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Urban Expansion and Its Implication to Build Urban Resilience in Regio-Metropolitan Cities of the Amahara Region, Ethiopia

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Abstract: There could be many empirical contexts which could be applied in urban resilience. The general objective of this research is to assess urban expansion and its implication on urban resilience in regio-metropolitan cities in the Amhara Region (Gondar and Bahir Dar). It used mixed research approaches and cross-sectional design. Data were collected from primary and secondary sources. Primary data were collected from a survey questionnaire, key informant interview and FGDs while secondary data were gathered from both published and unpublished sources. A multi-stage sampling technique was used to determine sample size, and a proportional sampling method was used. Quantitative data were analyzed using descriptive statistics (mean, percentage, SD), while qualitative data were analyzed using thematic analysis. The results indicate that major factors that influence building urban resilience are lacking proper urban planning, basic infrastructure and good governance in both cities, and both cities are extremely far behind in implementing urban resilience principles. Hence, the study improves the community participation in development policy formulation and implementation for urban resilience.

Keywords: hazards; regio-metropolitan; resilience; urban planning

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1. Introduction

Since urbanization is an irreversible phenomenon, Refs. [1,2] argued that, in order to resolve problems of cities, we have to tackle the root causes which helps to improve the socio-economic situation of the urban poor because they have limited financial resources to cover their cost. Improvements to the country's infrastructure may not be able to meet the increasing growth of disasters [3]. Hence, a deliberate policy is needed to reduce unprecedented accidents. In line with this, Kuddos et al. [2] also indicated that policies addressing urban environmental issues, such as planned urban space, are important.

Urban areas could be identified as complex systems [4]; therefore, it is no surprise that resilience theory is increasingly applied in urban studies. The resilience concept has been applied in a wide range of empirical contexts [5]. However, the popularity of urban resilience continues to proliferate in policy discourse and academic debates [6] and governments around the world should develop plans and programs towards achieving it. Climate change and disaster risk [7], as well as sustainability and security priorities [8], are shared concepts of urban resilience. The theoretical roots of resilience, however, are distinct from sustainability, adaptation, and vulnerability [9]. In present times, local institutions should organize urban resilience to adapt additional uncertainties and pressure to urban areas due to climate change and hazards [10,11].

Resilience is a terminology frequently used in social sciences. Previous studies [12,13] pointed out that social-economic resilience is the capacity of a population to cope and adapt to social or ecosystem changes and extreme environmental events. Social vulnerability (based on an array of social and economic variables) as defined in this study can be used

as a way of measuring such resilience [14]. It is well known that poorer or generally more vulnerable populations are more at risk of suffering from environmental stresses. Resilience is also used for pandemics like COVID-19. Studies indicated that pandemics could occur everywhere without any hindrance of passing states' sovereignties, and to affect a large number of people irrespective of social status, religion, color, economic status, educational status, etc. [15].

There is no only one agreed method on how to measure urban resilience. Cardoso et al. [16] stated that the most common way to overcome this constraint and to make the concept of resilience operational is to use indicators. Resilience is defined by Holling [17] as an ecosystem's ability to maintain basic functional characteristics in the face of disturbance. Redman [18] indicated that the conceptual relationship between resilience and sustainability is often muddled. Sustainability is usually linked to sustainable development. However, in some instances, sustainability and resilience are used interchangeably; in others, resilience is presented as an important component of broader sustainability goals [19]. Thus, resilience does not necessarily conflict with sustainability [20].

There is an inter-relationship between urban expansion and equitable and sustainable development [21]. The patterns, structures, and dynamics of urban expansion could have its effects on spatial inequality from multiple dimensions (economic, social, political, environmental, etc.) and urban resilience. Even though some other previous studies have concentrated on the LULCC in response to urban expansion [22], most of the conducted research focused on urban expansion and its impacts on a single city. In particular, there are not many studies which have been attempted to analyze urban expansion and its implication on urban resilience across Ethiopia's major cities. Thus, this study tries to address how urban expansion has implications on building urban resilience in large cities. Therefore, the main objective of this study is to assess the impact of urban expansion and its implication to build urban resilience in regio-metropolitan cities of the Amhara Region.

