preventive action and post-disaster adaptation. In addition, the DROP model is distinguished by its ability to monitor "critical points" in the life cycle of a community in relation to disasters, from the pre-event phase through response and immediate recovery, all the way to long-term reconstruction. This temporal continuum perspective makes it possible to identify weaknesses that are not visible at the moment of crisis, but manifest in later phases, such as population out-migration, economic stagnation, or loss of cultural identity (Sherrieb, Norris, & Galea, 2010). DROP is also designed to recognize the importance of multiple levels of governance for resilience. This implies coordination between local, regional, and national institutions, as well as cooperation with international organizations in cases of large-scale disasters (Tierney, 2014). In practice, this aspect of the model means that communities with better-established vertical and horizontal governance networks achieve faster and more efficient recovery.

The DROP framework is also applicable in different contexts, from risk assessment in coastal urban zones to the analysis of the resilience of rural communities affected by droughts. For example, in a study analyzing the resilience of communities in Louisiana after Hurricane Katrina, the model showed that communities with higher social cohesion and local risk knowledge recovered more quickly, even when they experienced significant material damage (Peacock, Van Zandt, Zhang, & Highfield, 2014). Similarly, the application of the DROP framework to assess resilience during the COVID-19 pandemic in rural areas showed that the institutional dimension (e.g., availability of health services and interoperability of communication) plays a key role in mitigating adverse effects (Fekete & Sandholz, 2021). In this case, communities with developed systems for the rapid dissemination of relevant information and a high level of social connectivity experienced fewer disruptions to basic functions than communities that lacked such systems. While the application of the DROP framework in the analysis of the consequences of the 2010 earthquake in Chile showed that the combination of strong infrastructural resilience and a high level of trust in local institutions can significantly shorten recovery time, even under conditions of extensive material damage (Contreras, Blaschke, Kienberger, & Zeil, 2013).

In summary, the practical value of the DROP framework is also reflected in its potential as a basis for adapted resilience measurement tools, such as the BRIC method. In this way, local governments can integrate results based on the DROP framework into the assessment of their risk management plans in order to prioritize investments in areas where resilience will be increased the most. At the same time, the model can serve as an educational framework for training civil protection officers and local leaders, enabling them to understand the interdependence of resilience factors better and plan preventive measures more effectively (National Academies of Sciences, Engineering, and Medicine, 2019).

2. Development of BRIC Resilience Dimensions within the Theoretical DROP Framework

When reviewing the indicators used to assess local communities' disaster resilience, their operational use in empirical research, and the ways in which they are adapted across different approaches and models—including the BRIC methodology grounded in the DROP theoretical framework—a number of substantive conclusions can be derived.

Across the scientific literature, resilience indicators are most frequently structured into eight broad dimensions: socio-demographic structure, community well-being, economic stability, institutional capacities, infrastructural development, geographic and spatial characteristics, inter-community cooperation, and risk analysis. While individual studies sometimes vary in how these dimensions are labeled, the underlying content largely converges: the categories typically comprise identical or closely related indicators that are conceptually aligned with the intended meaning of each dimension (Milenković, Cvetković, & Renner, 2024).

Within the socio-demographic dimension, a substantial proportion of the variables identified in the literature are designed to capture the resilience of contemporary urban communities. Together with economic characteristics, these indicators form a core basis for evaluating a local community's capacity to sustain resilience and maintain functionality over a longer time horizon (Ji, Wei, Shohet, & Xiong, 2021). The socio-demographic set typically includes variables that directly reflect the population's ability to confront adverse events and crisis conditions (Cvetković, 2023; Scherzer, Lujala, & Rød, 2019). The most frequently emphasized indicators include age (expressed through the proportional shares of defined age cohorts), gender, sensitive segments of the population (those highly vulnerable in the event of a disaster), the share of women in the available labor force, population density in urban communities, the average household size, the demographic dependency ratio, and educational status.

A defining feature of this group is its amenability to generalization and measurement at the household level. A common assumption is that communities with a higher share of employed individuals are better able to support themselves during disasters and, in some cases, provide assistance to others, relative to communities with a larger proportion of minors and older adults. Moreover, awareness among the employed segment regarding local disaster resilience can exert a markedly positive effect on behavior and preparedness across hazard types (Scherzer, Lujala, & Rød, 2019). In addition, knowledge acquisition is often linked primarily to formal education, through which skills, knowledge, and competencies are developed and subsequently shape adaptive capacity and the ability to respond appropriately to disasters. Communities with a higher proportion of individuals with limited education tend to exhibit elevated vulnerability, in part because of lower readiness to undertake timely measures, actions, and procedures. Conversely, higher levels of education are associated with faster returns to everyday life after disasters, given more adequate coping responses and improved access to social and economic resources in the post-disaster period (Muttarak & Lutz, 2014).

In summary, the most important and most frequently used indicators in this group are: age; gender; the extent and characteristics of the so-called vulnerable segment of the population; labor force participation and the share of women within it; population density; household size; the proportion of the population outside working age; and educational status. When these indicators are compared with those associated with the BRIC method and the DROP framework, it is apparent that, relative to the DROP framework, indicators related to social cohesion are not included, and religious organizations are treated as a separate category. At the same time, social and value-based indicators have expanded in later work. Relative to the original BRIC method (2010), it can also be observed that certain indicators present in the initial formulation were not consistently incorporated in later scientific studies—most notably access to transportation, language competencies, and capacities for mutual communication, which were more often omitted than retained (Milenković, Cvetković, & Renner, 2024).

Community well-being, as the next dimension and its associated variables, has a strong influence on overall community resilience because it subsequently shapes the functioning and outcomes of other indicator groups in disaster contexts. Empirical findings generally indicate that communities with adequate resources can formulate and implement strategies that reduce the consequences of disasters, whereas poorer communities often lack both the resources and the practical capability to prepare in advance (Bergstrand, Mayer, Brumback, & Zhang, 2014). Broader community development can also facilitate more frequent and higher-quality communication among community members through existing organizations and activities (Milošević, Cvjetković, & Baturan, 2024). This interconnection tends to support more effective management before and during disasters, thereby strengthening resilience to disruptive events (Mohamad, Jusoh, & Kassim, 2019). Within this dimension, the religious component is frequently highlighted as particularly influential due to its relationship with social connectedness, norms regarding helping others, and readiness to interpret disasters as phenomena that may be understood as recurring occurrences. In urban communities, religious organizations can shape preparedness, especially where a high share of individuals hold deeply rooted belief systems; such contexts are often associated with a high capacity to sustain resilience and promote protective behaviors (Cvetković, Romanić, & Beriša, 2023; Kim & Marcouiller, 2018).

