

Chapter 15

Community Resilience: A Potential Answer to the Emerging Pandemic



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Abstract There is a growing concern, on a global scale, about the ‘resilience’ and especially ‘community resilience’ amidst the emergency of new-pandemic (COVID-19) until the discovery of lifesaving drug(s). Though the term ‘resilience’ is widely used in various disciplinary platforms but metaphorically adopted in this piece to address peoples’ struggle for surviving and coping capacity under the vulnerable contagious environment, and restarting post-pandemic life. Thereafter, the encoded term ‘community’ coherently included for focusing the world’s community and also inherently scoping for addressing the issue of resilience hierarchically from large to small communities or like urban to rural communities. There is no doubt that the intruded COVID-19 brings a new threat to human civilization. Collectively various communities are adopting new adaptation strategies. While the methodology adopted is a review of literature from renounced contributors after rational examining, modification, and appropriate reconstructions of dimensions, as well as components or indicators. From a pandemic perspective, the four major dimensions of community resilience and their underside indicators are considered—*Society and Economy, Environment and Climate Change, Infrastructure, and Administration and Governance*. After a rigorous review of available focussed literature, it would not be inappropriate to state that the conceptual framework presented in this chapter could help measure the resilient power during the onset of a pandemic and reframe the policy proposal post-COVID survival.

Keywords Health hazard · Risk factor · Composite score assessment CSA · Standardized score · Global phenomena

15.1 Introduction

The global scene of mass-scalar epidemic and loss of human lives, thousand of millions, from a historical perspective, is not new. Alongside this, there is a ‘vague’

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idea or grey statement about the occurrence of the pandemic in every hundred years around (Morens and Taubenberger 2018; Kertscher 2020; Frost 2020) becomes widespread. A well established universal nature of pandemic is its worldwide outbreak. In addition, a ‘new-pandemic’ happens when a new pathogen emerges to infect humans and between communities with having contagious nature (Porta 2008; Merriam-Webster Dictionary n.d.). Again, the similar phonetic term ‘endemic’ is never so like a pandemic. The concurrence of a new-pandemic, *i.e.*, COVID-19, in the twenty-first century, is reportedly started from Wuhan, China (Dryhurst et al. 2020). It gradually reaches each nook and corner of the globe. The current fatal impact of this pandemic is around more than 691,013 confirmed deaths and more than 18 million confirmed infected cases (WHO 2020). The practical situation of human fatalities across affected nations or geographical areas (small or big) might be more than the available official records. Although there are controversies regarding the gaps between recorded data and ground realities, however, there might not be any debate on the challenging stressors by the new-pandemic to the global community. Not only these, but the current health emergency has also pushed the global community toward several crises *like* international relations and trade, economic, socio-political, socio-cultural, food and nutrition, health and wellbeing, and many more. However, this present situation will remain beyond the reach of effective tackling, instead of having improved science and technology of human care, unless the discovery of reliable and clinically tested lifesaving drug(s). Thus until the research and innovation of nectar-like drugs in medical science, the ‘community resilience’ would be a subordinate and helpful instrument for the survival of humans.

This study purposefully confers to relate out between three concepts like ‘pandemic’, ‘community’, and ‘resilience’. Moreover, it attempts to highlight the conceptual and diagnostic outlay of this very discourse (*community resilience*) not only for academic contribution but also to reframe policy in view of the sustainability of civil societies in the post-pandemic era. Instead of not being a case study, this piece is closely examining the existed and developed concepts around the arena of pre-mentioned terminologies and also seeks to judge the *focussed term* under the pandemic scenario. Besides this, the present work is attempting to throw light on *community resilience*, specifically the dimensions and scale of investigation. Other than these, after coherent and systematic cross-analysis of appropriate dimensions or major components with subcomponents, some more suitable subcomponents are developed further. Finally, a modified kind of conceptual model of community resilience, under the shadow of new-pandemic, has been built.

The remainder of this volume has acquainted with the relevant qualitative and quantitative discussion of said theme. The next sections are broadly comprised of the cross-examinations of the terms from numerous scholarly literature. Moreover, it also essentially cites the inherent qualities of both terms. The enhanced subsection is focused on exploring the direction of the study specifying community, resilience, and spatial differentiation. *Section 15.3* is simply devoted to researching the validity as well as the significance of community resilience (CR) under the severe pandemic phenomenon. The later part, *Sect. 15.4*, is functionally representing the calibration

of robust and sound composite score assessment (CSA) and its different connected techniques. Finally, *Sect. 15.5* is interpreting the roundup importance and future usage of *this* customized model for reframing existing policies which usually addressing human risk segments.

15.2 ‘Community’ and ‘Resilience’: Partner or Opponent

In an academic platform, during the description of the *man-nature interface*, most commonly, the term ‘resilience’ is applied as metaphoric sense. However, the genesis of this terminology or concept has been traced from the sciences of physics and mathematics. Along with the core of natural sciences, the concept is defined as the capacity of a substance or system to bounce back to its original state after the relocation of stressors. In another way, the definition may confer as a material with resilient power may bend or get squeezed, caused by stressors, and later on, return to its earlier status, rather than broken, after releasing the stressors (Gordon 1978; Bodin and Wiman 2004). Since its evolution and more comprehensive applications and due to ever-continuous development, there is no concrete definition of the said concept suitably applied to social sciences and human risk assessment. Whenever ‘resilience’ as a concept with growing concern, has been adopted to describe the capabilities or power of adaptations of individuals (*e.g.*, Orencio et al. 2015; Bonanno 2004; Butler et al. 2007; Rutter 1993; Werner and Smith 1982), groups or communities (*e.g.*, Brown and Kulig 1996/1997; Sonn and Fisher 1998; Smith et al. 2012; DasGupta and Shaw 2015; Dinh et al. 2016; Sharifuzzaman et al. 2018), and wider societies (*e.g.*, Pfefferbaum et al. 2015; Godschalk 2003; Adger 2000). On the other hand, the emphasizing subject areas (other than communities) are covered by the very *concept* like pandemic (*e.g.*, Naja and Hamadeh 2020; Keenan 2020), disaster and hazard management (*e.g.*, Paton et al. 2001; Ainuddin and Routray 2012; Bergstrand et al. 2014; Danar and Pushpalal 2014; Alshehri et al. 2015; Kulig and Botey 2016; Li et al. 2016; Parson et al. 2016; Anwar et al. 2017; Qin et al. 2017; Mayer 2019; Song et al. 2019; Almutairi et al. 2020), crisis analysis (*e.g.*, Camfield et al. 2013; Simpson 2020) and so forth.

When any kind of external shocks in the form of disaster (natural, human-made, or health-related) comes to the habitable areas, the members of the residing communities are probably the first who face and react upon it. So, ‘community’ is the principal actor in the non-implicit recognition under the approach of community resilience (CR). Besides, for this very reason, the community members should not only be recognized as ‘victims’ but also as prime means to deal with the extreme stressors. Moreover, it is worthy of being mentioned, in this context, to those who work with this concept (CR), should spontaneously acknowledge the dynamic qualities of a community like *strength* and *power* rather than *weakness* and *defenselessness* (Adger 2000; Gallopini 2006; Norris et al. 2008; Ungar 2011). Within a due course of time, epistemologically, the term ‘resilience’ is originated from natural sciences but presently becomes familiar after adjoining with the community (*e.g.*, ‘community resilience’) and has

been popularly adopted in the different academic and disciplinary milieu. In the broader section, like disaster or hazard management, the approach of CR is encountered with a broad definition. It is regarded that the word *resilience* possesses the qualitative and quantitative angles, and it incorporates the measurement of the degree or magnitude of vulnerability, power of struggle, and recovering capabilities of any target group or community (Norris et al. 2008; Engle 2011; Ungar 2011). Simultaneously, the COVID-19 is concurring onto present civilization, globally, and threatening the existence of humanity, which should be regarded as global-health-disaster.

