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Ecological Balance Program for Guinacot, Danao City, Cebu

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Abstract— The study focuses on the development of an Ecological Balance Program for the Langub River and Mountain area in Sitio Langub, Danao City, Cebu, Philippines. The region is highly vulnerable to natural and man-made hazards, such as landslides, floods, and environmental degradation, exacerbated by climate change and poor land-use practices. The study investigates the factors contributing to vulnerability, such as deforestation, quarrying, and inadequate local government response, through a survey of 50 respondents. The findings highlight the need for increased local government assistance, community involvement, and sustainable practices to mitigate hazards. Most respondents perceive that while some disaster mitigation measures are implemented, many areas remain under-addressed. The lack of tree planting, improper drainage systems, and overpopulation were identified as key issues. The proposed Ecological Balance Program aims to strengthen disaster preparedness and resilience through collaborative efforts between local government units, civil society, and community volunteers. The study recommends adopting sustainable environmental management practices, improving local disaster mitigation strategies, and engaging community members in conservation efforts to protect biodiversity and reduce vulnerability to future hazards.

Keywords: Ecological Balance Program, disaster risk reduction, climate change, vulnerability, natural hazards, Sitio Langub, Danao City, Cebu, community resilience, environmental management, mitigation measures, local government, biodiversity conservation.

1. Introduction

Millions of people in the world are affected by manmade and natural disaster that if it is not addressed well awaits like a ticking time bomb [1]. As long as civilization exist elsewhere the preservation for life and property takes account for its progress while mankind struggles to keep the balance in accord for self-preservation, nurture sometimes becomes a catalyst for a radical, dynamic change for progress and development [2]. Countries with unstable economy, increasing population, social turmoil due to corrupted policies from distorted politicians adds up the intensity of a nation that have had history of landslide, earthquake brought up damaging devastation even by a gentle natural cataclysm. According to Alfredo A. Arquillano UN Sasakawa Awardees for Disaster Risk Reduction in 2011 for its community empowerment programme to boost the resilience of a mostly poor population living below the poverty line that the primary goal of the National Disaster Risk Reduction Management Plan (NDRRM) is to improve the existing practices of the LGU on the disaster risk reduction and management through better partnership and working relationship among the departments within the local government unit, civil society organization private sectors and community disaster volunteers (CDV's) [3]. Because of this force majeure that rocks Asia's ring of fire in recent years, (Philippine included) that monitoring using state of technology gadgets, updating on land tectonic plates, documenting on devastations from uncommon practice in structural practices and manmade hazard prone areas, that MDRRM was seriously supported by the Philippine government. Global warming has already taken its toll, in the Philippines in particular the recent cataclysmic event of Tacloban of typhoon Yolanda, and Bopha spell out one of the strongest typhoons recorded internationally almost successively were rising temperature and abrupt cooling of super-heated bodies of water which increases wind velocities, not only climatic factors were affected but the symbiotic system were birds, insects and reptiles impede reproduction and disrupts the cycle of life [4]. The global warming has particular effects on a Himalayan country like Nepal: the temperatures are rising, the glaciers are melting, and new glacial lakes are forming that can burst at any moment; the precipitation system is affecting and the fragile ecosystems of the mountains impacting people's livelihoods [5]. Vulnerabilities to

climate change do not only depend on natural factors but also on economic, social and cultural factors that impact on people's status, behaviors, relationships, and power [6]. Ironically, the Philippines is located in the Southeast Asia in the Western Pacific Ocean were being underdevelopment is the country experiences a natural phenomenon such as frequent seismic, volcanic activity, typhoons that the cause of the most devastating floods and landslides. The country is ranked as the third most disaster-prone country in the world due to high exposure to natural hazard-prone countries in the world [7]. The social and economic cost of natural disaster in the country is increasing due to changing land-use patterns, migration, unplanned urbanization, environmental degradation and global climate change [8]. This is compelling reasons that there should be an accumulative disaster risk reduction and management and climate change adaptation [9]. Cebu is an elongated island and center of the Philippine archipelago, typical Tropical Island. It is also known for its rugged mountain ranges that traversing the northern and southern lengths of the island, separating the east and west coasts. It has a steep mountainous spine and some of them are found in SitioLangub, Barangay Guinacot, Danao City which is 33 kilometers of Cebu City. The location has diversity of plants, animals, and wonders of its geological location. As years passed, several problems are also manifested in various areas of the country with a landslide, flooding, drought, biodiversity loss, health risk and may other kinds of environmental risks and hazards [10].