The most important and most frequently used indicators in this dimension include: community awareness of disasters; communication and information transmission systems; the capacity to utilize previous experience; the ability to monitor potential risks; associations, communities, and groups established by local authorities; religious beliefs; and prevention plans. When contrasted with the BRIC method and the DROP framework, one conclusion is that, unlike the DROP framework, the examined studies did not develop indicators related to the absence of psychopathological conditions. In relation to the BRIC method published in 2010, it is also evident that it included indicators that were not consistently addressed in later research, particularly migration (population fluctuation) and the proportion of the population engaged in creative and innovative activities (Milenković, Cvetković, & Renner, 2024).

Economic conditions constitute the next dimension and are commonly used to evaluate the resilience of individuals, households, and the community overall (Mohamad, Jusoh, & Kassim, 2019). Because these variables can be measured at the household level, they enable aggregation into a cumulative profile of economic resilience. In disaster settings, they reflect the functioning of the economy across both large and small enterprises. The vitality of an urban community's economy is typically expressed through employment rates, income, retail turnover, supply chains, and related indicators (Cvetković & Šišović, 2024b; Scherzer, Lujala, & Rød, 2019). The economic resilience category generally incorporates both a static appraisal of the current state of the community's economy (economic activity) and a dynamic appraisal of the community's capacity to sustain economic growth over time (economic development) (Irwin, Schardong, Simonovic, & Nirupama, 2016).

The most frequently emphasized indicators and variables for this dimension include: financial resources for disaster response, employment rate, household income level, the proportion of the population living in poverty, and the characteristics and level of development of insurance coverage (from health insurance to other forms). When correlated with the BRIC method and the DROP framework, the conclusion is that, relative to the DROP framework, the indicators in this group are fully developed. Compared with the BRIC method published in 2010, the initial BRIC formulation included variables not identified in the examined studies, such as the GINI coefficient, the share of the population employed in the food industry, and the distribution and ratios of firms by size category. Additionally, unlike in the BRIC method, the share of women in the total economically active population is treated as a socio-demographic indicator in this framework (Milenković, Cvetković, & Renner, 2024).

Institutional indicators—together with their associated variables—function as measures of the quality of local governance and, more broadly, crisis management capacity within urban communities. In both scientific literature and practice, a prevailing view is that institutional resilience is neither static nor isolated, but rather emerges as a complex product of overall institutional performance. The core of this approach lies in institutional efficiency, understood as the capacity of institutions to deliver outcomes over time and to improve continuously (Milenković, 2025; Öcal, 2021). This efficiency has cascading effects: it supports citizens' trust, reinforces institutional legitimacy, and strengthens credibility in the public sphere. These elements, in turn, constitute sources of resilience that further enhance institutional capacity in crisis contexts (Balanggoy, 2024). Within this dimension, the role of individuals working in state institutions and occupying higher-level positions is particularly consequential, because their actions can directly shape the effectiveness of disaster response—especially through securing political support and mobilizing economic resources for recovery and remediation (Scherzer, Lujala, & Rød, 2019). The reviewed studies also highlight that communities located in closer proximity to centers of political and economic power often have greater opportunities to access resources that reduce disaster impacts. Such geographic and institutional proximity facilitates faster access to financial and organizational instruments, as well as political support, thereby strengthening resilience and accelerating recovery processes after crises (Cutter, Ash, & Emrich, 2014).

The most frequently used indicators in this dimension can be summarized as follows: availability of public and emergency services; civil protection programs; public–private sector cooperation; legislation and regulations applicable in disaster contexts; the existence of organized disaster response units; continuous population preparedness activities; disaster response plans; evacuation plans; continuity plans for local community functioning during crises; adequate spatial planning; and the share of employed persons working in local institutions. When these indicators are aligned with the BRIC method and the DROP framework, the conclusion is that, compared with the DROP framework, the institutional indicator set is more developed, including the introduction of new indicators and variables that increase the measurability of institutional resilience. Relative to the BRIC method from 2010, certain indicators were included in the initial BRIC formulation but not addressed in the examined studies, such as indicators related to flooding potential in the local community, allocations for emergency services, and fragmentation into political micro-communities. Overall, subsequent research developed more precise indicators and variables, enabling a more comprehensive assessment of institutional resilience than was available in the initial BRIC formulation (Milenković, Cvetković, & Renner, 2024).

Infrastructure, as a dimension and its associated variations, primarily concerns the resilience of residential buildings and the local infrastructure relied upon by the population. The quality of construction materials used in residential and communal structures directly influences the pace and effectiveness of post-disaster recovery (Scherzer, Lujala, & Rød, 2019). Higher-income individuals are generally able to secure higher-quality housing than lower-income individuals, which supports empirical findings on the correlation between indicator groups and their combined contribution to resilience (Muttarak & Lutz, 2014). Research further supports a direct relationship between construction materials and building processes, particularly where the objective is to ensure that residential structures and infrastructure systems can withstand disaster impacts. This relationship underscores that material quality and building standards are critical preconditions for developing and sustaining infrastructural resilience. Only where construction materials and technologies align with resilience requirements can stability and safety be achieved under unforeseen events, thereby supporting one of the foundational elements of overall community resilience (Karanci, Ikize, Doğulu, & Özceylan-Aubrecht, 2016).

The most frequently emphasized indicators in this dimension include: the share of areas covered by warning systems; building resilience assessment; building age; construction materials and quality; and the maintenance of existing infrastructure. When compared with the BRIC method and the DROP framework, the conclusion is that these indicators are more developed and more precisely defined than in the DROP framework, and that transport infrastructure is subsumed under general infrastructure rather than treated as a separate category. Relative to the BRIC method published in 2010, the initial BRIC formulation included indicators not identified in the examined studies, such as the share of mobile homes in total housing units, the share of vacant properties, hospital beds per 10,000 inhabitants, road network per square mile, precisely specified age of residential buildings, the number of hospitality accommodation facilities per square mile, and the number of educational institutions (for accommodation purposes) per square mile (Milenković, Cvetković, & Renner, 2024).