Moreover, according to Visser et al. (2012), *resilience* at the individual level is apprehended with an individual's characteristics like optimistic attitude, self-discipline, personal control, better self-esteem, the problem facing and solving skills, and practical views amidst the problematic environment. Community resilience (CR) is somewhat different from the previous, having important, worthy components. In another way, it can be said that CR is a healthier form of agglomeration of various components or subcomponents of individuals under a focussed human-group, which can able to cope up with sudden shock(s). This collective concept is concerned with individual members of the community rather than the community as a whole if the absorption of the shocks is concerned. CR is broadly linked with some dimensions like the magnitude of social connectedness, social relations and its quality, helpful community norms, the problem-solving capability of a community, and features of social networking threads (Norris et al. 2008; Aldrich 2012). *Resilience* and *community resilience*—both are dynamic and ever-changing concepts connected to a complex set of capacities, processes, and results that can interactively support one another. Nevertheless, it would be appropriate to explain CR in a single sentence:

community resilience measures the extent to which community capital can absorb immediate disturbances or chronic stressors as well as the community's adaptive capacity to self-organize into a stable, functional community system. (Acevedo 2014)

In the perspectives of social science and disaster management, it is easily understandable that both the terms 'resilience' and 'community' are not opponents rather than partners to each other. Furthermore, in a joint mode (community + resilience = CR) it would be a potential way-out to combat against the emerging pandemic (COVID-19) and adaptation of a community, to immediate and long-term environmental changes, *following* positive initiatives with collective manner, co-operative engagement of community members, affirmative response and recovery actions with proper coordination, non-individual level problem identification, and potable solution, future planning with priority setting.

Re-conferring the above agenda in systematize way forward is now became necessary in this part. Eventually, the scope of the appraisal of the concept of CR in the current global context, *i.e.*, under pandemic condition, is three-dimensional. From the illustration (Fig. 15.1), it can be readily observable that the X-axis shows *resilience*, Y-axis represents *community*, and Z-axis shows the *geographical* or *spatial* dimension. Thus incorporating the above three dimensions in a single frame would make

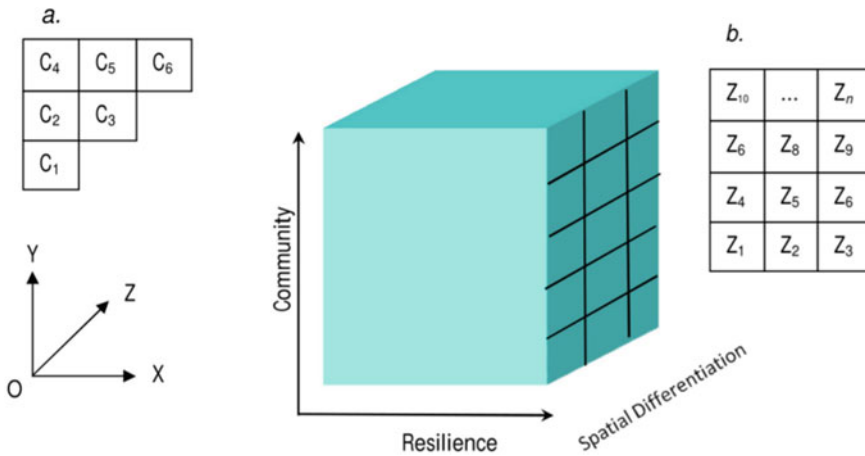


Fig. 15.1 Dimensions of study of CR (a. community differentiation, b. spatial differentiation) (Source Developed by author)

it more convenient to highlight the crisis corners of CR under the pandemic situation for any specific community or community in the broad sense and coherent policymaking as well.

In addition to this, the idea of the community under the purview of the present volume refers to the group of people, sorted by numerous categories. Figure 15.2 replicates the classification of the community on which the present concept may throw light. The reason behind is the COVID-19, the most contagious epidemic, impacts

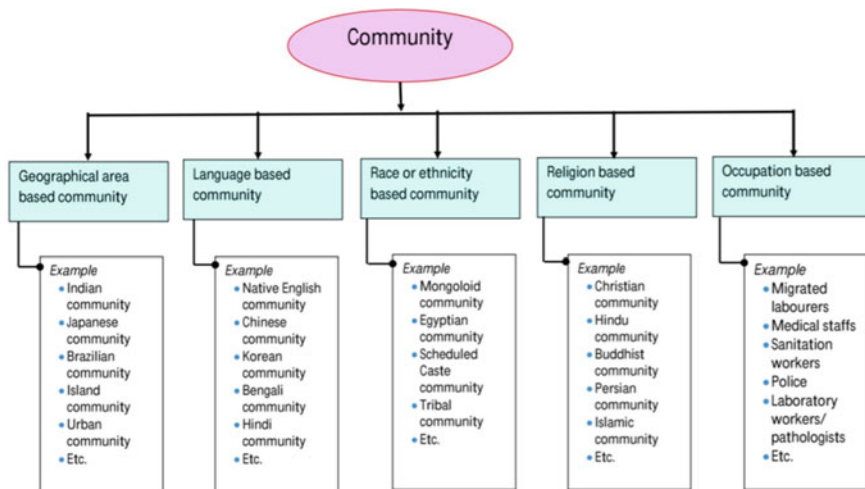


Fig. 15.2 Classified communities useful for studying CR under pandemic condition (Source Developed and conceptualized by author)

almost each and every human-group beyond their caste, creed, class, religion, and language and also each nook and corner of the globe. Therefore, the broad term ‘community’ is purposively classified into five major categories, *e.g.*, geographical area based community, language-based community, race or ethnicity-based community, religion-based community, and occupation-based community (Fig. 15.2). The underneath philosophy behind such classification is that among the categorized group of peoples, regarding their base of categorization, the power of resilience is supposed to vary from one community to another due to their varied lifestyle, livelihood, culture, knowledgebase, and many other things. Moreover, here lies another opportunity to study *this* with a cross-community comparative point of reference. The side-by-side cross-community analysis also may contribute some positive or more substantial points for policymaking to those communities who may have some lacuna(s) to fight against the pandemic. The upcoming paragraph focuses on the three dimensions, more intrinsically, and also the scale of research.