1.2 Theoretical background

Climate change has already affected the natural resources and people's lives and livelihoods. The Earth has warmed by approximately 0.7% for the past years. The temperature could rise even more rapidly, between 1.4°C and 5.8°C, in the coming century. Poor people in developing countries are more exposed to the effects of climate change, for they live and work in area where natural disaster could possible happen. Identifying the various factors that are susceptible to the damaging effects of hazards should be one of the concerns. However, the current condition is in danger because it is constantly threatened to dreadful conditions caused by natural and human-related activities such as soil erosion and landslides. Thus, the determination of vulnerable areas is deemed very important for an effective planning [11]. The location is in route to a plantation of lush vegetable produce that links to Danao market, it served to provide socio-economic gain along people living on the mountainous part of the city, upon acquiring the data needed for its social aspect, the identification of hazard analysis was established, clearly pinpointing the location, source, impact on nature, severity of the occurrences that are brought by erosions. The study is supported with Presidential Decree No. 1566 Strengthening the Philippine Disaster control, capability and establishing the National Program on Community Disaster preparedness and Bureau of Mines and Geosciences of the Department of Environment and Natural Resources ; Presidential Decree No. 1566, DCD Memorandum Circular No. 079, MGM Memorandum Circular No. 2000-33, Executive Order No. 888, Presidential Decree 1566, Republic Act 101211 as instrument for guiding rules and principles for soil erosion assessment and investigation. Collations of all this data that includes mapping, actual interviews, and historical documentation makes –up the database to formulate the output of the study.

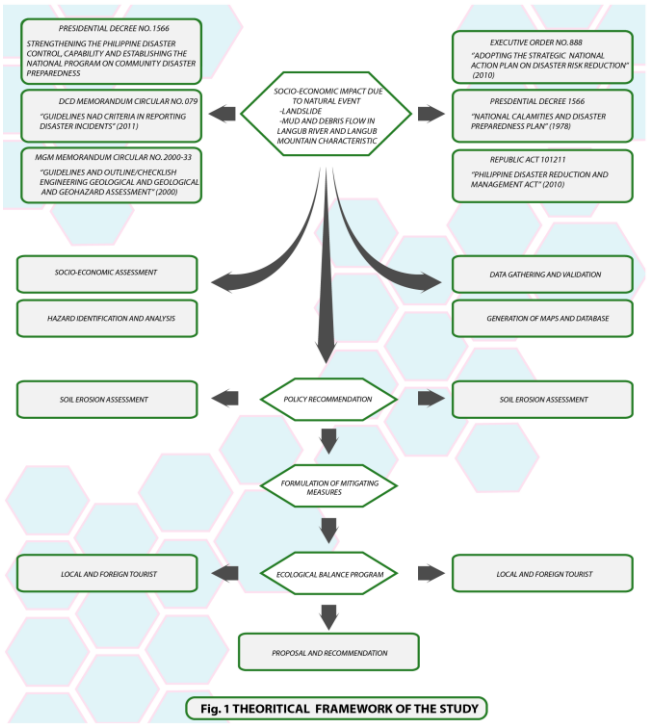

Fig. 1 THEORITICAL FRAMEWORK OF THE STUDY

1.3 Statement of the Problem

The purpose of this study was to propose an Ecological Balance Program for the Vicinity of Langub

River and Langub Mountain in SitioLangub, Danao City, Cebu

Specifically, this study sought to answer the following sub-problems:

1. What is the profile of the:
   1.1 respondents,
   1.2 locality as;
      1.2.1 contributory factors of natural and man-made hazards
      1.2.2 number of occurrences of the indicated hazards, and
      1.2.3 factors affecting the level of vulnerability?
2. As perceived by the respondent groups, to what extent are the mitigating measures implemented on natural and man-made hazards?
3. What are the issues and concern related to the identified hazards?

2. Materials and Method

In the undergoing of the study, the researcher characterized the fundamental methods, gradually the potential of the proposed project. The narrative method was used in the gathering of data by the use of the researcher-made questionnaire, interview and documentary evidence along the analysis of the data gathered. It comprised the analysis of the current condition together with the prevailing situations that are taking place. The Proposed Ecological Balance Program of the vicinity of Langub river and Langub Mountain in Barangay Guinacot, Danao City, Cebu to be considered as part of the research methods of the study.