Geographical and spatial characteristics represent key determinants of local communities' resilience to different types of disasters. The diversity of geographic conditions and spatial positioning increases both the complexity and the methodological demands of resilience assessment. Coastal communities, for instance, face distinctive risks such as storm surges associated with hurricanes and tsunamis, whereas communities in high-seismic-risk zones must prioritize strengthening earthquake resilience. Preparedness measures for floods or hurricanes differ methodologically and operationally from preparedness for earthquakes or tsunamis, underscoring the necessity of contextualized approaches in the design of resilience strategies (Johansen, Horney, & Tien, 2017).

This variation in hazard profiles also exposes fundamental limitations in the scalable use of universal resilience metrics. A single measure cannot adequately capture the specificities of all hazard types, nor can it fully represent resilience across communities that differ in size, geographic location, or socioeconomic characteristics. Consequently, resilience assessment must be adapted to both hazard-specific risks and the particularities of each community. Conceptually, resilience analysis also requires attention to the interactions between spatial and temporal scales through which community life unfolds. This entails examining how populations interact with their environments and how space—through physical, social, and cultural attributes—influences behavior, cognition, and collective sentiments. Resilience is therefore not an instantaneous or isolated attribute; it is better understood as a process that accumulates over the time a community spends within a given environment. Long-term settlement and adaptation to local conditions support the gradual development of stable functioning patterns, which strengthens the community's capacity to respond to crises and catastrophic events (Cvetković & Šišović, 2024a; Quigley, Blair, & Davison, 2018).

The most frequently used indicators in this dimension include: geographic location; spatial composition; and patterns of use of different parts of the community's territory. When correlated with the BRIC method and the DROP framework, the conclusion is that, relative to the DROP model, this indicator group is dispersed and not explicitly included as such within the DROP framework; instead, relevant components appear partially within ecological and institutional dimensions, though not defined in the same manner as in the reviewed studies. Relative to the BRIC method published in 2010, this group is not included, although certain indicators related to infrastructural and community resilience may partially overlap—particularly those concerned with the spatial distribution of public institutions (Milenković, Cvetković, & Renner, 2024).

Cooperation involves the construction of a comprehensive network that integrates individuals, organizations, institutions, and governmental authorities, whose functioning enables a continuous, two-way chain of communication (Milenković, 2025). This interaction extends beyond information exchange to include mutual influence that directly shapes decision-making processes. Decisions generated within such cooperative structures are pivotal for strengthening community response capacity and sustaining resilience during disasters. In this sense, cooperation functions not merely as a communication instrument, but as one of the central mechanisms through which collective resilience is built (Milenković, Cvetković, Ivanov, & Renner, 2024; Milenković, Cvetković, & Renner, 2024).

In this context, communities can be understood as key decision-making units for planning, financing, and implementing resilience measures, while also serving as intermediaries for cooperation with private owners of buildings and utility services. Because communities provide services that meet social needs and are supported by the built environment, the performance of these systems is effectively integrated even when they are planned and constructed independently. Accordingly, resilience should be assessed at the level of the built environment as an interconnected system of subsystems, where dependencies can propagate impacts across systems and affect the community as a whole (McAllister, 2015, p. 4).

The most frequently used indicators in this dimension include: cooperation between local communities and higher levels of government in decision-making and procedural implementation; comprehensive cooperation and networking at the local level; and the inclusion of the community in disaster management governance. When aligned with the BRIC method and the DROP framework, the conclusion is that, relative to DROP, this indicator group is more developed. Within DROP, social indicators include specifications related to social networking and its embeddedness within the community. In relation to the BRIC method published in 2010, this group is not included. The BRIC social resilience indicators contain a variable labeled communication capacities, but it is limited to the share of the population with a telephone, which is considerably narrower than the broader spectrum of communication mechanisms addressed in the reviewed studies (Milenković, Cvetković, & Renner, 2024).

Risk analysis represents one of the more important proactive indicator dimensions because it enables identification of potential hotspots of vulnerability within the local community—areas where resilience would be minimal if a disaster were to occur. This group typically encompasses: the availability of relevant and up-to-date databases on risks and vulnerabilities; historical records and archival sources on previous hazardous events; databases documenting populations currently exposed to specific hazards; systematic risk assessments for individual communities; hazard-based disaster risk mapping; and programs that support timely responses to early warnings. Within this dimension, archival data on past disruptive events are particularly important. Systematic recording and preservation strengthen institutional memory and provide a foundation for learning processes and the development of mechanisms that improve resilience. In this way, archived data function as resilience indicators in a full sense, enabling the creation of forecasts and scenarios grounded in historical experience. Geographic Information Systems are especially prominent in this regard because they allow local authorities, insurance companies, and other institutions to develop precise, long-term, and sustainable prevention strategies. These technologies also play a central role in establishing and implementing early warning mechanisms, thereby strengthening protection capacity and improving the timeliness of community responses (Cvetković, Jakovljević, & Renner, 2024; Macharia et al., 2020). Furthermore, scenario analysis using advanced simulation techniques provides a methodological approach for identifying and assessing potential disaster impacts on society and infrastructure systems. The value of scenario analysis lies in its capacity to surface “surprising” threats or disruptive events that may not be captured by classical risk assessment models, thereby generating additional insights into system functioning and the resilience of critical infrastructure. These insights support decision-makers in developing more effective prevention, adaptation, and risk management strategies, strengthening safety and long-term community sustainability (Zio, 2016).

The most frequently used indicators in this group include: disaster risk databases; community hazard assessments; risk mapping; and databases on populations potentially exposed to hazards. When compared with the BRIC method and the DROP framework, the conclusion is that this group is more developed than in DROP, although within DROP certain elements similar to risk analysis can be identified among institutional indicators. In relation to the BRIC method published in 2010, this group is not included; rather, some institutional resilience indicators can partially substitute for the risk analysis dimension that has been actively applied in the reviewed studies (Milenković, Cvetković, & Renner, 2024).