15.3 Re-Evaluating the Concept CR Under the Pandemic Lens

From the academic discussions in the preceding sections, it is now clear that the concept, as well as the approach of community resilience (CR) have not been applied to the new-pandemic scenario the world is presently facing. Thus during this crisis period (when due to lack of appropriate medication mortality rate is so high and turned into a global health emergency and throws the question of survival), it is ardent to keep the concept of CR under the scanner of the emerging vulnerable pandemic. In the surveyed literature, community resilience (CR) had been proven as a socio-political and strategic means for resolving hazardous or any human risk phenomenon, due to exterior stressors, from local to a global scale. Thus, in view of the above discussions, this section is attempting to re-evaluate the *concept* under the emerging pandemic condition. In order to boost physical, social, economic, cultural, and overall peoples’ daily living, during the pandemic and post-pandemic period, this model-based commentary (multilevel) framework (Fig. 15.3) highlights human sustainability at the individual, community, regional, national, and global levels. This multilevel framework is broadly inspired by the work of Naja and Hamadeh (2020). They purposively focused on ‘nutrition’ amidst the COVID-19, considering the current global outreach of the pandemic, household (individual), and community resilience appeared as the mainstay while remaining the first-combating agents in public health emergency and preparedness (Reissman et al. 2006). At the household level, the basic reliant denominator that helps to cope up with any health-disaster, including COVID-19 or SARS-2, is the family with its structure, income potential, awareness of members, culture (in a broad sense), and standard safety and security measures followed by the members.

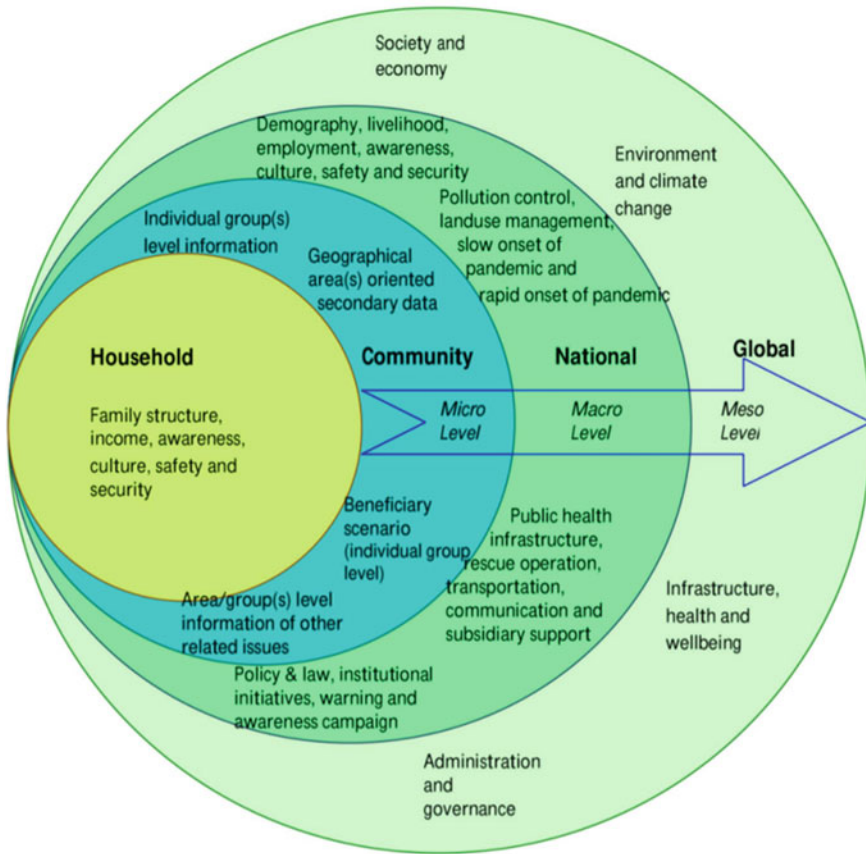


Fig. 15.3 A multilevel framework of research action on community resilience (Source Developed by author, based on Naja and Hamadeh 2020)

On the second layer, when it comes upon with *community-level* measures, the crucial bases are individual or group level information (primary or secondary), which helps to build the foundation of CR, then geographical area wise secondary information, especially for comparative areal reassessment. In addition to these, the beneficiary scenarios of the targeted community by any governmental or non-governmental institutions are also noteworthy for the same assessment, attaching with area or group level other related issues (helpful for the formation of robust subcomponents). Alongside the third layer (Fig. 15.3), contains the regional as well as national level analysis of significant indicators like society and economy (*indicators like*: demography, occupation, employment, awareness and education, safety and security), environment and climate change (*indicators like*: pollution control, landuse management, slow onset of pandemic, rapid onset of pandemic), infrastructure, health, and wellbeing (*indicators like*: public health infrastructure, rescue operation, transportation, communication,

subsidiary support), administration and governance (*indicators like*: policy and law, institutional initiatives, warning and awareness campaign). Apart from these, in the fourth layer or the end circle, when an initiation has been taken to discuss the world level crisis phenomenon (like COVID-19) and determining the global level resilience measurement through score-based computation after customization of suitable indicator and sub-indicators, with necessary modification and country-level or vulnerable zone-wise, a scientific analysis would only be possible.

15.3.1 Discussion of Parameters

During the previous decades, in respect of contemporary concepts like ‘community resilience’, a continuous development has been evinced throughout the globe. Numerous academicians, social scientists, and policymakers have contributed toward the formulation of qualitative and quantitative indicators and components related to building customized and developed composite index of CR, especially for natural disasters (USIOTWSP 2007; Cutter et al. 2008, 2010; Peacock et al. 2010; Uy et al. 2011; Joerin and Shaw 2011; Joerin et al. 2012; Teo et al. 2013). The primary reasons behind such encouragement and aspiration to adopt indicator-based research, in connection with CR, may be listed as:

- It progressively minimizes the complexity of computing one particular key concept (CR);
- It sounds better when the number of inter-related sub-indicators is included under every single component or indicator; and
- It makes it easy to indulge any researcher performing comparative analysis among the correlated parameters, which indirectly contributes to further policymaking (Cutter et al. 2008).

In comparison with the conclusive recommendation of community resilience approach as disaster recovery (Shea 2018) or “the ability of the community to bounce back, respond to, recover from and absorb the impacts and cope with” (Ainuddin and Routray 2012: 911) the present context seemed to be little bit dissimilar. Thus the proceeding discussions about the referred *components and subcomponents* may not be exclusively related to the current pandemic.

15.3.2 Modified Structure of CR Under Pandemic

In this present section, based on the previous studies and also with the best of literature review experiences, an ensemble suitable ‘community resilience index’ (CRI) is developed to perform composite score assessment (CSA) of these, mentioned earlier. This focussed index is comprised of four major dimensions, including socio-economic resilience (society and economy), environmental resilience (environment and