2. Methods and Materials

2.1. Study Area

This study is conducted in regio-metropolitan cities, specifically Bahir Dar and Gondar which are found in the Amhara Region and obtained a status of regio-metropolitan level in 2014 [23]. Bahir Dar city is the capital city of the Amahara Region of Ethiopia. The city is found at the southern shore of Lake Tana. The city is located ~565 km northwest of Addis Ababa. Its astronomical location is at 11°35′37.1″ N and 37°23′26.77″ E at an average elevation 1801 m.a.s.l (Figure 1) with an average annual mean yearly temperature of 19.6 °C and 1419 mm precipitation with mid latitude (Woina Dega) agro-ecology [24].The projected population of Bahir Dar based on a 2017 census of the country has increased from 221,991 to 332,856 [25]. Gondar city is the seat for the central Gondar zone administration. The city is located about 735 km northwest of Addis Ababa and 175 km away from Bahir Dar (Figure 1). It is astronomically located at 12°35′60.0″ N and 37°28′0.1″ E. It is one of the historic cities in the country where there are many tourist attraction sites like Fasil castle. The projected population of the city based on the 2007 census of Ethiopia has grown to 378,000 [25]. It is situated at an average altitude of 2111 m.a.s.l with mid latitude (Woina Dega) agro-ecology. These two regio-metropolitan cities have their own sub-city administrations. The researchers purposely identified peri-urban areas of these two regio-metropolitan centers.

2.2. Research Approach and Design

This study applied a mixed approach [26] mainly for its completeness and triangulation purposes. In this research, a cross sectional survey design was used to explore a contemporary phenomenon within its real-life context [27]. The unit of analysis of this research was at a household level.

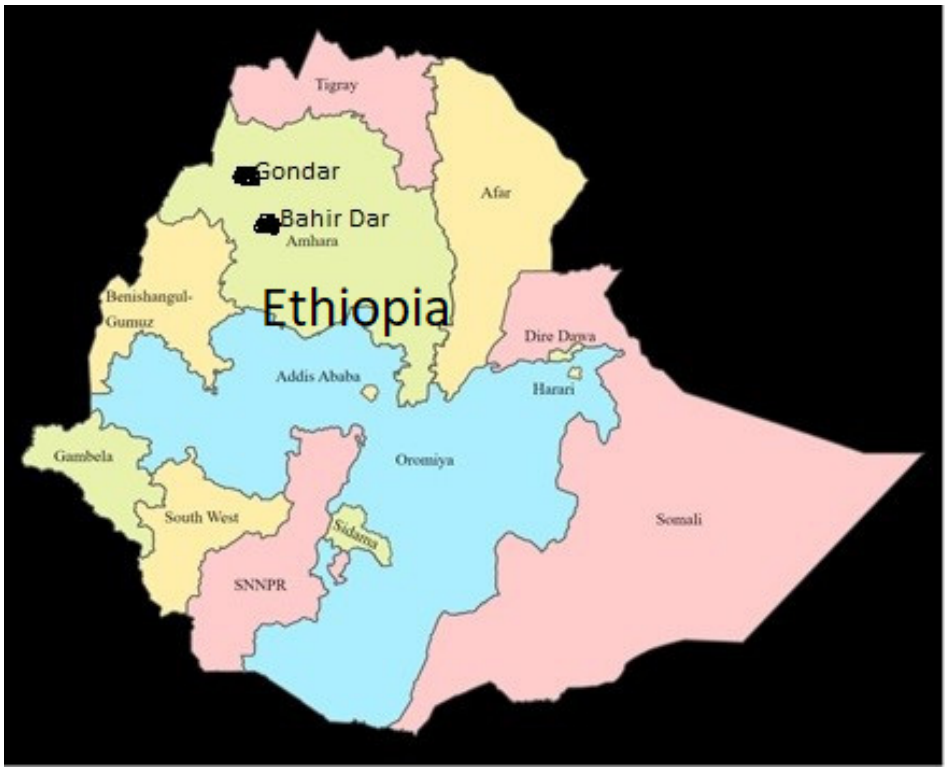

Figure 1. Location map of study areas (Source: Google map).