After the problems have been identified, the interview was used to gain additional information and data deemed necessary for the study to form an integral part of the same as a whole. The government officials, government documents, and legal files are deemed to be the source of the information and data mentioned therein. The data and information that the group would be able to gather will be the basis for the undergoing of the study.

However, the questionnaire was used among various local residents of Danao City to gain information on the scrutinize thoughts, ideas and suggestions regarding the study have been identified as a major substance in the study.

As long as the researcher is concerned, though the use of books and researching the internet, together with the government documents and /or files, which shall include laws and ordinances, was used as supporting data and as legal references in the proposed study.

2.2 Respondents

The respondents of the study were the localities of Sitio Langub, Barangay Guinacot, Danao City Cebu, the subjects of the study are all residents from the location, therefore, had a great concern for their community and livelihood.

Table 1: Distribution of Respondents

Respondents	N	Percentage
Barangay Residence	50	100%
TOTAL	**50**	**100%**

2.3 Instruments

The instrument used in this study is a researcher made four –sets questionnaires- one for the localities on contributory factors of Natural and Man-made Hazards. Second Frequency of Occurrences. Third Factors Affecting the Level of Vulnerability. Fourth Factors Affecting the Level of Vulnerability on the Implementation of Mitigating Measures.

2.4 Procedure of Gathering of Data

The following are the steps in data gathering:

Preliminary Preparation. The researcher will prepare and secure a letter of approval from the President of Cebu Technological University. Together with the letter is the researcher- made questionnaire.

Distribution of Questionnaire. Upon approval, the researcher distributes the questionnaire personally to the respondents, before filling up the survey questionnaire an explanation on the purpose of the study.

2.5 Treatment of data

The data gathered from the survey questionnaire where be tallied, collated, tabled and subjected to the following statistical treatments [12]. Weighted Mean, this was used to attest the respondents' response on the frequency of events.

2.6 Scoring Procedure

The average weighted point of the weighted categories was used as the mean of the evaluated item. Thus, the following parametric scale was utilized to provide equal chances for each response category.

Table 2: Contributory factors of natural and man-made hazards

Weight	Category	Verbal Description

3	Most Probable Cause	Means that the Degree on the destructive forces of nature that needs major attention from its occurrences is 100%
2	Less Probable Cause	Means that the Degree on the destructive forces of nature that needs a little attention from its, occurrences is 50%
1	No Probable Cause	Means that the occurrences on any forces of nature don't have any degree of its destruction is none

Table 3: For the Occurrences of the indicated hazard

Weight	Category	Verbal Description
3	Always (A)	Means that the Degree on the destructive forces of nature that needs major attention from its occurrences is 100%
2	Seldom (S)	Means that the Degree on the destructive forces of nature that needs a little attention from its, occurrences.
1	Never (N)	Means that the occurrences on any forces of nature don't have any degree of its destruction is none

Table 4: For the factors affecting the level of its vulnerability

Weight	Category	Verbal Description
3	Extremely (E)	Degree on the vulnerability level that needs major attention from its occurrences
2	Not Very Likely (NVL)	Degree on the vulnerability level that needs a little attention from its, occurrences
1	None (N)	Degree on the vulnerability level from any forces of nature that have no destructively effect.

Table 5: Extent of Implementation on Mitigating Measure

Weight	Category	Verbal Description
3	Very Well Implemented	Degree on the destructive forces of nature that needs major attention to mitigating measure from its occurrences
2	Implemented	Degree on the destructive forces of nature that needs a little attention to mitigating measure from its, occurrences
1	Not Implemented	Degree on the destructive forces of nature that don't need attention to mitigating measure destruction

3. Result and Discussion

This chapter presents, analyzes and interprets the data gathered to answer the problems of the study as perceived by the respondent groups, to what extent are the mitigating measures implemented on natural and man-made hazards and what are the issues and concern related to the identified hazards.

3.1 Profile of the Respondents

The respondents' profile includes residency, age, gender, and civil status.