3. Analysis of the Development and Adaptations of the BRIC Method

The fundamental indicators of community disaster resilience embodied in the BRIC indicators constitute a comprehensive analytical framework developed through the systematic grouping of indicators relevant to assessing communities’ resilience capacities to disasters. These indicators were further systematized into five interrelated groups that reflect the key dimensions of community resilience. Such a classification makes it possible to observe resilience not only as a collection of individual characteristics, but also as a dynamic whole in which different aspects—from social capital and institutional coordination to infrastructural robustness—act synergistically. It is precisely this approach that enables researchers and decision-makers to systematically assess the existing level of resilience and identify areas where intervention is necessary to enhance risk management capacities. The structure and categorization of the selected indicators are presented in more detail in Table 1, which serves as the starting point for further analytical interpretations and the practical application of the BRIC method (Cutter, Burton, & Emrich, 2010, p. 7).

In contrast to the initial studies that established this method, the current version includes 49 indicators across six dimensions, grouped into six clusters (University of South Carolina, 2025). These indicators can be seen as conceptual evidence of the validity of measuring baseline community resilience, as they use the so-called "pre-existing conditions" as starting parameters in their methodological foundations. The theoretical grounding for this understanding stems from the DROP theoretical framework, which provides a comprehensive conceptual approach in which spatial resilience is not treated exclusively as a response to disasters, but rather as a pre-constructed set of preconditions that enable a community to demonstrate adaptive capacity even before the catastrophic event itself. This approach emphasizes that resilience is not an ad hoc response to unforeseen circumstances but an integral quality that emerges from multiple factors, forming the basis for the systematic enhancement of risk management capacities (Cutter, Burton, & Emrich, 2010).

The original research study in which the BRIC method was formulated included an extensive indicator analysis at the level of 736 counties distributed across eight federal states in the southeastern United States. This region was selected due to its historical exposure to numerous disasters and to accelerated urbanization, which brought with them complex social and structural inequalities. Such inequalities, including racial, health, and social disparities, had a significant impact on the capacity of communities to respond adequately to catastrophic events. Precisely because of the high risk of statistical and methodological deviations, the ecological component was not included in the initial phase of the analysis. The selected indicators were subsequently organized into five thematic groups: social, economic, institutional, infrastructural, and community-based (Cutter, 2024).

Table 1. Indicator Groups for Measuring Resilience (Cutter, Burton, & Emrich, 2010).

Group of Indicators	Indicators
Social	1) Educational homogeneity; 2) Age; 3) Access to transportation; 4) Communication capacities; 5) Language proficiency; 6) Social needs; 7) Health insurance
Economic	1) Property ownership; 2) Employment; 3) Income distribution; 4) Sectoral employment; 5) Female employment; 6) Business size; 7) Access to healthcare
Institutional	1) Disaster response plans; 2) Flood protection; 3) Local services; 4) Population capacity for disaster response; 5) Political fragmentation; 6) Previous experience; 7) Civil protection; 8) Storm protection capacity; 6) previous experiences; 7) civil protection; 8) ability to protect against storms.
Infrastructural	1) Types of residential space; 2) Shelter capacities; 3) Medical capacities; 4) Road infrastructure; 5) Age of residential space; 6) Hospitality accommodation capacities; 7) Public educational institutions
Social Capital (Well-Being)	1) Population domicile stability; 2) In-migrants; 3) Voter turnout; 4) Size of the religious population; 5) Number of civil organizations; 6) Number of social organizations; 7) Share of employment in the innovative sector

The findings of the initial research that introduced the method and provided the empirical basis for subsequent applications were presented through a spatial assessment of the territories under analysis. The statistical procedure was conducted at the county level, and results were reported by positioning counties according to the lowest and highest values observed across the resilience indicators. A central conclusion was that resilience was strongest in urban settings, where particularly high values were observed within the social, economic, and institutional domains. By contrast, lower resilience in rural areas was associated primarily with institutional and infrastructural constraints. Methodologically, the BRIC approach relied on a recursive aggregation of complex datasets, reducing them to mean values. "In the initial version of the method, all indicators were treated equally, that is, they were not weighted, and their values were normalized using an equation within the range from zero to one, after which they were summed to yield the final numerical resilience score" (Cutter, Burton, & Emrich, 2010, p. 10).

In subsequent applications, the BRIC method was implemented at multiple territorial scales and across different geographic units. The analytical scope extended from national-level assessments (entire states) to highly localized applications (e.g., a single village). Although counties were used as the unit of analysis in the original 2010 BRIC study, this level of aggregation proved to be the most frequently adopted in later research.

In its original formulation, the BRIC study operationalized resilience through 36 indicators and their associated variables, organized into five indicator groups. Later studies reported substantial variation in indicator selection. In the literature reviewed, several studies employed more than 50 indicators, and in some cases the number was considerably higher (Milenković, Cvetković, & Renner, 2024).

The foundational research that established the DROP theoretical framework and the BRIC method constitutes a key starting point for subsequent conceptual and applied developments in this domain. In this regard, the 2014 study represents a particularly important milestone, as it marked a notable shift in the evolution of the BRIC approach. In that study, BRIC was applied to the entire territory of the United States, and the method was simultaneously refined in a manner that informed later applications and subsequent modifications (Cutter, Ash, & Emrich, 2014). The revised model introduced 49 indicators grouped into six dimensions, representing an expansion from the original 36 indicators across five groups. This modification reflected an effort to capture the broader specificities of the United States as a national system and to construct a more comprehensive resilience index. The initial stage of the 2014 study considered 61 candidate indicators; following validation, correlation screening, and detailed expert deliberation, the final set was reduced to 49. The study is especially influential because it established a methodological template for indicator selection in later work and for subsequent adaptations of the BRIC method. While later studies adopted diverse selection strategies, the most common procedures included expert evaluation (e.g., Delphi methods), systematic literature reviews, recommendations and guidelines issued by international organizations, and statistical techniques for assessing correlations among indicators or indicator groups. Collectively, these practices contributed to procedural standardization and enhanced the transparency of the BRIC analytical framework. The indicator group structure most frequently recognized in contemporary literature as the baseline architecture of the BRIC method is summarized in Table 2, providing a reference point for further application and development.