2.3. Data Type and Sources

The research used both primary and secondary sources. Primary data are comprised of both qualitative and quantitative data. The quantitative data were collected using survey questionnaires. The survey data were collected and filled by trained data collectors who were guided and supervised by the researchers. The qualitative data were collected through Focus Group Discussion (FGD), Key Informant Interviews (KIIs), and observation. FGD were organized from various groups of local communities. Each FGD contains between 8–10 participants. KIIs were conducted based on informants selected from concerned sectoral offices (Mayor Office, sub-city land administration offices, urban agriculture offices, water and energy offices, municipality, urban development and infrastructure office, and environmental protection offices) in each selected city. Moreover, secondary data were collected from different literature, policy documents, statistical survey, plans, and maps. In this regard, the researchers try to refer different books, published and unpublished documents, articles and research papers, governmental and non-governmental reports, policies and laws to obtain information regarding peri-urban development and planning in terms of main opportunities, challenges, and practices in the study areas.

2.4. Sampling Technique and Sample Size Determination

This research focused on two purposively selected regio-metropolitan cities in Amhara National Regional State. Multi-stage sampling techniques were used to identify study subjects. Firstly, sub-cities in each city were selected purposively based on the level of peri-urban expansion. Secondly, sample peri-urban kebeles were determined purposively from each sub-city. Accordingly, two peri-urban kebeles in each sub-city with a total of four peri-urban kebeles in Bahir Dar and Gondar cities were selected. Thirdly, household survey respondents were selected using a systematic random sampling technique from the sample peri-urban kebeles. Fourthly, from each peri-urban kebeles in both cities, household units were selected using a proportional sampling technique based on the number of households' sizes in each peri-urban kebele. The sample sizes of households were 130 (65 samples from each city). The basic reason why we took an equal number of sample households in each

city emanates from the fact that the selected cities have nearly proportional total population size. Finally, to gather the qualitative data, a total of 4 FGDs from 2 peri-urban kebeles (2 from each city) of selected cities and 10 KIIs (5 from each city) from concerned offices of the cities were purposively selected.

2.5. Methods of Data Analysis

This research used both qualitative and quantitative analysis methods. The quantitative data were analyzed using descriptive statistics (percentage, mean, SD) using SPSS Version 24. Qualitative data collected through FGDs, KIIs, and observation were analyzed using the thematic analysis method, where the data were organized systematically and grouped based on certain themes and analyzed according to themes and topics being discussed by participants.

3. Results

3.1. Socio-Demographic Characteristics of Sample Respondents

The survey distributed 130 questionnaires in the two cities and all respondents returned a completed questionnaire (100% response rate). The questionnaires were distributed equally between Gondar (n = 65, 50%) and Bahir Dar (n = 65, 50%). Table 1 presents the demographic and socio-economic characteristics of the respondents. In terms of sex, 50.8% and 67.7% of study sample respondents are males in Gondar and Bahir Dar, respectively, and the majority of the respondents (83.1% and 75.4%) were married in that order. With regard to age, almost all respondents in both cities are within the active working age group with a mean age of 42 and 37 years in Gondar and Bahir Dar, respectively (Table 1). In terms of housing ownership, 87.7% and 52.3% of the respondents lived in their own house while 12.3% and 47.7% lived in rented houses in Gondar and Bahir Dar cities, respectively.

Table 1. Socio-demographic characteristics of respondents (n = 65 for each city).

Variables	Gondar	Bahir Dar
Gender (%)		
Male	50.8	67.7
Female	49.2	32.3
Age (in years)		
Min/Max	24/85	23/68
Mean	42	37
Marital status (%)		
Married	83.1	75.4
Not married	6.2	18.5
Divorced	6.2	4.6
Widowed	4.6	1.5
Educational level (%)		
Cannot read & write	52.3	15.4
Can read & write	27.7	15.4
Primary school (1–8)	4.6	4.6
Secondary school (9–12)	4.6	1.5
Diploma	7.7	15.4
Degree & above	3.1	47.7
Occupation (%)		
Government employed	3.1	55.4
Self-employed	70.8	30.8
Unemployed	26.2	13.8
Housing ownership (%)		
Private	87.7	52.3
Rented	12.3	47.7

Source: Field survey, 2021.

3.2. Understanding the Concept of Urban Resilience: Community and Institutional Perspectives

The majority of the respondents did not understand the concept of urban resilience in Gondar (89.2%) and Bahir Dar (69.2%) cities. Urban planners and environmentalist experts as a key informant were further asked to express their understanding of urban resilience in relation to their institution activities. However, the interview data revealed that they did not know the meaning of urban resilience. Environmental experts from sanitation and beautification department explained that:

" . . . the concept of urban resilience can be explained as the process of identifying natural disaster and preparing mitigating measures for the disaster in the time of occurrence . . . "

In Gondar city, only 10.8% respondents heard about the concept of urban resilience from government and educational institutions. Similarly, in Bahir Dar, the respondents (30.8%) heard about the concept of urban resilience from the government institution, social media, and educational institutions (Table 2).