Table 6: Profile of the Respondents

Variable	*f*	*%*
Residency		
Less than a year	9	18
1-5 years	18	36
5 years and above	23	46
Total	**50**	**100**
Age		
50 years old and above	3	6
42 - 49	6	12
34 - 41	8	16
26 - 33	10	20
18 - 25	23	46
Total	**50**	**100**
Gender		
Male	17	34
Female	33	66
Total	**50**	**50**
Civil Status		
Single	31	62
Married	16	32
Separated	2	4
Widowed	1	2
Total	**50**	**100**

The demographic profile of the respondents is presented in Table 6. In terms of residency, 18% of respondents have lived in their current area for less than a year, 36% for 1 to 5 years, and 46% for more than 5 years. Regarding age, the majority of respondents (46%) are between 18 and 25 years old, while 20% are between 26 and 33 years old, and 16% are between 34 and 41 years old. Additionally, 12%

of respondents are aged 42 to 49 years, and 6% are 50 years old and above.

Gender distribution shows that the majority of respondents are female (66%), while 34% are male. Regarding civil status, 62% of respondents are single, 32% are married, 4% are separated, and 2% are widowed.

3.2 Profile of the Locality

Locality includes the contributory factors on natural and man-made hazards, the number of occurrences, and factors affecting the level of vulnerability.

Contributory Factors on Natural and Man-made Hazards

Table 7: Contributory factors on Natural and Man-made hazards

ITEM	WM	VD
Surge of water level of river during heavy downpour	**3.00**	**MPC**
No trees planted.	**2.88**	**MPC**
Slash and burn (kaingin)	**2.90**	**MPC**
Quarrying.	**2.70**	**MPC**
Over all mean	**2.87**	**MPC**

Legend: **WM** - Weighted mean; **VD** - Verbal Description; **MPC** - Most Probable Cause

The data collected highlights respondents' perceptions of Contributory factors on Natural and Man-made hazards. The surge in water levels of rivers during heavy downpours received the highest mean score (M = 3.00), indicating that it is viewed as the "Most Probable Cause" (MPC) of environmental issues. Similarly, slash and burn (kaingin) practices were rated with a mean of 2.90, and the lack of trees planted received a mean of 2.88, both also classified as MPC. Quarrying received the lowest mean score (M = 2.70), though it still remains within the MPC category. Overall, the mean score across all items was 2.87, reflecting that, on average, respondents perceive these factors as probable causes of environmental concerns. Among the listed concerns, the surge in water levels was rated the highest, suggesting greater awareness or concern regarding this particular issue. This implied that Degree on the destructive forces of nature that needs major attention from its occurrences.

Frequency of Occurrences

This data reveals the number of times that Natural and man-made hazards occurred in an instance as observed by the localities.

Table 8: Frequency of Occurrences

ITEM	WM	VD
Surge of water level of river during heavy.	3.00	A
No trees planted.	2.90	A
Slash and burn (kaingin)	2.90	A
Quarrying.	2.70	A
Over all mean	**2.88**	**A**

Legend: **WM** - Weighted mean; **VD** - Verbal Description; **A** - Always

Table 8 presents the frequency of occurrences of various environmental concerns based on the respondents' feedback, where "Always" (A) was used to describe how frequently each item occurs. The surge of water level in the river during heavy rains received the highest weighted mean (WM = 3.00), indicating that this issue was consistently perceived as always occurring. Both the lack of tree planting and slash-and-burn (kaingin) practices followed closely with a weighted mean of 2.90. Quarrying had the lowest weighted mean at 2.70, but it was still described as "Always" occurring. The overall mean for the frequency of these issues was 2.88, suggesting that, on average, these environmental concerns are persistent in the area. This implied that under frequency of occurrences the degree on the destructive forces of nature that needs major attention occurred only when there is heavy down pour.

Factors Affecting the Level of its Vulnerability

Data presents the factors affecting the localities in the present setting, how their conditions and circumstance measured through the level of vulnerability.

Table 9: Factors Affecting the Level of its Vulnerability

ITEM	WM	VD
Heavy down pour	3.00	VMA
Natural cliff formation	2.96	VMA
Degradation of river bank protector	2.90	VMA
Road drainage	2.78	VMA
Over all mean	**2.91**	**VMA**

Legend: **WM** - Weighted mean; **VD** - Verbal Description; **VMA** - Very Much Affected

