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RESILIENCE OF EDUCATIONAL COMMUNITIES IN DEVELOPING COUNTRIES: A MULTI-DISCIPLINARY APPROACH

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Abstract

The resilience of the educational communities and the school infrastructure is of paramount importance to protect children from the various natural and man-made threats and to recover from the post-disaster trauma. However, after a natural disaster, it is typical for most efforts to focus on shelter, recovery and rapid reconstruction without due consideration of a wider framework for building back better school buildings and at the same time creating infrastructure, institutions and communities that are resilient to different shocks and stresses.

Our current research which is conducted as part of a multi-disciplinary project SAFER (www.safernepal.net), using Nepal as a case study area, is addressing the above need. In this context, the purpose of this paper is to present the the development of a tool for resilience assessment of educational communities. Central to this is the identification and organization of resilience indicators under four dimensions covering physical infrastructure, governance, curriculum and community structure. These are informed by recent developments and guidelines but more importantly, by findings from our continuing engagement with the major stakeholders amongst educational communities. Different mechanisms including surveys, semi-structured interviews and workshops were used to elicit stakeholders' knowledge and to inform the design of a set of questions for the evaluation of resilience. These questions range from physical infrastructure to environment, hazard awareness to preparedness, and social state to governance. All the questions with objective responses from each stakeholder are quantified and evaluated with reference to importance of the questions under respective resilience indicators. This ultimately leads to a resilience index together with a graphical view of the multi-dimension resilience indicators for the educational community.

A mobile application with the above sets of questions and assessment methodology has been in parallel implemented to facilitate data collection during the survey within the educational community, as well as offering recommendations for resilience enhancement. The methodology and the tool can also be used for the self-assessment of resilience by the schools in developing countries and informing school improvement plans which are aligned to the Sendai Framework.

Keywords: school safety; disaster preparedness; recovery; community resilience; education.

1. Introduction

Resilience of a system, community or individual is of interest in many disciplines where the focus is on its ability to cope with shocks and stresses [1], [2]. The multidisciplinary research project "Seismic Safety and Resilience of Schools in Nepal" is responding to the structural and social needs of the local communities in Nepal to enhance the resilience of schools thus enabling effective and continuous education in a highly challenging environment. The project contributes towards community preparedness by studying soil stratification [3], seismic hazards [4], vulnerability of school buildings [5], low cost seismic isolation, and retrofit techniques. The project also benefits from an expert system for the evaluation of structural health of school buildings in cases of pre- and post event of disaster, mainly focusing on earthquake. The mobile app, designed to facilitate the data collection, uses background algorithms in line with the FEMA [6] and ASCE/SEI [7] guidelines for the structural assessment thus evaluating the overall condition with a quantified score that effectively reflects the relevant probability of collapse. Apart from these core technical initiatives, the research project also focuses on assessing, with the aim to quantify in a meaningful way, the resilience of educational communities to natural and man-made hazards considering a range of factors.

The purpose of this paper is present the developed methodology and discuss the challenges associated with increasing the resilience of educational communities. To this end, we first review the concepts of resilience and communities in order to formulate a conceptual framework for the community resilience. Next, we present our approach to engage with the stakeholders in the education system as well as with local communities to develop a tool that can be easily implemented in a Nepalese context. Finally, we demonstrate and analyse the use of this framework and tool to visualise the resilience of a school in Nepal before discussing the further applications of the proposed framework.

2. Resilience of Educational Communities

Resilience, as a capacity to cope with systemic disruptions, has a wide range of coverage in terms of functional goal. UNISDR defines resilience as "*ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management*" [8]. Similarly, community resilience represents the systemic cumulative effort to resist to, to cope with, to recover from, and to adapt to any shocks [9]. There are two strands of resilience, one is nested institutional level, and the other is personal level. Berkes and Ross [10] have argued for an integrated approach for community resilience while different research works (for example, [11]–[14]) have focused on different aspects of the problem. Studies on hazard-related resilience usually focus on particular locations [15], [16] as well as different historical periods [17]. The way resilience is assessed varies and is related to the different perspectives and research themes ranging from infrastructure [18], [19] to community [20] and depends on a wide set of factors affecting the capacity built and social system to recover after a shocking event. Resilience in any sector of human activity should lead to a quick recovery and in some cases even to an improvement in its performance after a shock at local, national, and at times international level. Central to this paper is how to assess the resilience of educational communities recognising that the ultimate goal of schools is to offer *effective and continuous education under safe environment*. An educational community can be recognised as a place-based community [21] with a mission to provide effective and continuous education. The size of the community is mostly dependent on and defined by the geographical boundaries, but the area of its responsibility may be shared with the territory of an adjacent educational community. Figure 1 shows a schematic graph of school functionality after any disaster event that disturbs everyday operation in any form. It is noted that a more resilient school community would have a reduced impact and can recover faster than the others. It is also important to consider that resilience is inherent but also be also improved prior to the shock by means.

