VULNERABILITY OF TOURISM IN KILIMANJARO NATIONAL PARK AND THE LIVELIHOODS OF ADJACENT COMMUNITIES TO THE IMPACTS OF CLIMATE CHANGE AND VARIABILITY

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Abstract

The study examined the vulnerability of tourism and the livelihoods of communities adjacent to Kilimamnjaro National Park in Tanzania to the impacts of climate change. Specifically the study identified tourism resources and assessed the potential factors affecting tourism resources and activities in Kilimanjaro National Park. Further, it examined the perception of local communities on patterns of climate change and variability impacts and vulnerability in the area. Both purposeful and random sampling was used for village and household selection in the area. Both qualitative and quantitative primary and secondary data were used in this study. Primary data were mainly collected using structured household questionnaires. Participatory Rural Appraisal (PRA) methods such as questionnaires, Focus Group Discussions (FGD), key informants, timeline drivers of change and direct field observation were used to obtain data for CC&V impacts on, and vulnerability of tourism resources, activities, peoples perceptions on climate change and variability in the area. Findings revealed that climate change and variability affects tourism and resources in diverse ways. Increased drought due to CC&V fosters forest fires, melting of the glacier and decreased hydrology. People perceived CC&V as changes in both rainfall and temperature patterns over time. Decreased glacier, dry-river beds, forest fires and outbreaks of malaria were perceived as indicators of CC&V. Education, capacity building, soft loans, grants were strategies adopted to facilitate adaptation to the impacts of climate change. It is anticipated that the information obtained from this study will enable researchers, policy makers and conservation officers in National parks in Tanzania to streamline effective mitigation, coping and adaptation strategies for sustainable tourism and ecosystem protection.

Keywords: Vulnerability, impacts, tourism, climate change livelihoods

Introduction

Kelly and Adger (2000) define vulnerability as the lack of capacity of individuals and social groups to respond effectively to, recover from, or adapt to, an external stress placed on their livelihood and well-being. Further McCarthy *et al*., (2001) describe vulnerability to climate change as a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and adaptive capacity. Africa including Tanzania is mentioned as being highly vulnerable to climate change impacts with less adaptive capacity due to poverty *inter alia* (IPCC,2001).

Climate change and variability (CC&V) is a complex and challenging global phenomenon for sectors of the economy in both developing and developed countries (IPCC, 2001; IPCC, 2007, UNFCCC, 2008). The United Nations World Tourism Organization studies recognize the impacts of climate change and variability on socio-economic sectors globally, and specifically on tourism (UNWTO, 2008). In Tanzania, climate change and variability has already caused adverse impacts in peoples' livelihoods and in the economic sectors including tourism (URT, 2007). Temperature and rainfall patterns are of major concern in climate change and variability matters.

The African continent is expected to warm by 0.02^{o}C per decade in a low scenario and 0.05^{o}C in a high scenario (Hulme *et al*., 2001). In Tanzania prediction shows that the mean daily temperature will rise by 3^{o}C - 5^{o}C and the mean annual temperature by 2^{o}C – 4^{o}C throughout the country.

Furthermore global precipitation trends will increase and decrease according to regions and agro-ecological conditions. In Tanzania, it is projected that in areas with bimodal rainfall patterns, precipitation will increase; whereas in areas with a uni-modal pattern, precipitation will decrease. Kilimanjaro Region has a naturally bimodal rainfall pattern and hence experiences both long rains (*masika*) and short rains (*vuli*) seasons. Thus, according to the predictions *"masika and vuli"* seasons in the region will increase (Mwandosya *et al*., 1998; URT, 2007).

Africa, including Tanzania is mentioned as being highly vulnerable to climate change impact with less adaptive capacity due to poverty *inter alia* (IPCC, 2001). According to Hastenrath (2001) and Bradley *et al*. (2004) the global impact of climate change and variability on higher altitude regions may be amplified and will have an influence on those regions, their resources and surrounding environments. In Kilimanjaro region, the Kibo glacier which attracts thousands of tourists is vulnerable to climate change and variability and the projections show that it will diminish by the mid-21st century. This condition is likely to aggravate the situation increasing the

vulnerability of the livelihoods of adjacent communities and associated sectors of economy (URT, 2007).

Tourism is a sector of the economy that is sensitive to climatic changes. Despite this sensitivity, the available literature has explored very little about the impacts of climate change and tourism especially at specific destinations (Boko *et al*., 2007). According to Tanzania's National Adaptation Plan of Action (URT, 2007) the vulnerability assessment of climate change in Tanzania is evidenced by impacts on socio-economic sectors and peoples' livelihoods drawing particular attention to agriculture, water and forests, and reduced tourism though it is a very crucial sector.