Table 2. Understanding the concept of urban resilience and source of information (n = 65 in each city).

Alternatives		Gondar		Bahir Dar	
		N	%	N	%
Yes	Friend	0	0	1	1.5
	Government institution	4	6.2	8	12.3
	Social media	0	0	6	9.3
	Educational institution	1	1.5	4	6.2
	Other	2	3.1	1	1.5
No		58	89.2	45	69.2

Source: Field survey, 2021.

In addition, in Gondar city, a few respondents (35.4%) understood the concept of urban resilience easily, while, for the majority of respondents (64.6%), the concept is complex to understand. In the same way, in Bahir Dar city, a few respondents (29.2%) and the majority of respondents (71%) stated that urban resilience is an easy and complex concept to understand, respectively (Figure 2). This indicates that building urban resilience requires conceptual understanding through negotiations and engagement between different stakeholders with different agendas. Our finding is consistent with previous studies [28] who reported that there is limited understanding of the concept of urban resilience amongst the community and local urban planning-related institutions.

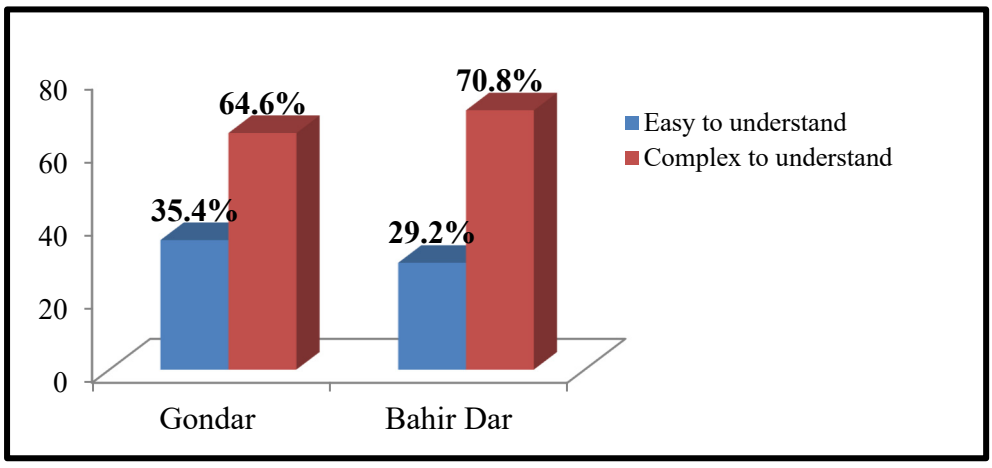

Figure 2. Understanding level of the concept of urban resilience. Source: Field survey, 2021.

3.3. Factors That Influence Building Urban Resilience

In this research, empirical evidence was collected from respondents about the factors that influence building urban resilience. Hence, the findings show that major factors that

influence building urban resilience lack good governance (98.5% and 95.4%), lack proper urban planning (96.9% and 95.4%), and lack basic infrastructure (90.8% and 86.2%) in Gondar and Bahir Dar cities in that respective order (Figure 3).