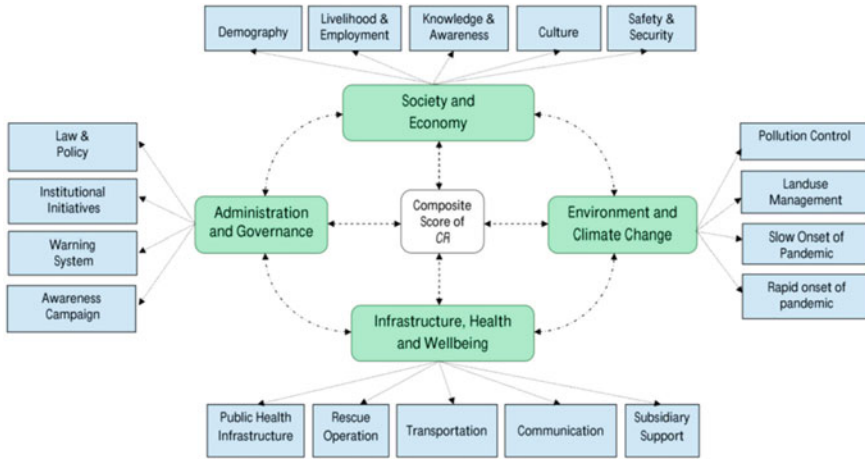


Fig. 15.4 Structure of community resilience and customized index (Source Developed by the author after, Norris et al. 2008; Qin et al. 2017)

climate change), infrastructure and health resilience (infrastructure, health, and well-being), institutional resilience (administration and governance) (Fig. 15.4). Afterward, these dimensions are divided into 22 components (demography, occupation, employment, pollution control, landuse management, slow onset of pandemic, rapid onset of pandemic, public health infrastructure, warning and awareness campaign, etc.). Moreover, 80 quantitative subcomponents or variables are incorporated for analyzing CR, under any spatial scale (Tables 15.1, 15.2, 15.3, and 15.4). These incorporated subcomponents or variables are altered into well-recognized forms (percentage, per person, binary value, density, etc.). Correspondingly, the effects or relation to each variable to CRI, either *positive* or *negative*, are identified and referred based on pioneering studies and review observations. Thus in the tables, the given ‘+’ means positive effect, and ‘-’ means the negative effect. Despite all of these, the other descriptions and references are given in the respective tables.

15.4 Socioeconomic Resilience

It is an established fact that the CR is a multidimensional concept, counting socio-logical, economic, ecological, and institutional elements (Cutter et al. 2008; Norris et al. 2008; Sherrieb et al. 2010; Qin et al. 2017). However, very few of the academic contributors have considered the clubbing of the ‘social’ and ‘economic’ parameters into a single dimension, especially in the case of present pandemic (COVID-19). To say elaborately, in case of this new-pandemic, humans are regarded as violent agents of contiguity indirectly. It threatens the foundation of *social resilience*, i.e., social relation, social bondage, social networks, and belongings. Thus it is perceived that

Table 15.1 Variables composing socioeconomic resilience

Dimension	Component	Subcomponent	Unit	References	Relation to CR
Society and Economy	Demography	Average population growth rate	Point value	Cutter et al. 2003	(-) value > growth rate < resilience
		Population density	Population per thousand	Hou et al. 2016	(-) value > density < resilience
		Percentage of elderly population (> 60 years)	Percentage	Su et al. 2015	(-) value > proportion < resilience
	Livelihood	Percentage of disable population to total population	Percentage	Cutter et al. 2014; Sharif 2016	(-) value > proportion < resilience
		Percentage of workers dependent solely on natural resource	Percentage	-	(+) value > proportion > resilience
		Percentage of workers dependent on single earning source	Percentage	-	(-) value > proportion < resilience
	Employment	Percentage of traditional workers become jobless during pandemic	Percentage	-	(-) value > proportion < resilience
		Percentage of traditional workers trapped under debt during pandemic	Percentage	-	(-) value > proportion < resilience
		Percentage of workers fall under unorganized sector	Percentage	-	(-) value > proportion < resilience
		Percentage of workers drawing half/partial salary	Percentage	-	(-) value > proportion < resilience
		Percentage of unemployed youths (> 25 years)	Percentage	-	(-) value > proportion < resilience

(continued)

Table 15.1 (continued)

Dimension	Component	Subcomponent	Unit	References	Relation to CR
		Percentage of workers adopted new means of earning during pandemic	Percentage	–	(+) value > proportion > resilience
	Culture	Frequency of cases not avoiding religious gathering	Point value	–	(–) value > magnitude < resilience
		Frequency of cases not avoiding marriage/death-ceremony/party like mass gathering	Point value	–	(–) value > magnitude < resilience
		Regional/local level growth of selling of herbal product	Point value	–	(+) value > magnitude > resilience
	Awareness	(inverse) Percentage of cases disobey local lockdown and roaming unnecessarily	Point value	–	(+) value > magnitude > resilience
		(inverse) Percentage of cases of hectic fines for not covering faces by 'face-mask/cloth'	Point value	Sing and Avikal 2020	(+) value > magnitude > resilience
		(inverse) Percentage of cases not avoiding heavy crowd	Point value	Sing and Avikal 2020	(+) value > magnitude > resilience
		Increments of sales at (regional/local level) sanitation items	Point value	–	(+) value > magnitude > resilience
	Safety and Security	Number of households below minimum living standard per 10,000 households	Point value	Lixin et al. 2014	(–) value > magnitude < resilience

(continued)

Table 15.1 (continued)

Dimension	Component	Subcomponent	Unit	References	Relation to CR
		Percentage of population above minimum living standard	Percentage	Lixin et al. 2014	(+) value > proportion > resilience
		Percentage of homeless family or household	Percentage	Despotaki et al. 2018, Chung et al. 2020	(-) value > proportion < resilience
		Expenditure for social welfare per person	\$ per person	Zhang and Huang 2013	(+) value > magnitude > resilience
		Social welfare budget per person	\$ per person	Zhang and Huang 2013	(+) value > magnitude > resilience

Source Compiled by author

Table 15.2 Variables composing environmental resilience

Dimension	Component	Subcomponent	Unit	References	Relation to CR	
Environment and Climate Change	Pollution Control	Expenditure for air pollution control/forestation or green management per 10,000 persons	Point value	Markard and Rosenbloom 2020	(+) value > magnitude > resilience	
		Expenditure for water pollution control/improving water quality per 10,000 persons	Point value	–	(+) value > magnitude > resilience	
		Expenditure for household, market and waste management per 1000 households	Point value	–	(+) value > magnitude > resilience	
			Sewage management centralized treatment rate	Percentage	Qin et al. 2017	(+) value > proportion > resilience
			Expenditure for green space/parks management per 10,000 persons	Point value	Qin et al. 2017	(+) value > magnitude > resilience
			Ratio of industrial solid waste treatment comprehensively utilized	Percentage	Qin et al. 2017	(+) value > proportion > resilience
	Landuse Management		Percentage of buildup area	Percentage	–	(+) value > proportion > resilience
			Percentage of area under commercial use	Percentage	Sherrieb et al. 2010; Cutter et al. 2016	(+) value > proportion > resilience
			Percentage of area under green and open space	Percentage	Qin et al. 2017	(+) value > proportion > resilience

(continued)

Table 15.2 (continued)

Dimension	Component	Subcomponent	Unit	References	Relation to CR
		Percentage of area under massive dense settlement	Percentage	–	(–) value > proportion < resilience
		Percentage of area under vulnerable old buildings	Percentage	–	(–) value > proportion < resilience
	Slow Onset of Pandemic	Percentage of community asset (school or other buildings) utilized for quarantine	Percentage	–	(+) value > proportion > resilience
		Frequency (per month) of area sanitization	Unit value	–	(+) value > magnitude > resilience
		Percentage of household (among total) advised for home quarantine	Percentage	–	(+) value > proportion > resilience
	Rapid Onset of Pandemic	Frequency (per month) of complete lockdown	Unit value	Qian et al. 2020	(+) value > magnitude > resilience
		Percentage of additional community asset (club or public community hall) utilized for quarantine	Percentage	–	(+) value > proportion > resilience
		Percentage of testing (per day) for Corona in local area	Percentage	Qian et al. 2020	(+) value > proportion > resilience
		Frequency (per month) of door-to-door health survey by local administration	Unit value	–	(+) value > magnitude > resilience