With an altitude of 5895 meters above sea level (m.a.s.l.), Mt. Kilimanjaro is the tallest free standing mountain in the world that is a prime tourist destination in the northern tourism circuit of Tanzania, specifically the Kilimanjaro National Park (KINAPA) located on the mountain. Due to KINAPA's potential and its being the prime destination for tourists, climate change and variability on it is likely to be a threat to tourism and associated livelihood activities. Climate change and variability is likely to have an impact on resources in KINAPA which attract tourists apart from the ice-capped Kibo.

Likewise, climate change and variability (CC&V) impacts may extend to local communities adjacent to KINAPA who depend on tourism and other socio-economic activities and consequently affect their livelihoods (income, lifestyle, culture, well-being and behavior). For instance, increased frequencies of flooding, drought and land degradation, due to CC&V will subsequently reduce the viability of recreation activities and wildlife expeditions and hence have a negative impact on tourism and the livelihoods of surrounding communities.

Research objectives

The specific objectives of the study were:-

(i) To identify tourism resources available in Kilimanjaro National Park and adjacent villages.

(ii) To assess the factors affecting tourism resources and activities in the Kilimanjaro National Park (KINAPA).

(iii) To examine the perceptions of local communities on the patterns of climate change and variability, vulnerability and impacts in the study area.

Location of the study area

Kilimanjaro region is located in the north east of Tanzania covering an area of 13,209km^2. It is among the small regions in Tanzania which comprise about seven districts namely Rombo, Same, Mwanga, Hai, Moshi

Rural, Moshi Urban and Siha**.** Located in the districts of Moshi Rural, Hai, Siha and Rombo KINAPA covers 756km^2 and was established in 1973. It became a World Heritage Site in 1989 with its forest reserves which were established in 1921. It has Africa's highest peak and the world's largest free standing mountain, *viz.* Mt. Kilimanjaro (5,895m.a.s.l.). Mt Kilimanjaro measures 80km by 50km on the Tanzania and Kenya border (3°04'S, 37°21'E). It is volcanic in origin with three single peaks, Shira (4,005m) Mawenzi (5,140m) and Kibo (5,895m), the only peak retaining glaciers **(**Agrawala, *et al*, 2003). The summit region of Kibo has collapsed to form a caldera 1.9 km by 2.4 km in diameter (Kaser *et al*., 2004).

This research on the vulnerability of Tourism and the Livelihoods of Communities to the Impacts of Climate Change and Variability was carried out at KINAPA and adjacent villages namely Mshiri, Lyasongoro and Mweka in Moshi Rural district; and Foo in Hai district (Fig 1).

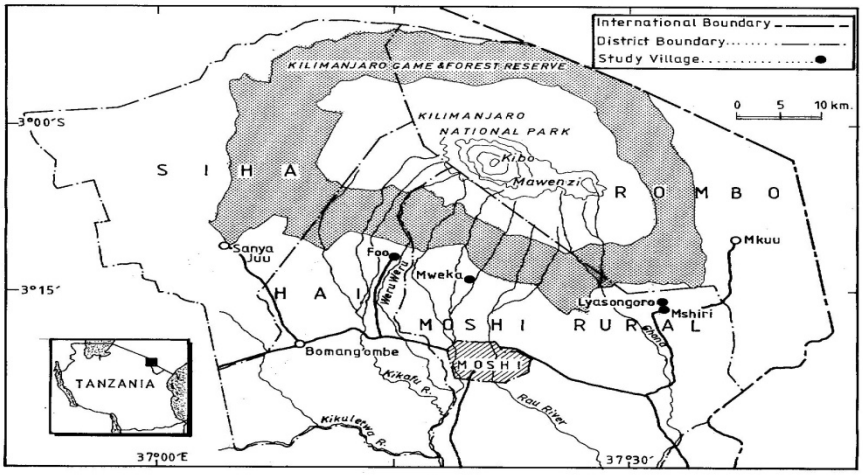

Figure 1: Location of KINAPA and the study Villages
Source: Geography GIS-Lab-UDSM, March 2011

Methodology

Research Design

This study employed a survey design to accomplish its objectives. Both cross-sectional and longitudinal designs were used in the assessment. The Cross-sectional research design allowed collection of data at one time.