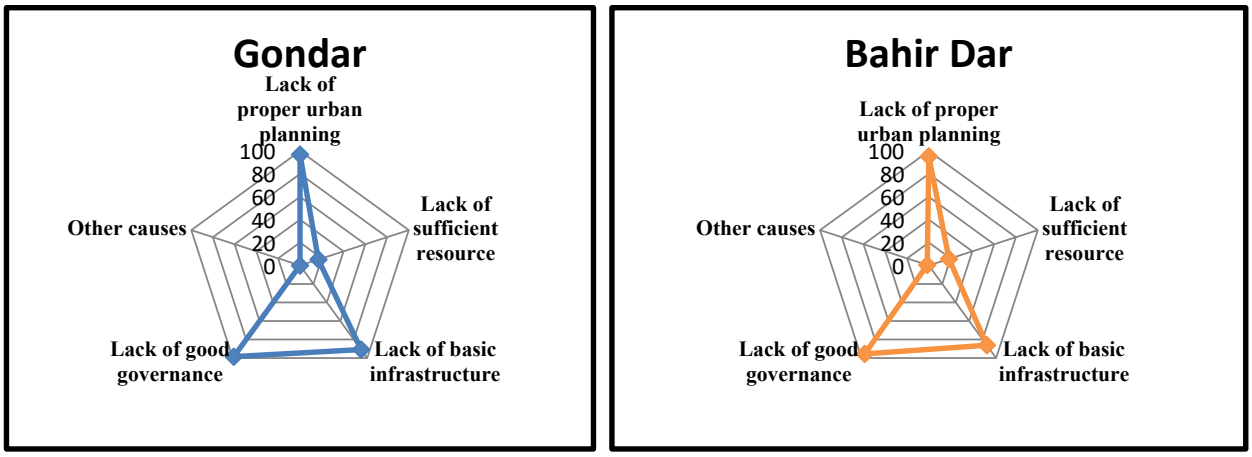

Figure 3. Factors that influence building urban resilience. Source: Field survey, 2021.

This implies that weak public institutions and a poor track record of public policy implementation in different urban sectors lead to inefficient provisions of service and utilities to the whole communities of the urban centers, which in turn affects the building of urban resilience.

3.4. The Occurrence of Hazards

The major hazards that occur in Gondar city are fire (97%), temperature increment (94%), and flood (80%), respectively. In the same fashion, hazards that occur in Bahir Dar city are temperature increment (95%), fire (91%), and flood (88%), respectively. On the other hand, storm wind occurs more in Gondar (45%) than Bahir Dar (39%) (Figure 4) The probable reason for this could be expansion of the Sahara desert towards the south from Sudan (Table 3). This means that urban resilience has been in practice to prepare for, react to, and recover from sudden shocks and long-term disruptions and to maintain critical infrastructure when exposed to these natural hazards.

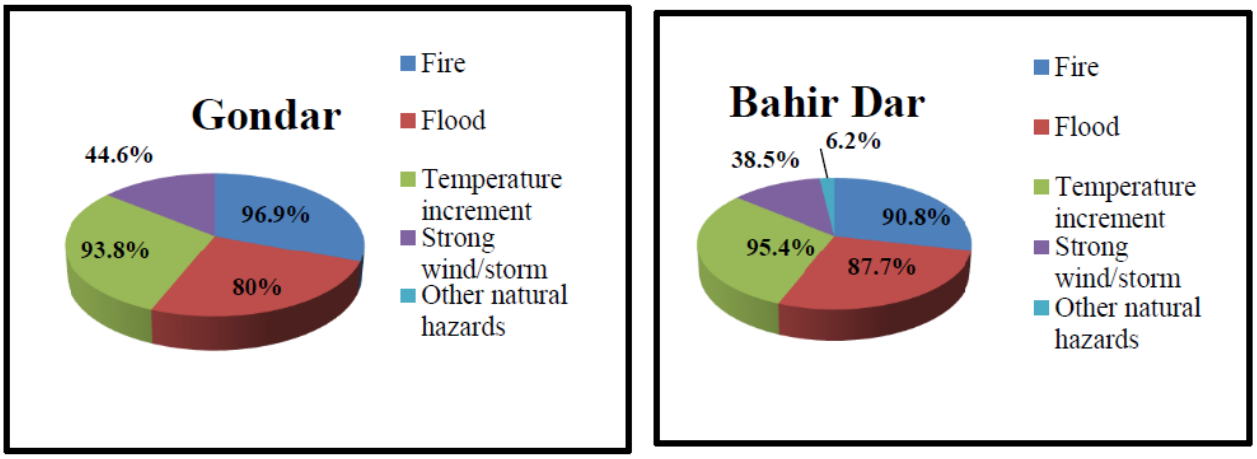

Figure 4. Hazards that occurred in the study areas (Source: Field survey, 2021).

Table 3. Urban infrastructure resiliency to disasters [1] and familiarity of the urban resilience concept in urban planning [2] (n = 65 each city).

Alternatives	Gondar [1]		Bahir Dar [1]		Gondar [2]		Bahir Dar [2]	
	N	%	N	%	N	%	N	%
Yes	28	43.1	2	27.7	2	3.1	4	6.2
No	37	56.9	63	72.3	63	96.9	61	93.8

Note: [1] urban infrastructure resilience to disaster. [2] familiarity of urban resilience concept in urban planning. (Source: Field survey, 2021).