Table 2. Groups of Indicators for Measuring Resilience
(Cutter, Ash, & Emrich, 2014; University of South Carolina, 2025).

Group of Indicators	Indicators
Social	1) Educational structure; 2) Working-age population; 3) Access to transportation; 4) Communication capacities; 5) Language proficiency; 6) Social needs; 7) Health insurance; 8) Psychosocial support; 9) Food security; 10) Access to healthcare
Economic	1) Property ownership; 2) Employment; 3) Income distribution; 4) Sectoral employment; 5) Female employment; 6) Business size; 7) Employment in enterprises; 8) Distribution of retail outlets; 9) Public sector; 10) Energy burden
Institutional	1) Disaster response expenditures; 2) Flood protection; 3) Distance from the capital city; 4) Distance from major urban centers; 5) Political organization; 6) Disaster experience; 7) Training of the local population; 8) Population fluctuations; 9) Nuclear capacities; 10) Insurance coverage
Infrastructural	1) Types of residential space; 2) Hospitality accommodation capacities; 3) Healthcare capacities; 4) Transport infrastructure; 5) Age of residential space; 6) Shelter capacities; 7) Public educational institutions; 8) Railway infrastructure; 9) Availability of high-speed internet

Social Capital (Well-Being)	1) Population domicile stability; 2) In-migrants; 3) Political engagement; 4) Religious organizations; 5) Civil organizations; 6) Volunteer organizations
Ecological	1) Local food suppliers; 2) Disaster protection measures; 3) Efficiency of electricity use; 4) Permeable surfaces; 5) Efficient water use

In studies devoted to the development and application of the BRIC methodology, ever since the first study from 2010 led by Susan Cutter, the guidelines and recommendations of the Organization for Economic Co-operation and Development (OECD) have been predominantly used. The application of these guidelines provided an important methodological backbone, enabling indicator selection and categorization to be based on internationally accepted principles and standards. In this way, not only was the internal consistency of the BRIC method ensured, but also its comparability with other relevant studies in the field of resilience assessment (OECD/European Union/EC-JRC, 2008).

Although the OECD guidelines constituted the fundamental methodological framework for developing the BRIC method, the full spectrum of recommended steps was not implemented. In Susan Cutter's 2010 study, the application of five OECD guidelines was documented, representing an initial level of alignment with international recommendations. However, in subsequent studies, the author gradually refined the methodological approach by increasing the number of guidelines used in indicator construction. In this way, the number of applied guidelines increased over time and, in some cases, reached eight, contributing to greater complexity, reliability, and validity of the analysis (Cutter, Ash, & Emrich, 2014).

An analysis of the distribution of OECD guidelines applied in contemporary studies on the adaptation of the BRIC method shows significant variability, ranging from 3 to 9 guidelines. Within that spectrum, about one-fifth of the studies (approximately 20%) used five, six, or seven guidelines, indicating a relatively balanced selection of methodological reference points. Nevertheless, key steps are often omitted. The most frequently neglected guidelines were those related to the imputation of missing data, the conduct of reliability and sensitivity analyses of the indicators, as well as the обеспечение of transparency through traceability back to the original data sources. In addition, systematic examination of data structure and its integration with other indicator systems was often not conducted. These gaps indicate that although the OECD guidelines represented a universal methodological framework, their implementation was partial and often adapted to the specific research contexts (Milenković, Cvetković, & Renner, 2024).

Table 3. Representative Studies Related to the BRIC Method

Author and Year	Territory	Resilience	Groups of Indicators	Total Indicators
(Csizovszky, 2023)	Hungary / national level	Disasters	Social 7; Economic 7; Infrastructural 8; Social Capital 7; Ecological 7	36
(Aksha & Emrich, 2020)	Nepal / national level	Natural Disasters	Social 9; Economic 4; Infrastructural 3; Social Capital 3; Ecological 3	22
(Singh-Peterson, Salmon, Goode, & Gallina, 2014)	Australia / regional level	Disasters	Social 6; Economic 6; Institutional 6; Infrastructural 5; Social Capital 4	27
(Scherzer, Lujala, & Rød, 2019)	Norway / national level	Natural Disasters	Social 8; Economic 7; Institutional 4; Infrastructural 9; Social Capital 10; Ecological 9	47
(Camacho, Webb, Bower, & Munford, 2024)	England / national level	Disasters	Social 10; Economic 12; Institutional 6; Infrastructural 5; Ecological 3; Social Capital 8	44

The study that adapted the BRIC method for England and Norway applied the most respected OECD guidelines. In that case, the 10- and 9-guidelines were applied, respectively, except for missing data imputation, in which indicators for which data were missing were excluded (in the adaptation for Norway).

As a characteristic feature, studies relevant to the application of the BRIC method often use the Delphi technique for indicator selection. The Delphi approach involves the systematic inclusion of experts from relevant scientific and professional fields, who, in a specific national or local context, identify and evaluate indicators to measure resilience. In this way, arbitrariness in indicator selection was avoided in scientific studies, and expert consensus was applied, taking into account the specificities of each country or community. Some of these studies include (Singh-Peterson, Salmon, Goode, & Gallina, 2014; Ciccotti, Cassia Rodrigues, Boscov, & Günther, 2020; Pazhuhan, Moradpour, Hesarakizard, & Ayyoob, 2023; Talubo, Malenab, Morse, & Saroj, 2023; Cohen, Leykin, Lahad, Goldberg, & Aharonson-Daniel, 2013; Tseng, Huang, Li, & Jiang, 2022).