Source Compiled by author

Table 15.3 Variables, composing the infrastructure and health resilience

Dimension	Component	Subcomponent	Unit	References	Relation to CR
Infrastructure and Health	Public Health and Health Infrastructure	COVID recovery rate (total recovered patients/total COVID patients)	Point value	WHO 2020	(+) value > magnitude > resilience
		Number of days of active opening of OPD section in hospital/healthcare institutions (for non-COVID patients)	Point value	-	(+) value > magnitude > resilience
		Number of COVID dedicated hospitals/healthcare institutions per 10,000 people	Point value	Zhou et al. 2014 (modified)	(+) value > magnitude > resilience
		Number of COVID dedicated hospitals/healthcare beds per 1000 people	Point value	Ge et al. 2013 (modified)	(+) value > magnitude > resilience
		Average doctor-patient ratio, during pandemic (per 1000 people)	Ratio	Zhou et al. 2014 (modified)	(+) value > magnitude > resilience
		Average nurse-patient ratio, during pandemic (per 1000 people)	Ratio	Zhang and Huang 2013 (modified)	(+) value > magnitude > resilience

(continued)

Table 15.3 (continued)

Dimension	Component	Subcomponent	Unit	References	Relation to CR
		Percentage of health workers (doctor, nurse, health staffs, etc.) attacked by COVID-19	Percentage	–	(+) value > proportion > resilience
	Rescue Operation	Rescue of emigrants from abroad by air/water ways per 100 people	Percentage	–	(+) value > proportion > resilience
		Rescue of migrated workers by train/bus per 100 people	Percentage	–	(+) value > proportion > resilience
		Rescue of quarantined (suspected) COVID patients escaped from quarantine center (comparing with total COVID patient)	Percentage	Qian et al. 2020	(+) value > proportion > resilience
	Transportation	Principal road density (principal road in km ₂ /total buildup area km ²)	Point value	Frazier et al. 2013; Sharifi 2016	(+) value > magnitude > resilience
		Number of emergency vehicle available per 10,000 people	Point value	DasGupta and Shaw 2015	(+) value > magnitude > resilience
		Number of civil vehicles owned per 10,000 people	Point value	Liu and Li 2016	(+) value > magnitude > resilience

(continued)

Table 15.3 (continued)

Dimension	Component	Subcomponent	Unit	References	Relation to CR
		Number of public transportation vehicles per 10,000 people	Point value	Zhou et al. 2014	(-) value > magnitude < resilience
	Communication	Number of mobile users per 10,000 people	Point value	DasGupta and Shaw 2015	(+) value > magnitude > resilience
		Number of internet subscribers per 10,000 people	Point value	Lixin et al. 2014	(+) value > magnitude > resilience
	Electricity	Percentage of households using electricity for lighting	Percentage	Cimellaro et al. 2014; Mishra et al. 2017	(+) value > proportion > resilience
	Cooking gas	(Inverse) timely supply of cooking gas and home delivery	Point value	-	(-) value > proportion < resilience
	Water source	Percentage of households using tap/pipe water source	Percentage	Cimellaro et al. 2014; Mishra et al. 2017	(+) value > proportion > resilience
	Subsidiary Support	Provision of distribution of face-mask and sanitizer among poor (Yes = 1, No = 0)	Point value	Zou et al. 2020	(+) value > magnitude > resilience
		Percentage of poor benefited by subsidized rationing system (basic foodstuff) by NGO/Govt.	Percentage	Qian et al. 2020	(+) value > proportion > resilience

(continued)

Table 15.3 (continued)

Dimension	Component	Subcomponent	Unit	References	Relation to CR
		Provision of any monetary help for the poor (Yes = 1, No = 0)	Point value	Zou et al. 2020	(+) value > magnitude > resilience

Source Compiled by author

Table 15.4 Variable composing institutional resilience

Dimension	Component	Subcomponent	Unit	References	Relation to CR	
Administration and Governance	Policy and Law	Implementation of strict price regulation rule(s) in regular market (Yes = 1, No = 0)	Numeric value	–	(+) value > proportion > resilience	
		Implementation of law & order during violence against health workers (Yes = 1, No = 0)	Numeric value	–	(+) value > proportion > resilience	
		Amendment of penalty rule for not using face-mask/cloth in public place (Yes = 1, No = 0)	Numeric value	Zou et al. 2020	(+) value > proportion > resilience	
			Provision of any alternative job for reemployment of poor worker (Yes = 1, No = 0)	Numeric value	–	(+) value > proportion > resilience
	Institutional Initiatives		Deployment ratio of police force (number) during pandemic (per 10,000 people)	Point value	Zou et al. 2020	(+) value > magnitude > resilience
			Deployment ratio of volunteers (number) during pandemic (per 10,000 people)	Point value	–	(+) value > magnitude > resilience
			Deployment ratio of temporary health workers (number) during pandemic (per 10,000 people)	Point value	–	(+) value > magnitude > resilience
			Increment of ‘bed-patient ratio’ (pre-pandemic ratio—post-pandemic ratio)	Point value	Qian et al. 2020	(+) value > magnitude > resilience
			Provision of ‘work from home’ initiative, (Yes = 1, No = 0)	Numeric value	Qian et al. 2020	(+) value > proportion > resilience

(continued)

Table 15.4 (continued)

Dimension	Component	Subcomponent	Unit	References	Relation to CR
		Frequency of lockdown within six months (two weeks) for breaking the chain of contagion	Point value	–	(+) value > magnitude > resilience
	Warning Initiatives	Provision of high-tech warning system about COVID-19 in mobile ringtone (incoming & outgoing), (Yes = 1, No = 0)	Numeric value	Dako-Gyeke et al. 2020	(+) value > proportion > resilience
		Provision of warning system about COVID-19 in virtual social network, (Yes = 1, No = 0)	Numeric value	Dryhurst et al. 2020	(+) value > proportion > resilience
		Provision of traditional warning system about COVID-19 in public place, (Yes = 1, No = 0)	Numeric value	–	(+) value > proportion > resilience
	Awareness Campaign	Provision of up-to-date awareness campaign about COVID-19 in newspapers/television, (Yes = 1, No = 0)	Numeric value	–	(+) value > proportion > resilience
		Provision of small-scale awareness campaign about COVID-19 in marginal/remote areas (Yes = 1, No = 0)	Numeric value	–	(+) value > proportion > resilience
		Provision of praising and thanksgiving events for COVID-front-level-warriors (Yes = 1, No = 0)	Numeric value	Dako-Gyeke et al. 2020	(+) value > proportion > resilience

Source Compiled by author

the combination of ‘social’ and ‘economic’ factors may construct a more significant dimension of resilience as these two dimensions boost each other. Socioeconomic resilience is formed by six major components, including demography, livelihood, employment, culture, awareness, safety, and security (Table 15.1). Demographic characteristics refer to average population growth, population density, the proportion of the elderly, and the disabled population (Cutter et al. 2003, 2014; Hou et al. 2016; Su et al. 2015; Sharifi 2016). Whereas, under the broad economic angle, livelihood and employment cooperatively help to build a more suitable parameter, seemed to be reasonable for the current pandemic. Walking along the different way, under the major component of livelihood, four subcomponents are taken into account, *i.e.*, percentage of workers solely dependent on natural resource; the percentage of workers dependent on the single earning source; the percentage of traditional workers become jobless due to pandemic cause; and, percentage of workers severely trapped under debts due to pandemic.