On the other side, as indicated in Table 4, study participants were ranked the natural hazards that occurred in their respected city based on order of frequency that temperature increment is rank first in Gondar city, followed by strong wind and fire. In Bahir Dar, temperature increment is ranked first, followed by flood and fire. This infers to that new threats/stresses (extreme temperature) due to population growth, climate change, and technology needs integrated urban plan and implementation of urban resilience to de-risking this natural disasters.

Table 4. Frequency and rank of hazards in the study area.

Type of Natural Hazards	Gondar										Bahir Dar									
	Very Frequent		Frequent		Less Frequent		Infrequent		Mean	Rank	Very Frequent		Frequent		Less Frequent		Infrequent		Mean	Rank
	N	%	N	%	N	%	N	%			N	%	N	%	N	%	N	%		
Fire	0	0	1	1.5	64	98.5	0	0	1.98	3	4	6.2	10	15.4	50	76.9	1	1.5	1.74	3
Flood	0	0	1	1.5	62	95.4	2	3.1	2.02	4	14	21.5	13	20.0	36	55.4	2	3.1	1.40	2
Temperature increment	26	40.0	38	58.5	1	1.5	0	0	0.62	1	39	60.0	25	38.5	1	1.5	0	0	0.42	1
Strong wind	0	0	21	32.3	41	63.1	3	4.6	1.72	2	0	0	11	16.9	28	43.1	26	40.0	2.23	4
Landslide	0	0	0	0	0	0	65	100.0	3.00	5	0	0	0	0	0	0	65	100.0	3.00	5

Source: Field survey, 2021.

3.5. Urban Infrastructure Resiliency to Disasters and Urban Resilience Concept in Urban Planning

In this context, our finding shows that urban infrastructures are not resilient for tackling shocks and stresses caused by the current and future climate change with 57% and 72.3% in Gondar and Bahir Dar cities, respectively (Table 3 [1]). This means that urban infrastructures have been built only for the sake of performing daily activities without considering their performance during disasters.

Studies indicated that everyday life relies on the operation of different Resilience of Civil Infrastructure Systems (CISs), such as electric power, water and gas distribution, and transportation infrastructures [29]. However, consideration of incorporating the concept of urban resilience into the urban planning and design fields to prevent the natural disasters has limited practice in developing countries and in Ethiopia too. The findings reveal that higher percentage (>94%) of the study participants agreed that the concept of urban resilience is not familiar in the urban planning activities in both cities (Table 3 [2]).

Moreover, results revealed that the majority of the respondents indicate there is no incorporation of ecologically sensitive area in land use plan to build urban resilience both in Gondar (88%) and Bahir Dar (83%) in their urban planning practices (Table 4). The key informants also confirmed it in both cities.

4. Discussion

4.1. Urban Resilience Principles

Resilience requires a comprehensive approach for measuring and analyzing because it is multi-dimensional as well as place-scale and time-specific [16]. For enhancing and identifying the real needs of urban resilience, planning the efficiency and effectiveness and

measuring implemented resilience assessment are necessary. In line with this, Cardoso et al. [16] indicated that the current and expected future status of resilience is a basis for cities to know where they are, helping to identify strengths and weaknesses, thus supporting the decision on strategies, actions and measures to be taken, and planning for the long-, medium- and short-term progress.

According to UNISDR (2013) cited in Darkwah et al. [28], urban resilience in African cities rests on different key tenets, these include:

(1) Working with multiple stakeholders;
(2) Incorporating risk assessment;
(3) Making safe land available for urban development;
(4) Upgrading informal settlements;
(5) Installing risk-reducing infrastructure.

Based on this context, we collected empirical evidence about the applicability of the principles determined by UNISDR that helps to achieve urban resilience in both study sites. Our findings show that stakeholder engagement and making safe available land for urban development were applicable with a percentage value of 80% in both cities, followed by the provision of public space (54.1% and 48.3%) in Gondar and Bahir Dar cities, respectively (Table 5). This is to mean that, by considering other survey results, both cities are practicing the principles without understanding the concept of urban resilience (Figure 5).

Table 5. UNISDR principles in achieving urban resilience in the study area (results based on multiple response rate).