In studies that apply the BRIC methodology, the basis of analysis is almost always publicly available data. However, in situations where specific data were unavailable, the OECD methodology was not applied in full. Instead of imputing missing data using alternative compatible sources, which would allow greater reliability and completeness of the analysis, researchers often resorted to excluding such indicators from the model. This practice was implemented without providing clear, substantiated reasons, leading to methodological inconsistencies and potentially reducing the validity of the results. In this way, it has been shown that despite the existence of clear guidelines, their full implementation has not always been ensured in practice, leaving room for critical re-evaluation and the need for improvement of procedures, as in the studies (Csizovszky, 2023b; Scherzer, Lujala, & Rød, 2019; Bixler, Yang, Richter, & Coudert, 2021; Weaver, 2016; Aksha & Emrich, 2020; Javadpoor, Sharifi, & Roosta, 2021). In some scientific studies, based on statistical analyses, specific indicators were excluded as not yielding relevant results, i.e., they were not valid indicators of resilience. A particularly problematic aspect was the approach to indicator construction, which primarily relied on content analysis of already published research and on processing publicly available data. In such studies, models and concepts primarily developed in the United States and other highly developed Western countries were most often adopted.

Across the aforementioned approaches, the specificity of local conditions—most notably geographic, social, economic, and infrastructural differences that are essential for constructing optimal, context-adapted indicators for each state or community—has not been sufficiently incorporated. This limitation is amplified in developing countries, where publicly available data are frequently scarce, incomplete, or of uncertain reliability. Rather than addressing these constraints through fieldwork and primary data collection, many BRIC-based studies omit this step, thereby substantially reducing the analytical depth and weakening the credibility of their findings. Notable exceptions, such as Jepson and Colburn (2013), demonstrate that integrating field research and questionnaire-based data with expert-driven procedures (e.g., the Delphi technique) can generate high-value evidence and support the development of markedly more robust indicators. Implementing such an approach would deepen the analysis and provide a more realistic, context-sensitive foundation for resilience measurement—an essential precondition for constructing valid and well-calibrated composite indices.

When applying the BRIC method, careful attention must be paid to the selection and operational use of indicators within each group—particularly those capturing social, economic, and infrastructural components—because these domains represent core determinants of local communities' resilience to natural disasters. The foundational intent of BRIC, and its theoretical anchoring in the DROP framework, was to enable the "localization" of indicators and their adaptation to the specific conditions of the area under assessment, as reflected in studies that engage directly with the DROP model and its applications (Siebeneck, Arlikatti, & Andrew, 2015; Mavhura, Manyangadze, & Aryal, 2021).

Among the scientifically recognized applications of BRIC, the assessment of community resilience in Norwegian municipalities (Scherzer, Lujala, & Rød, 2019) is particularly illustrative. The theoretical framing was explicit, and the authors consistently emphasized both the preservation and the contextual adaptation of the BRIC approach. They argued that "the community resilience index for Norway should be specific to that country, and the finally selected indicators should be reasonable and justified in the Norwegian context" (Scherzer, Lujala, & Rød, 2019, p. 3). The study began with the indicator list from the original BRIC formulation and adopted a conservative strategy regarding data availability: indicators without complete datasets were excluded rather than imputed or substituted with the most recent available values irrespective of the reference year—a practice observed in some other studies. Official Norwegian institutional datasets were used as sources. From an initial pool of 139 indicators, 27 were removed immediately due to missing data, and the final index was constructed using 47 indicators distributed across six groups. These groups differed from those in the original BRIC structure, and a distinct Environment category was introduced to capture specific geographic and spatial characteristics. The final indicator set emerged from a screening procedure in which indicators were excluded if they failed to produce meaningful results, did not support identification of spatial variation between communities, or were assessed as substantively weak within a given group.

In methodological terms, the Norwegian study departed from the original 2010 BRIC implementation by normalizing index values and subsequently applying differential weights. More broadly, the literature suggests a prevailing tendency to normalize indicators to a 0–1 range, whereas fewer studies employ scaling around a base value of 0 with deviations from −1 to 1. Only a limited subset of studies applies weighting schemes based on indicator importance using procedures associated with the approach developed by Becker and colleagues (Becker, Saisana, Paruolo, & Vandecasteele, 2017). In the Norwegian application, the authors also performed a detailed appraisal of indicator definitions and relevance. First-order sensitivity indices were used within each group to quantify the relative importance of individual indicators. The resulting set was then evaluated using Pearson's correlation coefficient, leading to the exclusion of seven additional indicators. Results were presented cartographically, with standard deviation-based classification facilitating clear visualization of index performance and spatial differentiation across municipalities.

A further instructive application is the BRIC-based assessment of community resilience in Hungary (Csizovszky, 2023). Here too, the theoretical grounding was clearly stated and the study was explicitly framed as an adaptation of the BRIC model. The author also considered earlier adaptations, using the Norwegian study as a relevant benchmark and point of departure. As in the Norwegian case, the initial reference was the original BRIC indicator list; following a review of the literature, the author selected 36 indicators across five groups for the Hungarian context. Unlike the Norwegian approach, the study did not adopt a stepwise exclusion model to determine an "optimal" number of indicators; missing data were not treated as a central limitation, and the analysis proceeded using only available values. Official Hungarian institutional datasets served as the primary sources. As in the Norwegian study, index values were normalized to a 0–1 range. Subsequently, the indices were repeatedly refined within groups to retain only those considered analytically relevant. Indicators yielding extremely high or extremely low values for particular local communities were excluded on the grounds that they did not support valid inference.

A notable feature of the Hungarian study is the broader statistical validation of indicator validity and interrelationships. Pearson's correlation coefficient was used to evaluate linear association among indicators; the Variance Inflation Factor (VIF) was applied to detect potential multicollinearity; and the Kaiser–Meyer–Olkin (KMO) test was used to assess sampling adequacy for factor analysis. Based on these diagnostics, indices that failed to meet defined reliability thresholds were removed from the index set. Final results were again presented through cartographic outputs to support interpretation and spatial comparison. Standard deviation was used to highlight index performance and provide a transparent depiction of variation in resilience across local communities.

Beyond these cases, several additional studies offer methodological guidance for further research, including applications in Nepal, Australia, and England. The Nepal-focused study (Aksha & Emrich, 2020), partly due to national-context specificity, was primarily grounded in the DROP framework rather than constituting a direct BRIC adaptation. Although it does not implement BRIC in a strict sense, its methodological value lies in demonstrating how a community resilience index can be constructed through carefully selected indicators and associated variables. As such, it supports broader understanding of alternative methodological pathways for resilience assessment and the role of national-context specificity in shaping indicator design. The Australian study (Singh-Peterson, Salmon, Goode, & Gallina, 2014) is notable for retaining the original BRIC indicators in their initial form; rather than modifying the indicators themselves, adaptation occurred at the level of indicator variables using available statistical datasets. To strengthen reliability and validity, the adaptation process was additionally triangulated through interviews with relevant experts.