The data in Table 9 presents the factors affecting the level of vulnerability, as perceived by respondents. The weighted means (WM) and verbal descriptions (VD) were used to evaluate the extent of each factor's impact. All factors were classified as "Very Much Affected" (VMA). Among the factors, "Heavy downpour" received the highest weighted mean (WM = 3.00), indicating that it is perceived to have the most significant impact on vulnerability. This was followed by "Natural cliff formation" (WM = 2.96) and "Degradation of river bank protector" (WM = 2.90), both also considered highly impactful. The

factor "Road drainage" had the lowest weighted mean (WM = 2.78) but still fell under the category of "Very Much Affected." Overall, the mean weighted score for all factors was 2.91, suggesting that, on average, all the factors contribute significantly to the perceived level of vulnerability. The data implied that the residents of Sitio Langub, Danao City was Very Much Affected by the identified factors of Vulnerability. Areas vulnerable to landslide are those unstable geology and steeper slopes it is impetuous by high rainfall that causes the saturation of the soil and mass movement down slope due to some ground disturbance.

3.3 As perceived by the respondent groups, to what extent are the mitigating measures implemented on natural and man-made hazards

The data reveals the extent of implementation on a mitigating measure on the very location as provided by the local government to alleviate existing conditions.

Table 10: Extent of Implementation on Mitigating Measures

Extent of Implementation on Mitigating Measures	RESPONSES (n=50)			X	VD
	Very Well Implemented (3)	Implemented (2)	Not Implemented (1)		
Responses of local government from localities request on the problem.	1	5	44	1.14	NI
Quality on the existing disaster mitigating project in the area.	10	15	25	1.70	I
Maintenance of existing disaster prevention program.	20	15	15	2.10	I
Participation of community for the restoration and repair of any disaster mitigating measure	41	7	2	2.78	VWI
Average Weighted Mean	**1.93**				
Interpretation	**Implemented**				

As shown in the Table, Responses of local government from localities request on the problem got a weighted mean on 1.14 which is described as Not Implemented; Quality on the existing disaster mitigating project in the area had a weighted mean on 1.70 which is described as Implemented; Maintenance of existing disaster prevention program had a weighted mean on 2.10 which is described as Implemented; while Participation of community for the restoration and repair of any disaster mitigating measure had a weighted mean on 2.78 which is described as Very Well Implemented. The average weighted mean of 1.93 which is described as Implemented. The table implied that extent of implementation on mitigating measures was seen as Implemented and that recovery, repair and restoration were also noted as being partaken. Mitigating measures were identified as the crucial element to reduce damage caused by natural and man-made hazards and at the same time improving the current conditions in the vicinity of Langub river and Langub Mountain.

3.4 What are the issues and concern related to the identified hazards

The data below supports the problem that hounds the community's local governments involvement to progress and its pivotal role to society in general.

Table 11: Issues and Concern related to identified hazard

ITEM	F	RANK
Less Assistance from Local Government	50	3
No Program in river clean-up drive	48	2
Quarrying.	48	2
Surge of water level of river during heavy rain	48	2
No Person with authority overseeing the hazard	37	1

As revealed in the Table, Less Assistance from Local Government got the rank 1; Surge of water level of river during heavy No Program in river clean-up drive, Quarrying had a triple tie and computed as rank 3; No Person with authority overseeing the hazard got the rank 4; Slash and burn (kaingin) got the rank 5; No trees planted got the rank 6; House built within the perimeter of location of occurrences got rank 7; Presence of deep-rooted trees

surrounding areas got the rank 8; while Overpopulation was the last.

The ranking inferred that Less assistance from local government got the attention from the respondents were observed. Policy recommendations inputs to the sustainable management within the vicinity of Langub river and Langub Mountain should be put into fruition. Clean and Green Program Encourage Civil Welfare Training Service (CWTS) students in cleaning and planting more trees within the vicinity are also seen to help replenished water shed.

4. Conclusion

4.1 Findings

The study's findings reveal several key insights from the 50 respondents. Of these, 46% (23 respondents) had been residents of the area for over five years, 36% (18 respondents) had lived there for less than five years, and 18% (9 respondents) had been residing in the area for under a year. Most of the respondents were young adults, with some mature and older individuals, and a majority were female. All 50 respondents were single. The evaluation indicated that most of the residents were not adequately educated about the potential impacts of natural and man-made calamities. The study suggests that there is a need to establish a program with mitigating measures to minimize damage from future hazards [13]. Additionally, it was noted that the entire population had experienced such calamities, regardless of how long they had been living in the area [14]. The degree of natural destructive forces was a major concern that requires attention, and the residents of Sitio Langub, Danao City were particularly affected by factors contributing to their vulnerability. The study also identified the extent to which mitigating measures had been implemented, and highlighted a lack of local government assistance as a concern. Furthermore, the data gathered showed that Sitio Langub in Barangay Guinacot is prone to landslides, making it a vulnerable area.