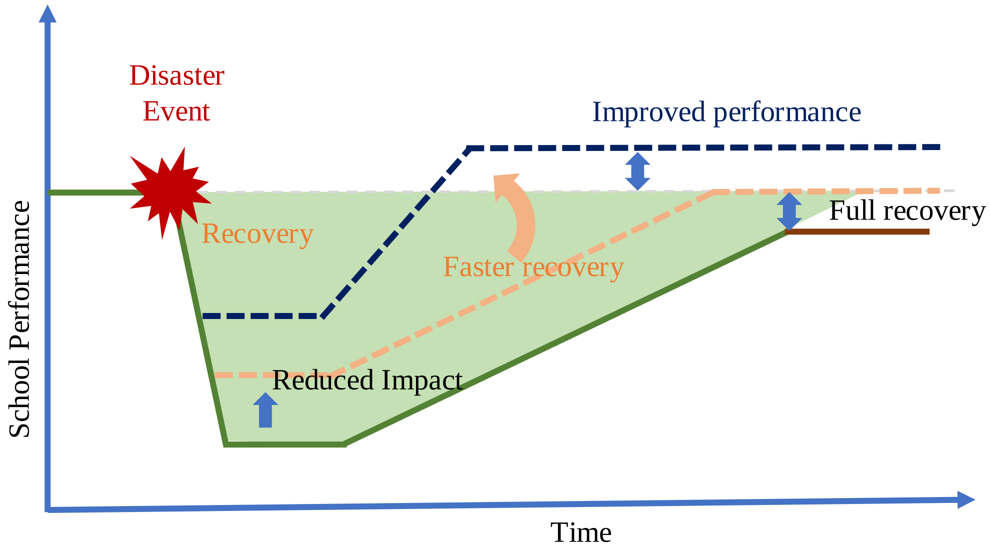

Fig. 1 - School performance with time after a disaster event

Specifically in a Nepalese context, the main components of the educational community at local level are: (a) School Management Committee (SMC), (b) Headteacher (HT) or Principal, (c) teachers, (d) students, (e) parents, and (f) community members other than the aforementioned ones. There are government bodies who supervise the educational institutions. International development agencies and/or national non-governmental agencies may aid particularly after a disaster. Media can be a part of local society as a means of information dissemination. Figure 2 illustrates the nexus of social key components of an educational community in Nepal.