Similarly, under the component of employment also four subcomponents are included, *i.e.*, percentage of workers under unorganized sector; the percentage of workers drawing partial salary due to pandemic; and percentage of unemployed youths (over 25 years age of both genders); and, percentage of workers adopted new kind of earning during the pandemic period. From the previous experiences, it has been observed that the above-mentioned phenomena (pointing out as subcomponent) are more or less true in the developing and underdeveloped countries.

So it is thought to be ardent for replicating one of the important corners of economic resilience. Unlike conventional resilience studies, this work purposively put culture and awareness as important components rather than direct inclusion of formal education or other allied factors. Three subcomponents are included under the major component like culture (Table 15.1), these are frequency of cases (recorded) violating mass-gathering rule for religious cause; frequency of cases (recorded) violating mass-gathering rule for social functions causes (e.g., marriage ceremony; death ritual, or rejoicing party); and, regional or local level growth of selling herbal product. It also indirectly helps to measure the variable of consciousness of any community for immunity boosting at the individual level. In case of another component like awareness among included subcomponents (four), the first three subcomponents are considered in the inverse scale, and only the last one is involved with the increment of sales of sanitation items during the pandemic, which replicates the growing consciousness of any community. The rest three subcomponents are the percentage of cases of disobeying local lockdown, percentage of cases of penalty for not using any face-mask or cloth, and percentage of cases of disobeying social-distancing norm (Singh and Avikal 2020). Under the broad dimension of socioeconomic resilience, the last important component is safety and security, and this component is formulated with five subcomponents. The first three are the proportion of households below minimum living standard, percentage of population above minimum living standard, and the percentage of homeless family or household. These above-discussed subcomponents are vital in case of resilience because the proportion of ‘below-poverty-line’ population and homeless family counts directly indicate the less resilience capability (Lixin et al. 2014; Despotaki et al. 2018; Chung et al.

2020). On the other hand, the rest two subcomponents like expenditure for social welfare per person and social welfare budget per person directly confirm the security measures (Zhang and Huang 2013).

15.5 Ecological Resilience

Environmental and climate change resilience comes under the holistic categorization of resilience, like ecological resilience. This kind of resilience dimension is comprised of important components like environmental pollution control; landuse management; slow onset of pandemic; and, rapid onset of pandemic. As this emerging pandemic is thought to be linked with environmental degradation and global climate change (Markard and Rosenbloom 2020), there are four major components incorporated to form the ecological or say, environmental, and climate change resilience. This is especially focussed on assessing the resilience under a public health emergency. Any kind of disease detrimentally carries and spreads through the basic earth's elements. Though in case of COVID-19 it is carried through water droplets in the air. Hence, the inclusion of the major component of 'environmental pollution control' is coherent. This component is constructed with six subcomponents like expenditure patterns (per 10,000 populations in a given area) for air pollution control, water pollution control, and waste management (Table 15.2).

Previously recognized three subcomponents i.e., sewage management centralized treatment rate; expenditure for green or open space, or parks management (per 10,000 persons); and, the ratio of industrial solid waste treatment which are comprehensively utilized and they are found instrumental (Qin et al. 2017). In order to build the second component of landuse management, five subcomponents are taken under consideration. The first three are the percentage of built-up area (as a general consensus); the percentage of area under commercial use; and, the percentage of area under green space having a positive effect on CR (Sherrieb et al. 2010; Cutter et al. 2016; Qin et al. 2017). The rest two variables are crucial. The percentage of area under the huge dense settlement is the common characteristic feature of human habitation in developing and underdeveloped countries and also considered responsible for the furious spreading of endemics and epidemics. Again the percentage of area under old and vulnerable buildings also weakens the resilience quality as they extend the threat of unhygienic living and other related issues. Remaining two major components like the slow onset of pandemic and rapid onset of the pandemic are very reasonable for community resilience measures during the pandemic period, existing under the environmental management dimension. There are three subcomponents under the component of slow onset of pandemic, i.e., percentage of community asset utilized for quarantine; frequency of area sanitization; and, percentage of households advised to be home quarantine. On the contrary, four different types of subcomponents are included under the component of rapid onset of pandemic, i.e., frequency of complete lockdown (for breaking the chain of contiguity of COVID-19); the percentage of additional community assets utilized for quarantine (important for an enhanced number of

cases in a heavily populated area); the percentage of Corona testing (a vital issue for combating coronavirus diseases) (Qian et al. 2020); and, frequency of door-to-door survey for monitoring health of citizens in the local area (Table 15.2).

15.6 Health and Infrastructural Resilience

Health and infrastructural resilience is the fundamental dimension of CR under pandemic conditions. It helps to gauge public health and health infrastructure, lifeline options (transportation, communication, electricity, cooking gas, water supply, etc.), rescue operation, and subsidiary support (specifically valid for underdeveloped and developing worlds). Furthermore, this very dimension critically serves the CR by providing support for better resilience and sustainability. Within this dimension, there are eight vital components—public health and health infrastructure; rescue operation; transportation; communication; electricity; cooking gas; water supply; and, subsidiary support (Table 15.3). The first component (public health and health infrastructure) is very much crucial for the pandemic-related composition of CR. This component has seven significant variables, i.e., area or region-specific COVID recovery rate (WHO 2020); the number of active opening of OPD for non-COVID patients; the number of COVID dedicated health institutions per 10,000 people (Zhou et al. 2014); COVID bed-patient ratio (Ge et al. 2013); doctor-patient ratio per thousand (Zhou et al. 2014); nurse-patient ratio per thousand (Zhang and Huang 2013); and, the percentage of health workers attacked by COVID-19. Additionally, the component like ‘rescue operation’ is seemed valuable for developing countries. It is composed of three subcomponents, i.e., rescue of emigrants from outside country per 100 people; the rescue of migrated workers to their native villages per 100 people; and, the most vital one—the percentage of the rescue of quarantined COVID patients escaped from quarantine centers (ardently responsible for the mass-scale spreading of pandemic) (Qian et al. 2020). Among the components which provide lifeline options for better tolerance during a pandemic are transportation, communication, electricity, cooking gas, and water supply. Transportation is considered as an important lifeline because it not only maintains the supply of necessary daily-goods but also provides support in emergency communication and movements of passengers and patients in acute morbid condition for availing better health services. This component has been formulated with four subcomponents, i.e., principal road density (Frazier et al. 2013; Sharifi 2016); the number of emergency vehicle available per 10,000 people (DasGupta and Shaw 2015); the number of civil vehicles owned per 10,000 people (Liu and Li 2016); and, the number of public transportation vehicles per 10,000 people (Zhou et al. 2014). The subcomponents like the number of mobile users per 10,000 people (DasGupta and Shaw 2015) and the number of internet subscribers per 10,000 people (Lixin et al. 2014) build the valued component of *communication*, during a pandemic when changed virtually. Social network is the time-demand. The next two components are built with singular subcomponents, e.g., timely home delivery of cooking gas (inverse scale) and percentage of household using pipe or tap

water (Cimellaro et al. 2014; Mishra et al. 2017). Under the dimension of health and infrastructural resilience, the last component, *i.e.*, subsidiary support hypothesized to be crucial for enhancing peoples' resilience, especially in poverty dominated areas (Qian et al. 2020). This component is composed with three respective variables, like percentage of poor (households) benefited by subsidized rationing system (basic foodstuff) by NGO or Govt., provision of distribution of *free* face-mask and sanitizer among poor (binary scale), and provision of any monetary help for the poor (binary scale) (Zou et al. 2020).