4.2 Conclusion

Based on the findings, it concludes that the proposed ECOLOGICAL BALANCE PROGRAM FOR GUINACOT of Sitio Langub, Barangay Guinacot Danao City, Cebu should have the following assessment in order to prevent potential damage that Guinacot is so vulnerable to hazard.

4.3 Recommendation

Since the finding of the study, the following favorable recommendations for implementing of the proposed study are undertaken and addressing it to the primary concerns. In order to pursue the investigation about disaster measures and serve as the eye-opener in preserving and conserve the beauty of nature it is highly recommended that the Ecological Balance Program be adopted. The environment and social concerns related to disaster mitigating measures and preserving the mountain biological and cultural diversity. This research can be also be made as a reference in what disaster mitigation purposes and can contribute to providing investment for the conservation of biodiversity and mountain culture, and support an integrated and participatory approach to be aware of the phenomenon ecosystems for the long-term future

References

[1] Hon'ble, P., Patil, P. P., Kumar, S., Deore, S. J., Bhatt, E. B., Patil, S. U., ... & Sonawane, M. J. (2019). Disaster management: new challenges and solutions.

[2] Hubbard, B. M. (2015). *Conscious evolution: Awakening the power of our social potential*. New World Library.

[3] Matthies, A. (2017). Community-based disaster risk management in the Philippines: Achievements and challenges of the purok system. *ASEAS-Austrian Journal of South-East Asian Studies*, *10*(1), 101-108.

[4] Santos, C. T. (2018). *The Impact of Tropical Cyclone Haiyan in the Philippines: Contribution of Spatial Planing to Enhance Adaptation in the City of Tacloban* (Doctoral dissertation, Universidade de Lisboa (Portugal)).

[5] Tse-Ring, K., Sharma, E., Chettri, N., & Shrestha, A. B. (2010). *Climate change vulnerability of mountain ecosystems in the Eastern Himalayas*. International centre for integrated mountain development (ICIMOD).

[6] Otto, I. M., Reckien, D., Reyer, C. P., Marcus, R., Le Masson, V., Jones, L., ... & Serdeczny, O. (2017). Social vulnerability to climate change: a review of concepts and evidence. *Regional environmental change*, *17*, 1651-1662.

[7] Swapan, M. S. H., & Sadeque, S. (2021). Place attachment in natural hazard-prone areas and decision to relocate: Research review and agenda

for developing countries. *International journal of disaster risk reduction*, *52*, 101937.

[8] Parven, A., Pal, I., Witayangkurn, A., Pramanik, M., Nagai, M., Miyazaki, H., & Wuthisakkaroon, C. (2022). Impacts of disaster and land-use change on food security and adaptation: Evidence from the delta community in Bangladesh. *International Journal of Disaster Risk Reduction*, *78*, 103119.

[9] Schipper, L., & Pelling, M. (2006). Disaster risk, climate change and international development: scope for, and challenges to, integration. *Disasters*, *30*(1), 19-38.

[10] Kelarestaghi, A. (2003, October). Investigation of effective factors on landslides occurrence and landslide hazard zonation–case study Shirin Rood drainage Basin, Sari, Iran. In *Proceeding of the Map Asia 2003 conference: 13–15 October 2003; Kuala Lumpur, Malaysia*.

[11] Ghoneim, S. A., Elsayed, M. M., & Amer, H. S. (2022). A GIS vulnerability assessment tool to support strategic planning of cities facing flash floods–case study of Nuweiba City–Egypt. *Civil Engineering and Architecture*, *10*(5A), 288-312.

[12] Chavez, R. M. (2023). Design and development of autotronics simulation model for car lighting system. *Sci. Int. (Lahore)*, *35*(4), 435-439.

[13] Rose, A. (2007). Economic resilience to natural and man-made disasters: Multidisciplinary origins and contextual dimensions. *Environmental hazards*, *7*(4), 383-398.

[14] Bonanno, G. A., Brewin, C. R., Kaniasty, K., & Greca, A. M. L. (2010). Weighing the costs of disaster: Consequences, risks, and resilience in individuals, families, and communities. *Psychological science in the public interest*, *11*(1), 1-49.