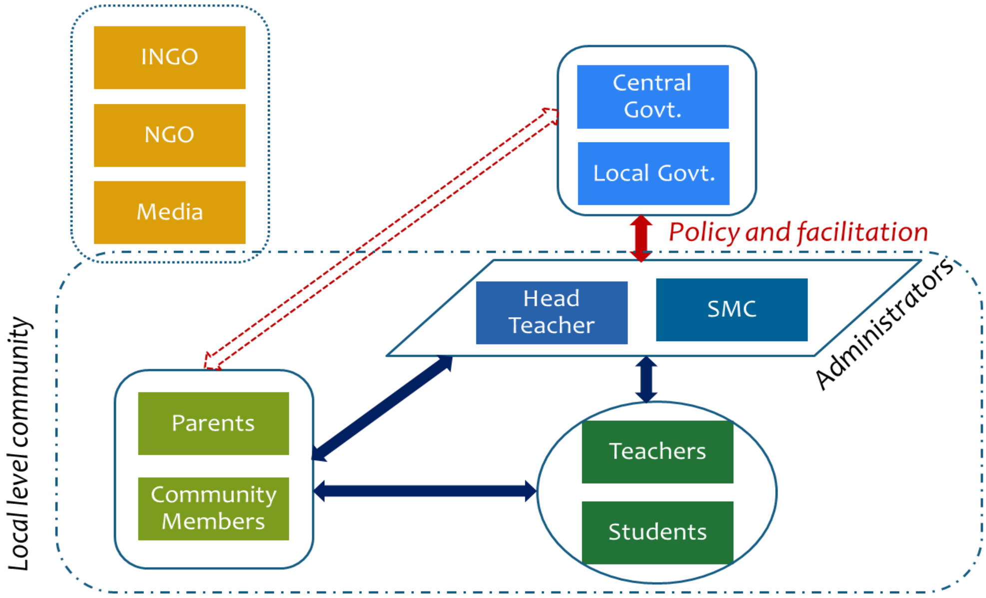

Fig. 2 - Educational community with social components

Educational community resilience can be assessed through different approaches. This study takes a multi-disciplinary approach [22] which has four dimensions: (i) school infrastructure, (ii) school community, (iii) school governance and (iv) school curriculum. While these encompass the Comprehensive School Safety framework [23] our approach aims to proceed beyond. School infrastructure is not limited to the school building but includes other infrastructure, such as water supply and sanitation, and access to school. School community further includes the attributes of the local stakeholders as well as how they interact and support each other in normal conditions. The management of school resources and leadership during difficult times is key to school governance. School curriculum can help prepare the students for future challenges including natural hazards and equality, for example.

For each dimension, 14 different indicators covering various aspects have been identified (see Table 1). These are informed by recent guidelines and practices [24], [25] and more importantly, by findings from our four rounds of workshops, interviews and questionnaires involving school stakeholders in Nepal during April 2018 to December 2019. A set of questionnaires, containing over 130 questions, has been prepared to gather evidence for different resilience indicators. This evidence is used to assess the state of that community on a relative scale and a School COmmunity REsilience index (SCORE) is introduced as a quantitative representation of the resilience of educational communities.

Table 1 - Dimensions and indicators used in school community resilience assessment

Dimension	Indicator
Governance and funding	I1. Hazard awareness and integration
	I2. Preparedness and training
	I3. Resources (human & financial)
	I4. Governance
School curriculum	I5. Hazard education and awareness
	I6. Richness and diversity
School community	I7. Socio-economic state
	I8. Local culture
	I9. Social cohesion
	I10. Health and well-being
Infrastructure and environment	I11. Ecosystem and environment
	I12. Access and use
	I13. Non-structural health (services)
	I14. Structural health

3. Community engagement and data collection

Assessing, or even measuring in a quantified way, resilience [21] is challenging but important in order to improve a community's response to disasters. A mobile app to measure the educational community resilience has been developed through direct engagement with the community in order to co-produce the concept of the app and implement it in a series of community sessions. Along these lines, we visited a number of state schools in different geographical and social settings and conducted workshops with school children, parents and teachers. We also engaged with the School Management Committee members, headteachers and local government officials through semi-structured interviews that helped contextualize the framework and adapt good resilience mapping practices accordingly. This engagement has contributed to the development of resilience indicators, presented in Table 1, and the choice of data collection methodology discussed herein.

Fig. 3 - Head teacher and teachers (left) and community members (right) engaging in paper-based questionnaire at Kavre, Nepal, prior to developing the mobile app for quick data collection and resilience assessment

Given that resilience depends on the state of preparedness for future shocks and includes both soft and hard measures, reliable data collection, processing and efficient paperless survey implementation are key. In terms of data harvesting it is note that two major different data types were collected: (a) one is the factual data, for example, emergency drills are run or not run, whether the community has access to resources etc and (b) the other is the perception of an individual, for example, how effective emergency drills are, or what is the level of preparedness. The quality of data of course depends upon the knowledge and awareness of the participants.