15.7 Institutional Resilience

Institutional resilience, here modified as administration and governance resilience, has been recognized as the ability of functioning of an organization or administrative body to foresee, organize for and adjust with new 'code' of dynamic change or strategic alteration due to emergence of any new kind of external shocks (Qin et al. 2017). However, the concurring situation, the worldwide public health emergency, is quite different from the previously held natural or human-made disasters. The COVID-19 outbreak demands the full attention of the almost entire machinery of any administration, local to national levels. Targetting the best and comprehensive output, four major components have been incorporated under institutional resilience, *i.e.*, policy and law; institutional initiatives; warning initiatives; and, awareness campaigns (Table 15.4). The first component—policy and law, is composed of four subcomponents that would be measured by binary value analysis. The subcomponents are the implementation of price control in regular markets, implementation of law and order during violence against health workers, implementation of penalty advisory for not using face-mask, or piece of cloth in public places (Zou et al. 2020) and provision of any alternative job for the redeployment of vulnerable workers. Under the second important component, *i.e.*, institutional initiatives, six subcomponents are assumed to be vital. These are the deployment ratio of local police force during the pandemic; deployment ratio of additional volunteers for pandemic management (Zou et al. 2020); deployment ratio of additional (temporary) health workers for pandemic management; increment of bed-patient ratio during pandemic; provision of 'work from home' initiative (binary scale) (Qian et al. 2020); and lastly, the frequency of lockdown within six months for breaking the chain of contagion (Table 15.4). In the case of the components of warning initiatives, three coherent subcomponents are taken into account.

These are the provision of high-tech warning system about COVID-19 in mobile ringtone (incoming and outgoing) (Dako-Gyeke et al. 2020); provision of warning system in virtual social platforms (Dryhurst et al. 2020); and, the provision of traditional warning system in public places (like street drama and loudspeaker announcements). The last component, under this major resilience dimension, *i.e.*, the awareness campaign has incorporated three subcomponents—provision of an up-to-date awareness campaign about COVID-19 in newspaper and television programs; provision of

a small-scale awareness campaign about coronavirus in marginal and remote areas and provision of praising; and, thanksgiving events for COVID-front-level-warriors (Dako-Gyeke et al. 2020).

Although the vast array of incorporated variables and adjacent components, along with their variety of units, seemingly create complexity to form a unique index, it is essential because of all-round coverage of newly intruded challenge and coping capacity in real sense. In the next section, the study approach, as well as the computational breakthrough, has been interpreted.

15.8 Study Approach of CR: Method and Analysis

Now the discussion comes to the point where it is necessary to underline, after knowing what should be the lines and orders and also the scale of database needed for community resilience (CR) study under pandemic, the corners and direction of study method of CR as well as calibration steps for the end result of CSA. After following the guidance of Fig. 15.1, it becomes an easy job for understanding. If the 'X' axis represents the degree of *resilience* and 'Y' axis represents *community*, and when a researcher is focused to a single geographical area ('Z₁') then binding with that particular singular region (micro or macro), he/she should go for inter-community (formally categorized) analysis of CR to the emerging pandemic. Apart from the above, when a researcher is motivated to study community resilience but with a geographical perspective, he/she must have to choose more than single 'area' or 'region' (e.g., 'Z₁', 'Z₂', 'Z₃' ... 'Z_n'). However, rest of the items like *community* ('Y₁') should be included as a whole (without any formal categorization), and the base item like *resilience* should be included as 'X'. But a researcher should be cautious about more than one 'area' or 'region' inclusion under a particular study. He/she either take into consideration the pre-classified formal regions under a micro (e.g., number of districts under a state)/macro (e.g., number of states under a nation or country) region or purposively do the systematic classification of the region (big or small) accordingly. The third option would be more complicated than the former two. Here, a researcher must choose the base axis 'X' for representing the targeted item *resilience* and its several resilience dimensions. Then he/she may choose the number of formally or systematically classified communities (e.g., 'Y₁', 'Y₂', 'Y₃' ... 'Y_n'). Also further, he/she may include the number of 'area' or 'region' (e.g., 'Z₁', 'Z₂', 'Z₃' ... 'Z_n') for mapping the differential community-wise magnitude of CR with the areal diffusion. It would not be wrong to say that the third option is proved to be more suitable for geographers who are much concerned with human risk assessment.

According to Qin et al. (2017) the development of composite score assessment like CR can be shown in a simplified format as follows:

$$CR = f(\text{SocEcon Res}, \text{Ecol Res}, \text{Infras and Heal Res}, \text{Inst Res}) \quad (\text{Eq. 15.1})$$

Where, *CR* stands for community resilience; *SocEcon Res* stands for socioeconomic resilience; *Ecol Res* stands for ecological resilience; *Infras and Heal Res* stands for infrastructural and health resilience; and *Inst Res* stands for institutional resilience.

In the case of building the whole *Community Resilience Index (CRI)* each subcomponent or variable contributes uniformly for the formation of each major component as an overall index value, using a balanced weighted approach. In short, after a clubbing of specific subcomponents, the formation of major components is possible (Hahn et al. 2009; Pandey and Jha 2012; Alam 2017). Thus, assessment of the dimensions of CR should be determined to be 0 to 1 with equal weight to all associated subcomponents (Pandey and Jha 2012). The appropriateness behind the adaptation of the ‘balanced weighted approach’ for the composite score assessment (CSA) is, *this, the approach gives equity to each and every subcomponents when any study contended with varied geographical regions (from micro to macro). On the contrary, few incorporated subcomponents (modified) may react differently and somewhere extraordinarily on varying geophysical environments. From the above point of view, it is justified to adopt the above-mentioned approach. Thus it would be authentic to ensemble those subcomponents with equal weightage. Because all associated subcomponents are measured on a varied scale so it is reasonable to standardize each subcomponent as an index (Hahn et al. 2009), and index building Eq. (15.2) as follows:*

$$Index_{suc} = \frac{SuC_v - SuC_{min}}{SuC_{max} - SuC_{min}} \tag{Eq. 15.2}$$

Where, *Index_{suc}* is the index value for each subcomponent,

SuC_v is the original subcomponent or indicator value for an area or *vth* village,
SuC_{max} and *SuC_{min}* is the maximum and minimum value of each subcomponent.

These two maximum and minimum values of each subcomponent are used to convert the indicator value into a standardized index. For instance, variables that measure frequencies—such as ‘percentage of unemployed youths’ and ‘percentage of the disabled population to total population’—the minimum value set at 0 and the maximum at 100.