Variables	Gondar		Bahir Dar	
	n = 154	%	*n* = 159	%
Stakeholder engagement	49	80.3	48	82.8
Incorporating risk assessment			3	5.2
Making safe land available for urban development	46	75.4	38	65.5
Provision of public space	33	54.1	28	48.3
Upgrading informal settlements	14	23.0	11	19.0
Installing risk-reducing infrastructure	10	16.4	18	31.0
Good information sharing system	2	3.3	5	8.6
Protecting ecosystems	0	0	8	13.8

Source: Field survey, 2021.

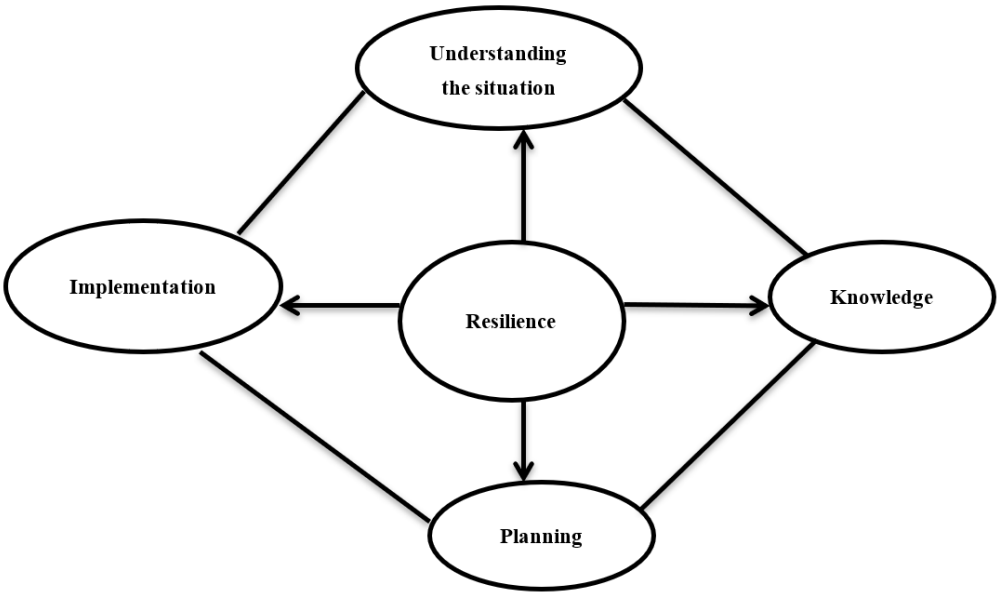

Figure 5. Adaptive resilient planning process, modified from Mengistu et al. [15].

This finding is consistent with the findings of [29] who reported on incorporating all stakeholders in decision-making improves legitimacy, expanding the depth and diversity of knowledge, and helping to detect and interpret change and disruptions. They further argued that resilience grows as the network of stakeholders strengthens linkages in the system (Figure 6). These linkages promote dialogue and collaboration to address emerging problems or crises.