In contrast, the study focused on England (Camacho, Webb, Bower, & Munford, 2024) is distinctive in its comprehensive use of OECD methodology for indicator selection and index construction. The principal limitation of this approach, however, is the absence of indicator localization through empirical procedures; instead, the analysis builds on earlier work by the same authors (Camacho, Bower, Webb, & Munford, 2023), which synthesized studies applying BRIC with an emphasis on whether indicator-construction steps were implemented in line with OECD recommendations.

4. Conclusion

By synthesizing the qualitative analysis of the indicators and their variations used for measuring resilience, and by placing them within the same context of application for the final assessment of resilience, that is, for obtaining a resilience index, it is possible to draw specific conclusions regarding which indicators were not developed within the BRIC method in Susan Cutter's 2010 study, without taking into account her 2014 work, which represents an adaptation of the original method. By comparing the indicators of the BRIC method with the indicators of other methodological approaches for measuring resilience—such as the Climate Disaster Resilience Index (Prashar, Shaw, & Takeuchi, 2012), the Disaster Resilience of Communities Index (Mayunga, 2007), the Coastal Cities Resilience Index (Simonovic & Peck, 2013), the Climate Vulnerability and Capacity Assessment Index (Garg, et al., 2007), as well as other relevant methodological approaches published in earlier periods in which more than 80 indicators in total were identified—specific differences can be observed. These differences refer to indicators and corresponding indicator variations that are not applied within the BRIC method but have an influence on the optimal measurement of resilience because they take into account, or may take into account, the specificities of a particular country or territory in relation to the economic, social, geographical, demographic, and other characteristics, that is, the dimensions of resilience contained in the BRIC method. An overview of these indicators is presented in Table 4.

Table 4. Indicator Groups and Excluded Indicators in the BRIC Method (Milenković, Cvetković, & Renner, 2024).

Group of Indicators	Excluded indicators in the BRIC Method
Socio-demographic	Community disaster preparedness (partially); prior experience; social connectedness; share of the population that does not speak the national language (partially); special needs among specific population groups; access to specialized healthcare facilities; infectious disease control.
Economic	Household budgets and subsidies; business organization size; spatial distribution of retail chains; funds available for post-disaster reconstruction; level and diversity of economic resources; food security.
Institutional	First aid training and preparedness; access to healthcare services; immunization capacity; operational biological protection systems; capacity for disease research and prevention; management and regulation of natural resource governance.
Infrastructural	Residential buildings and land use; local community resources; electricity supply; water supply; transportation; utility infrastructure
Community well-being (Social capital)	Risk awareness and preparedness (partially); risk perception; religious beliefs; religious organizations; trust in government
Geographical and spatial characteristics	Hazard intensity; hazard frequency; multiplicity of risks; extent of open land; environmental protection services; biodiversity index
Cooperation	Effectiveness of local institutions (partially); cooperation with other levels of government; interconnection of institutions and organizations (partially); institutional cooperation and coordination (partially); integration of special population needs into crisis management plans; community volunteerism

The specificity of each local community emerges from the interplay between its geographical and spatial characteristics and the attributes of its social organization, which directly shape the development level of infrastructural systems, the degree of institutional maturity, the scope and quality of cooperation, capacities for conducting risk analyses, and the prevailing social and economic characteristics. It is this multifaceted constellation of factors that gives the resilience of different communities its distinctive forms and dynamics.

Considering the current, expanded formulation of the BRIC method, it can be concluded that it is structured around six resilience dimensions. Social resilience reflects a community's capacity to recover rapidly from disasters and captures demographic and social attributes, including population structure, educational attainment, healthcare capacity, and social cohesion. Within the BRIC method, this dimension is operationalized through indicators such as the population-to-education ratio, availability of communication, social cohesion measured by language proficiency, working-age population, health insurance, healthcare capacity, commodity reserves, and availability of healthcare workers.

Economic resilience measures the capacity of communities to recover, including employment levels, average household income, economic diversification, and access to financial resources. In the BRIC method, it is defined through the following indicators: property ownership, employment rate, income equality by affiliation, independence from the primary or tourism sector, income equality by gender, enterprise size, geographical distribution of large retail companies at the regional and national levels, and employment in public institutions.

Infrastructural resilience measures the availability and quality of infrastructure, such as the transport network, healthcare facilities, utility services, and access to drinking water, as well as the capacity to maintain logistical communication and transport during disasters. In the BRIC method, the following indicators are defined: types of housing structures, availability of temporary and service accommodation, healthcare accommodation capacity, evacuation road routes, quality of the housing construction stock, availability of temporary shelters, availability of educational institutions, logistical infrastructure, and broadband internet services.

Institutional resilience encompasses the ability of local and state institutions to plan, coordinate, and implement risk management activities, including disaster prevention and response, through emergency plans, preparedness of local response teams, and civil protection capacities. In the BRIC method, it is defined through the following indicators: expenditures for disaster response, insurance against natural disasters, coordination of competences, experience in providing disaster assistance, local disaster training, the relationship between local and state authorities, proximity to large urban conglomerations, population stability within the territory, distance from potential accident-prone areas, and insurance of agricultural activities.

Social well-being resilience integrates the community's capacity to facilitate easier communication and coordination during disasters by fostering interpersonal relationships, awareness, and mutual connectedness among individuals through organizations and joint activities. In the BRIC method, it is defined by the following indicators: local population domicile stability, political engagement, religious beliefs and religious organizations, civil society organizations, humanitarian and volunteer organizations, and civic preparedness and disaster response skills.

Ecological resilience concerns the assessment of the resilience of resources to disasters, including the capacity of ecosystems to regenerate after stress events and resilience to climate change. In the BRIC method, the following indicators are used: local food suppliers, disaster protection measures, electricity use efficiency, permeable surfaces, and efficient water use.