The subcomponents are aggregated after being standardized using Eq. 15.3 (Pandey and Jha 2012; Alam 2017) as follows:

$$C_v = \frac{\sum_{i=0}^n Index_{suc}}{n} \tag{Eq. 15.3}$$

Where, *C_v* is one of the major components for *CRI*,

Index_{suc} is the *i*th subcomponent, belonging to major component *C_v* for *vth* village,
n is the number of subcomponents under the major component.

Once the computation of the values of each of the *four major components* and after average the *CRI (Community Resilience Index)*, following *Livelihood Vulnerability*

Index model, would be derived as the following:

$$CRIa = \frac{\sum_{z=1}^4 W_{Cz} C_{az}}{W_{Cz}} \quad (\text{Eq. 15.4})$$

Equation 15.4 (Alam 2017; Alam et al. 2017) may also be articulated in the following way:

$$CRIa = \frac{W_{SE}SE_a + W_{ECC}ECC_a + W_{IH}IH_a + W_{AG}AG_a}{W_{SE} + W_{ECC} + W_{IH} + W_{AG}} \quad (\text{Eq. 15.5})$$

Where, *CRIa* represents the CRI for a village or area a, which equals the weighted average of the four major dimensions. Side by side, weighted are included to assure that all dimensions contribute equally to the overall *CRI*. Along with this, the weight of each of the major components (WC_z) is built by using the number of subcomponents that build each major component (Alam 2017; Alam et al. 2017). Sequentially based on the above-discussed pathways one can solve the research problem(s). The aftermath section is devoted toward the summary, caveats, and policy layout of the very concept.

15.9 Summary, Caveats, and Suggestions

Starting with the common epidemic symptom, or influenza-like symptom(s), among a small number of people in Wuhan, China (Chen et al. 2020; Li et al. 2020), this pathogenic attack has turned into pandemic as a result of rapid and huge infected cases with high human fatality and with ever-growing numbers world over. Subsequently, COVID-19 is the vital issue that has to be examined at all platforms (Singh and Avikal 2020). In the advent of this crucial time, it is needful to prescribe a ‘policy-medicine’ as community resilience, which will not only help to battle against this new kind of challenge but also overall preparedness of any community for the upcoming unknown threats. It is true that after the global experiences about the ongoing poignant impact of COVID-19, this post-modern society may survive if it can beat the human health issues, food & nutrition, economic, financial, and socio-political pressure in a highly competitive world (Sharfuddin 2020). Under this subjection, the real ray of hope would be *community resilience* (CR). After a systematic and rigorous review of literature, the present customized index has been composed which may be capable of addressing the every possible aspect of human life for combating against the utmost challenges and also for re-boosting coping capabilities for future, through the engagement of appropriate policies. Apart from this, the detailed discussions of each and every dimension, as well as major components (with correlated sub-indicators), may help to develop further suitable co-assisting variable(s) for the required field of study. Side by side, the entire volume also may be supportive of the new action of research running smoothly.

Alongside this, it has some caveats too. *First*, for composing the above said overall index, a vast array of datasets is needed, and from data-acquaintance and calibration point of view, it is complicated and troublesome. *Second*, in studying any geographical area, especially related to the underdeveloped or developing world or any middle-income (MICs) and low-income countries (LICs), all the required parameters may not be suitable, or datasets are easily accessible. *Third*, in some cases, the dataset on the temporal scale may not be available, which is proved to be valuable for making any ratio scale (e.g., the increment of bed-patient ratio = pre-COVID bed-patient ratio—post-COVID bed-patient ratio). *Fourth*, the most important is the policy agenda; it is the way by which ‘policy-medicine’ would be applied for the best resilience. However, it is a well-known phenomenon that ill-management and poor implementation of the proposed policy and plans or programs in developing and underdeveloped nations are still going on. But the present compulsion of humanity, as a whole, is to minimize stressors as well as to boost up community resilience.

Amidst the din and bustle, a question may arise that whether the human-world is prepared for this vulnerable scenario. And it is the basic instinct of humanity innately carrying weakness and defenselessness with its journey of struggle (Sharfuddin 2020). The possible answer is affirmative. Yes, human society as a legislative form, like any nation, can reach its goal. In order to reach to its best part of policy suggestion, it can be said that based on (any) case study outcomes and its derived demanding corners or gaps a more suitable and appropriate reframed policy design may fruitfully contribute toward resilience power of community as a part or as a whole. Here, in Fig. 15.5 a sample policy model (in short and simple format) has been produced, which exclusively focuses on humanistic prioritization during the pandemic, and may be in post-pandemic period. Additionally, the proposed beneficiary policy suggestion might be customized, and the mode of prioritization might be reset in accordance with community-specific and geographical region-specific study findings. A researcher or a policymaker should always deal with the value of human lives and humanity in the true sense of the term to make policies working for the benefit of the humankind.

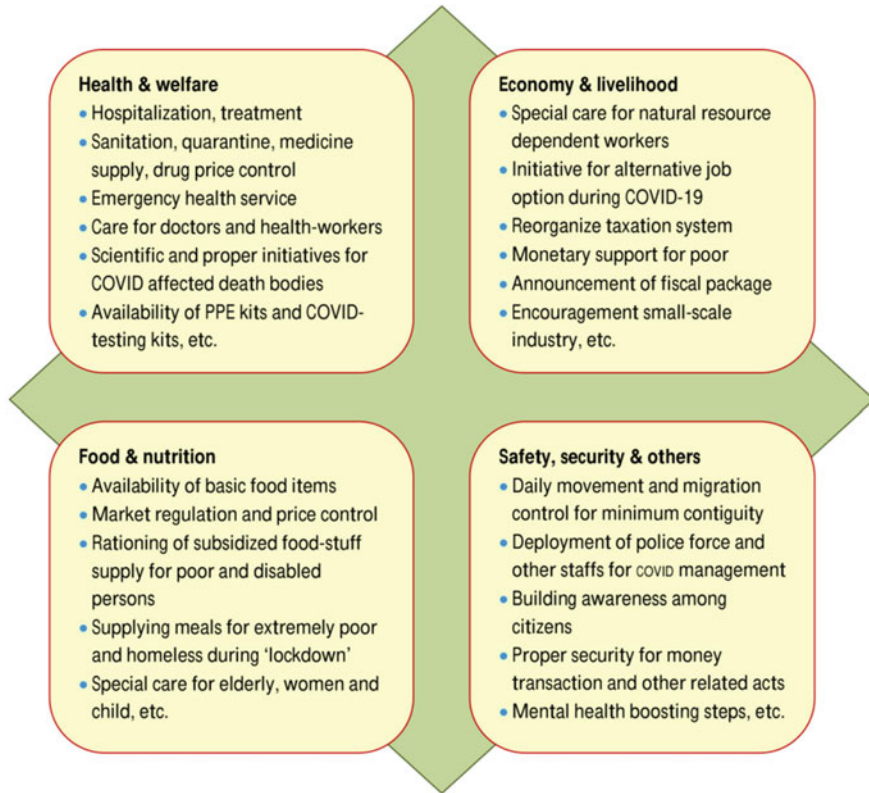


Fig. 15.5 Policy suggestion sector-wise prioritization after CSA (Source Developed by author)

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