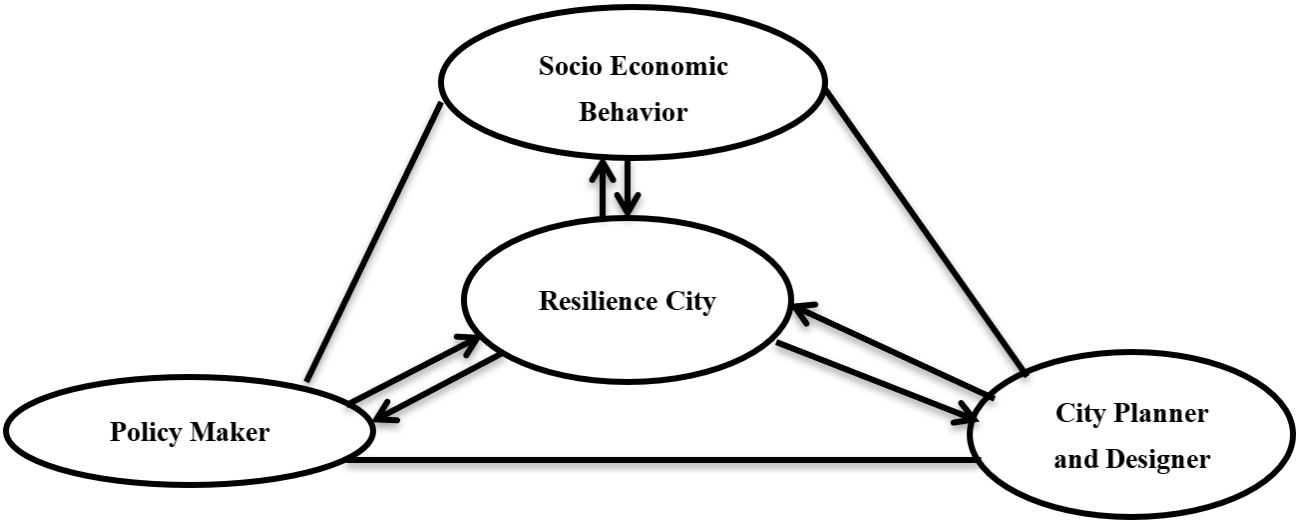

Figure 6. Ways of integration to promote city resilience, modified from Mengistu et al. [15].

4.2. Theoretical Critiques and Conceptual Frameworks of Resilience

There are five W's to understand urban resilience: for Whom? What? When? Where? and Why? [20]. Resilience for whom? prevails over who benefits or loses in particular decision-making. It entails considering potential trade-offs between stakeholders [30]. Resilience of what to what? requires operationalizing and specifying what will be made resilient to what such as climate change, natural disaster, etc. [31]. Resilience when? is for short-term disruption (e.g., flooding) or long-term stress (e.g., climate change effect). Resilience where? interlinks globally through commodity, socio-cultural, political, economic, and infrastructure networks [30,32,33]. Why resilience? tends to prioritize swift system recovery after a disturbance. In short, urban plans and interventions must be considered in terms of trade-offs, interconnections, and multiple scales [20].

A resilient city is able to withstand a variety of challenges because the following elements are incorporated into urban systems and the ways in which people construct and maintain those systems [34]. It has four main elements (Figure 7).

Figure 7. Elements of urban resilience, source, Melkunaite and Guay, [35].

Opitz-Stapleton et al. [34] pointed out that ***Redundancy*** is when several urban systems can serve similar functions and provide substitutable services when another system is disrupted. ***Flexibility*** is the ability to absorb shocks and slow-onset challenges. It is a diversified economic base. ***Capacity to reorganize*** is the ability to change and evolve in response to changing conditions. ***Capacity to Learn*** is an ability to internalize past experience, respond to it, and avoid repeating mistakes.

5. Conclusions

Urban resilience building has become a major component of climate adaptation, environmental management, regional economic development, and strategic planning [36]. However, in the literature, the way in which urban resilience is used and understood is dominated by an emphasis on bouncing back to where we were.

To understand the urban resilience situation in Ethiopia, we gathered empirical evidence from Gondar and Bahir Dar cities as a case study about the policy frameworks to build urban resilience. Our findings show that a higher percentage (95%) of the participants replied that there is no policy guideline available for building urban resilience in the urban planning process at both study sites. This result was also confirmed by the key informant responses. For instance, a key informant in Bahir Dar city responded that urban resilience issues are practiced by assigning a focal person that is selected by the city mayor from the transport, sanitation and beautification, and agriculture departments to identify natural disasters in the city once in a year. He further replied that there is no organized policy and institution to perform urban resilience issues in the urban planning process. This implies that there is no guiding framework in relation to building urban resilience in the planning process in both cities.

Previous studies pointed out that resilience thinking addresses the dynamics and development of complex social-ecological systems [37]. Resilience in this context is the capacity of social-ecological systems to continually change and adapt yet remain within critical thresholds. Meanwhile, it is worth mentioning that such an emphasis also shapes the type of responses that are planned by the relevant institutions [36]. With respect to this, much of the resilience-building literature is dominated by post-disaster emergency planning, where the focus is on sudden, large, and turbulent events, at the expense of gradual, small, and cumulative changes in planning. Although resilience is a relatively new concept in planning, it is rapidly gaining momentum [36]. In this study, it is indicated that urban resilience offers a useful framework which allows us to think in new ways about planning, ways that have a lot in common with interpretive planning and the relational understanding of space and time.

6. Recommendation: Policy Frameworks to Build Urban Resilience

Urban resilience in planning should be context sensitive, and capacity-building activities should be undertaken to ensure the participation of a wide range of local stakeholders and key actors throughout different stages of the planning process. Such an approach improves the accountability and transparency of the process and enhances the chances of implementation. In this context, the development of policy guidelines and implementation of regulatory, anticipatory, and monitoring frameworks are essential to ensure urban resilience goals and avoid being overwhelmed by future uncertainties.

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