Within the BRIC method, however, a shortcoming is observed in the indicator dimensions, which are insufficiently precise to encompass the aforementioned specificities adequately. Therefore, in the method's modification and further development, it is necessary to integrate new or adapted indicators to enable a more comprehensive and accurate determination of the resilience index. In this way, a basis is created for resilience measurement that is more closely aligned with the actual conditions and needs of individual communities, thereby significantly enhancing the validity and applicability of the results obtained through the BRIC approach. "The way in which resilience to disasters caused by natural hazards is manifested differs clearly between urban and rural environments. The drivers of disaster resilience differ, indicating the need for resilience-building efforts to be adapted to the local context rather than applied universally across all locations, or even to all urban or rural areas. Social, economic, and ecological processes that have transformed the nation provide the fundamental context for disaster resilience patterns: regional specificity, unique differences between urban and rural areas within and across geographic regions, and variations in drivers among similarly classified areas such as rural counties" (Cutter, Ash, & Emrich, 2016, p. 1251).

The complexity of assessing local community resilience has necessitated a multidimensional approach to indicator selection, allowing the analytical process to incorporate a broader, yet more context-appropriate, set of resilience dimensions. Such an approach is essential for capturing the resilience phenomenon from multiple angles and, in turn, for producing a more comprehensive and more precise account of local communities' capacity to respond to crises.

However, indicators are susceptible to methodological decisions made during their construction, meaning that the selection of procedures and parameters can significantly influence the final results. The BRIC method was conceived and developed as an analytical tool to support decision-making in disaster risk reduction. For this reason, its authors emphasized that confident methodological choices were deliberately made to ensure that the index would be transparent in interpretation and sufficiently intuitive for practical use by decision-makers. In this way, BRIC is ensured not to remain merely an academic construct but also to function as a helpful instrument in risk management processes (Cutter, Burton, & Emrich, 2010). Although indicator selection inevitably involves trade-offs between methodological rigor and interpretive simplicity, the enhanced version of the BRIC method developed by Susan Cutter has been incorporated into official disaster risk assessment practices in the United States.

A central limitation of the existing evidence base is its restricted geographical and cultural coverage. Much of the research to date has focused on regions such as the United States and Europe, which constrains the extent to which findings can be transferred to other socio-economic settings without deliberate contextual adaptation and localization. Future work should therefore encompass a wider range of countries and regions—particularly those at different levels of development and characterized by distinct socio-economic conditions—in order to assess more comprehensively the applicability of the BRIC method and the DROP framework across diverse contexts. There is also a clear need to further refine and adapt existing indicators, especially in the domains of social, economic, and infrastructural resilience. Indicators such as age structure, labor force employment, education, access to transportation, language competencies, and communication capacities remain insufficiently addressed in parts of the literature and warrant particular attention. In parallel, efforts should be directed toward developing new indicators that better capture the complexity and multidimensionality of local community resilience while remaining sensitive to the specificities of different geographic settings. Measuring local communities' resilience to natural disasters using the BRIC method—and tailoring the indicator set for a resilience index—constitutes a methodological challenge in its own right. Resilience cannot be observed directly; rather, it is inferred from a broad constellation of contributing factors. A key weakness in prior studies lies in the implementation of assessment tools and in their effectiveness in improving outcomes, particularly with respect to selecting adequate indicators. As a scientific field, resilience measurement continues to evolve, and there remains no fully satisfactory approach for identifying and contextually adapting the indicators to be measured an issue that may reflect both the accelerating pace of societal change and the environmental transformations associated with contemporary development.

With regard to institutional resilience, there is a further requirement to develop more precise and comprehensive indicators capable of more accurately assessing institutional capacity to respond to disasters. This includes strengthening existing emergency intervention plans and developing additional approaches for evaluating and enhancing local institutional capabilities. Overall, the literature points to a clear need for further research and for the development of integrated approaches to disaster resilience measurement. Future work should expand analyses across diverse geographical and cultural contexts and advance methodological tools that enable a more comprehensive assessment of local community resilience (Milenković, Cvetković, & Renner, 2024).

One of the main methodological weaknesses identified in earlier BRIC-based studies is that OECD guidelines were most often omitted precisely in those segments where difficulties arise—namely, in data collection, indicator quality assessment, and indicator comparability. These are also the stages at which weaknesses in research design and in the selection of optimal resilience indicators would be expected to be most visible.

A further shortcoming concerns the limited use of appropriate instruments for generating the evidence required to construct optimal resilience indicators for a geographically defined research setting. In particular, expert assessment is often insufficient within the domains represented by the indicator groups used in these studies. Moreover, fieldwork—specifically surveys and interviews—is not adequately employed in cases where public data from state and other institutions are unavailable.

Methodological decisions should be guided by the results of multivariate analyses, including the grouping of indicators and the determination of weights within composite indices (OECD/European Union/EC-JRC, 2008). In addition, in an effort to reduce the number of measured indicators, Cutter and collaborators published a study in 2022 that, alongside correlation-based approaches, applied Principal Component Analysis (PCA). "However, PCA did not lead to factors that are conceptually justified and aligned with the contemporary understanding of community resilience and its drivers" (Derakhshan, Blackwood, Habets, Effgen, & Cutter, 2022, p. 5).

In practical terms, indicator and indicator-group selection for resilience assessment should therefore be pursued through a balanced, dual-track process. The first track involves statistical testing, including correlation-based screening and other quantitative diagnostics. The second track involves expert evaluation and the use of field research (surveys and interviews) to identify which indicators should be retained in the measurement framework.

Overall, while the BRIC method performs strongly in supporting the identification of relevant resilience indicators, it does not provide a complete set of universally transferable indicators suitable for all countries or territories in which disaster resilience is to be assessed. The application of BRIC and the DROP theoretical framework is therefore contingent on further adaptation and refinement for successful use in specific local contexts. In practice, such adaptation must be undertaken precisely in the domains represented by indicators not covered by the BRIC method. By integrating selected indicators derived from the research's theoretical framework into the BRIC indicator groups, localization would be achieved, thereby rendering the resulting measures both meaningful and measurable for a specific territory or country, such as Serbia. The specific indicators incorporated into the modified method will depend on data availability, statistical procedures, expert judgment, and fieldwork, through which feasibility of data collection can be established and indicator use optimized for the construction of a resilience index.

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