Community engagement took place in several phases. First, we conducted workshops with stakeholders and experts at local level, semi-structured interviews with headteachers, school management committee members and local government officials in order to trace the most efficient and reliable way of data extraction. During such activities we also collected comments and suggestions on the methodology, data reliability, and usefulness of the outputs. The first set of questionnaires was developed and tested for all stakeholders of educational community at local level in two schools in Kavre district. Local language (Nepali) was used and the questions were arranged in order to facilitate the flow of multiple-choice questions. Some of these questions could have multiple answers. Printed questionnaires were distributed to all stakeholders in each school and they were asked to complete them based on their own knowledge and perceptions. The second set of questionnaires had been revised to address the comments and suggestions received from the experts and peers during fieldwork. This not only included a new set of questions but also provided an improved set of response options. This revised questionnaire was used in two other schools in a different community of Kavre and Sindhupalchok and followed the similar path of activities. Figure 3 shows the community engagement in paper-based survey in Kavre district. A third set of tests had been conducted in Dailekh and Banke with some amendments to cover comments and suggestions from the previous activities.

The paper-based survey has been useful in developing a set of questions to gather evidence for different resilience indicators, but it makes data processing at a larger scale difficult. In addition, there were some problems in responses from different stakeholders in paper-based survey, as some of the questions were skipped, and some conditional questions seemed to have been answered randomly. Some students, teachers and parents had also skipped a number of questions.

Next, a mobile application tool was trialled where a pre-arranged set of questions were used through an android app "School buildings safety in Nepal (SAFER)"[1]. This mobile app has been previously used in the structural vulnerability assessment and now there is an additional option to use the app for processing the assessment of educational community resilience. All data gathered are synchronized with the server and are accessible through the central WebApp that provides a detailed overview to the decision-maker. This app was used to collect the data in another round of trial in Mahottari and Sarlahi districts in Nepal. Three school communities were engaged in this phase of study. Another test of mobile application has been conducted in three more schools in Nuwakot. Implementing an electronic questionnaire in a developing country needs to be carefully designed. It also needs to account for several factors such as network and mobile phone/tablet availability. The first was bypassed by developing an app that operates without internet connection and can sync at a later stage when the Headteacher, who is responsible for the survey, connects to a local network. The later was addressed by developing the app for the basic Android operating system that is widely available in the vast majority of the phones used in the country. This was further facilitated by our local partners Save The Children who were able to provide a limited but adequate number of tablets for community engagements. Successive sessions in different regions in Nepal demonstrated that the survey was able to conducted in all cases it was attempted.

Currently, the questionnaire has been finalized through a series of consultations and trials. Three sets of trials using paper-based survey and the mobile application has resulted in an extensive questionnaire incorporating thoughts form experts and peers and the project has entered the final phase of data gathering, liaison and training with local governance and implementation at a district level.

[1] https://play.google.com/store/apps/details?id=uk.ac.bristol.rit.safer&hl=en_GB

4. Results and discussion

Data collected through the paper-based survey and mobile application has been studied and analysed. Here we present a preliminary data analysis from a Higher Secondary School in Kavre district, where, SMC members, the headteacher, 3 teachers, 7 students and 4 parents participated. There are different numbers of questions for different stakeholders, but several questions are also identical; a total of 86, 86, 77, 62 and 56 tailored questions were addressed to five different categories of participants, respectively. There was another set of 25 questions relating to hazards, which was addressed to the SMC, headteacher and teachers only.

Each question has a minimum of three and a maximum of six response options and is assigned with values ranging from 0 for the worst scenario to 100 for the most favourable answer in terms of resilience. The average of responses is calculated for each stakeholder group per question, where applicable. Next, total score for each question is calculated through a weighted average between stakeholders. The contributions of SMC, headteacher, teachers, students and parents were taken as 25%, 25%, 20%, 20% and 10% respectively. Each question feeds into the 14 pre-determined resilience indicators of Table 1. A minimum of eight and maximum of twelve questions were identified for each indicator. The score for each indicator is now calculated from the weighted average of the scores for questions under that indicator.

Figure 4 shows an indicative sample of the resilience indicator values of the school under consideration on a radial chart. For this school community, the resilience indicator vary: the weakest aspect is the socio-economic state of the community where the school is located. This suggests that the community does not have the means to prepare for a disaster. Based on this assessment, the local government can initiate hazard awareness programs and plan measures for disaster risk reduction in the community as per the local needs. Hazard education and awareness in the school seems to be the best indicator, which scored within the excellent band. Overall, two indicators are excellent, three indicators need to be improved, whereas other nine indicators are acceptable, but clearly the school community can further improve its resilience by means of tailored measures.

For checking the reliability of data, responses from each stakeholder group for the same question are compared with others. A total of 67 identical questions were answered by SMC members and the Headteacher independently. Among them more than 50% of the responses (36/67) were identical which indicates a reasonable consensus. Figure further 5 shows the percentage of responses where discrepancies are observed between the SMC and the Headteacher. In some cases the responses are distinctly different, which mainly shows the lack of proper coordination in some of school management activities as well as different perception and knowledge. It is noted that the Headteacher had been newly appointed to this school, having moved from distant Eastern Nepal, hence he might not have had adequate knowledge of local practices. Some of the variations are also in coordination with local government, School Improvement Plan (SIP) and local community.

Tables 2 and 3, respectively, show the matrices of inter-stakeholder response agreement: full agreement with 0% variation and ±20% variation respectively. The data shows that SMC and the Headteacher are in the closest agreement as their responses are 54% identical and 64% within ±20%. Similarly, Teachers' answers are well correlated to those of the Headteacher and the SMC (43% identical and 67-70% within ±20%). As expected, students present a weaker correlation with their parents, teachers and the school management scheme, however, the difference is not major. In any case, the different perceptions within a community are captured with the proposed framework as it is offering a chance to all members of the community to have a voice and influence the survey outcome. Most importantly, gaps between the stakeholders and within the stakeholder groups can also be tracked and relevant feedback provided.

Even in cases of inter-stakeholder agreement in self-assessing the different factors that affect community resilience, such a tool can be used to collect data efficiently and at the same time can provide better feedback to people concerned, pointing out the gaps in the community in a short span of time.

School community resilience index can then further be used to rank all schools under an administrative unit and helps to prioritize the schools for further actions. Each indicator value provides a scenario of community that ultimately contributes towards review of policy and plan of action.

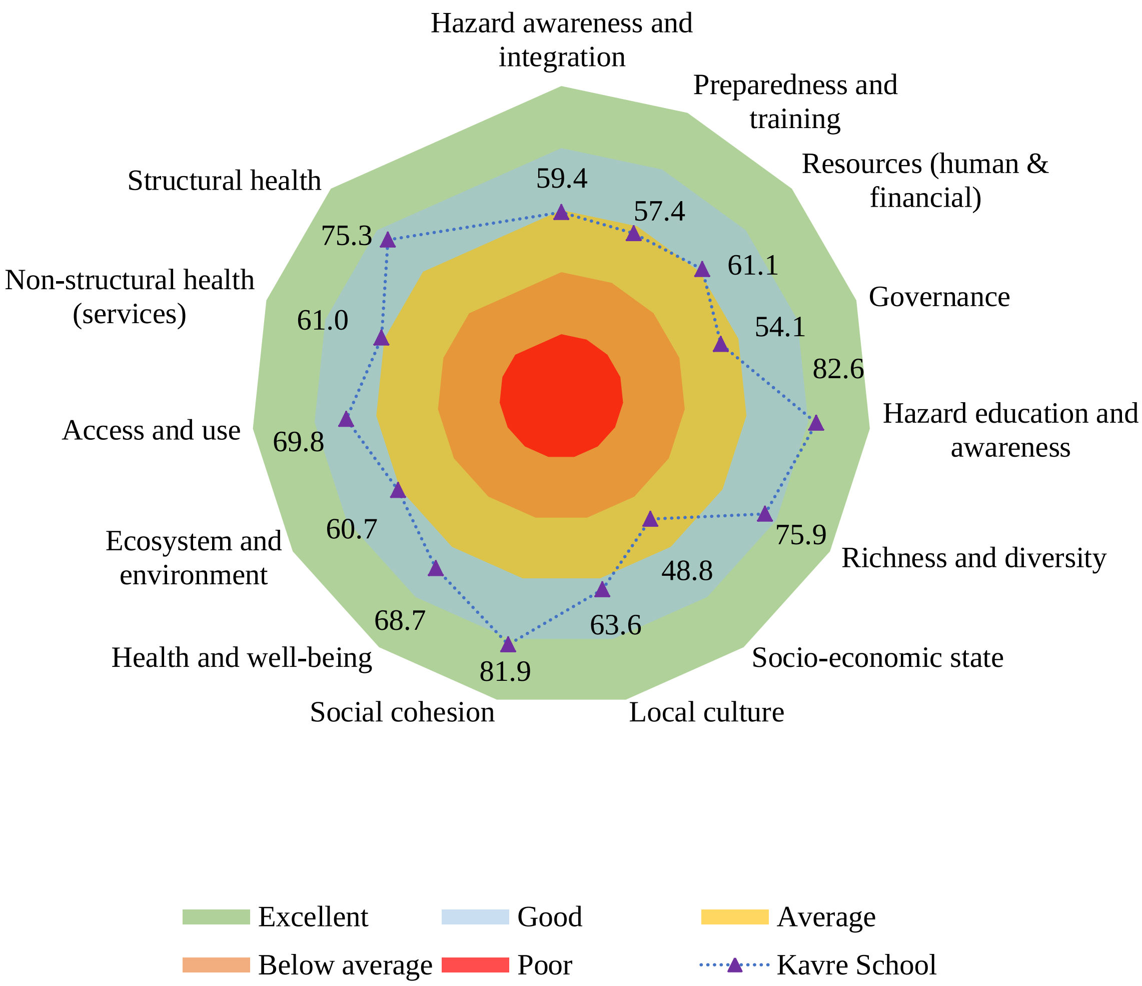

Fig. 4 - Resilience indicator mapping for a Higher Secondary School in Kavre, Nepal

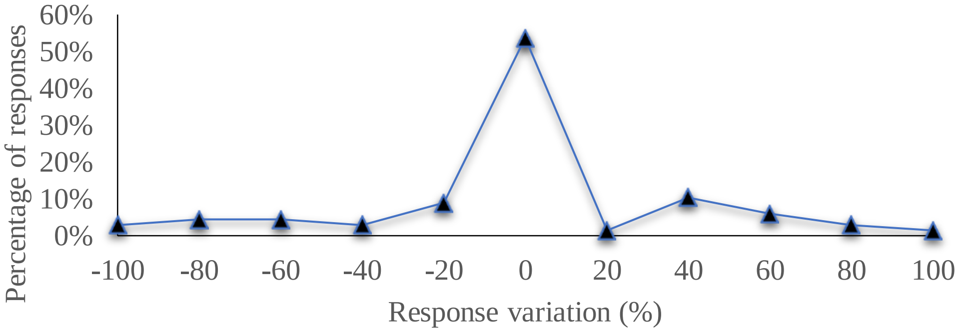

Fig. 5 - Comparison of responses between SMC and headteacher for a school in Kavre

Table 2 - Full agreement percentage matrix of responses between stakeholder groups

Stakeholders	**SMC**	**HT**	**Teachers**	**Students**	**Parents**
SMC		54%	43%	38%	38%
HT			43%	39%	26%
Teacher				30%	35%
Students					29%
Parents					

Table 3 Responses with ±20% variation between stakeholder groups

Stakeholders	**SMC**	**HT**	**Teachers**	**Students**	**Parents**
SMC		64%	70%	62%	57%
HT			67%	56%	50%
Teacher				62%	65%
Students					50%
Parents					

5. Conclusions

This paper presents a quantitative methodology to self-assess the social strength of local educational communities in Nepal to cope with natural hazards and environmental shocks by means of an electronic app and webApp. Data collection and processing for the resilience quantification have been carefully co-designed after a series of community engagement sessions. This method of independent contribution of stakeholders in measuring resilience drastically reduces the biases of collecting information an offers the opportunity to all members of the community to influence the assessment process, while ensures positive engagement. Each stakeholder's feeling of active participation in the process can influence the change needed to prepare more proactively towards current and future hazards. Multidisciplinary approach of assessing resilience using this self-assessment app can be used throughout Nepal but can also be implemented in regions with a similar structure of their educational system. Furthermore, the methodology and app developed can contribute towards ranking of the schools in terms of resilience thus helping addressing the indicators with poor scores through the appropriate policy and mitigating measures. Overall, it is expected to have a positive impact on the community preparedness level of the educational communities in Nepal and the work currently undertaken to gradually meet the goals set in Sendai Framework for Disaster Risk Reduction.

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