Four (4) villages located to the south of KINAPA were purposefully selected for this study due to their special characteristics in relation to tourism. Household interviews were conducted with a sample size of 5% of the households in the four selected villages. Both simple random sampling and purposive sampling were used in this research. Simple random sampling was used in selecting 80 households in the four villages adjacent the park. In all the villages, 80 households were randomly selected from sub villages:-

Nkwawangya, Nkwakundu, Nkwamembe Kialia, Orera, Mweka Juu, Mweka Chini, Kifura, Mshiri , Masia Lefure and Marawe respectively.

Sources of Data

Participatory Rural Appraisal (PRA*)*

PRA methods were used to collect primary data in this study. These methods include semi-structured questionnaires for interviews including key informant interviews, focus group discussions and drivers of change. A timeline was used to indicate historical mapping of past climate related events that were related to climate change and tourism based on local criteria. The seasonal calendar shows the annual cycle of activities and how they are affected by Climate Change. Also direct field observation through transect walk along both vertical and horizontal gradients was used to collect information on land use patterns, opportunities and impacts. The data collected using household questionnaires were compiled, processed and analysed using the Statistical Package for Social Science (SPSS). Descriptive analyses such as frequencies and cross tabulation were used to determine simple numbers of occurrences of variable or the relationships among variables.

Results and Discussion

The following results were obtained; Section 1 presents findings on identified tourism resources available in Kilimanjaro National Park and adjacent villages. Section 2 covers vulnerability, climate change and variability factors affecting tourism resources and associated activities in KINAPA. Finally findings on the local communities' perceptions on climate change and variability patterns, vulnerability and impacts are presented in Section 3.

Tourism Resources Available in the Study Area

KINAPA has abundant resources which have potential as tourist attractions. There are natural resources such as forests, mountains, water sources, springs, rivers, waterfalls, and wildlife. Cultural and historical resources include traditional houses, traditional foods, the Chagga museum, underground caves, graveyards, monuments and old mission churches (Table 1).

Based on the results obtained from interviewed respondents on natural tourist resources available in KINAPA and adjacent villages show that 70% and above reported the presence of forest resources, mountains, water sources, springs and falls, and wildlife as potential tourist resources in the area. Direct field observation done during this study confirmed the presence of a dense KINAPA forests bordering the Mweka village, which

offer landscape beauty as a tourist attraction. Foo village was reported to have a lot of resources as tourist attractions as reported by 28.8% of the respondents; followed by Mshiri (26.2%), Lyasongoro (23.3%) and Mweka (21.2%).

Table 1: Tourism Resources Available in the study area

		Villages				
Resources		**Mshiri**	**Lyasongoro**	**Mweka**	**Foo**	**Total %**
Natural	Mountains	23.8	20	16.3	27.5	**87.6**
	Forests	26.3	22.5	18.8	28.8	**96.4**
	Waterfalls	22.5	23.8	17.5	28.8	**92.6**
	Wildlife	12.5	23.8	20	13.8	**70.1**
Cultural	Traditional Houses	17.5	23.8	20	25	**86.3**
	Traditional Foods	6.3	23.8	21.3	26.3	**77.7**
	Museum	0	10	20	7.5	**37.5**
Historical	Early Churches	2.5	23.8	0	21.3	**47.6**
	Monuments	2.5	2.5	0	27.5	**32.5**

Source: Field Survey January 2011

Respondents‘ responses by cases

Furthermore, water sources, springs and waterfalls were observed including Kikafu and Weruweru in Machame and Ghona in Marangu. These form named waterfalls such as Kinukamori, Kilasia, Ndoro, and Moonjo which attract cultural tourism in the area. A few wild animals such as blue monkeys, black and white Colobus monkeys, elephants, and water buffaloes were seen in parts of KINAPA.

Results on cultural resources from table 1: above indicate that 77.7% of the respondents reported the availability of traditional foods. About 86.3% of the respondents reported that traditional houses were available; and 37.5% of the respondents reported that museums were available.

Factors Affecting Tourism Resources and Activities in KINAPA

Major tourism activities mentioned by respondents were; mountain climbing, businesses such as hotels, lodges, restaurants, mountain equipment hiring as well as selling arts and crafts (souvenirs), camping, bird watching, cultural tourism and photographic tourism. The results presented in table 2 below show that 93.8% of the respondents reported mountain climbing as the first major tourism activity dominating the area. Camping in the mountain campsites and adjacent village campsites was reported by 83.8% of the respondents; whereas 73.8% of the respondents reported the presence of birdwatching and viewing.

Table 2: Tourism activities available in the area

Villages	Tourism Activities in %						Total Average%
	Mountain climbing	Wildlife tourism	Bird watching	Camping	Photographing	Others	
Mshiri	26.3	0	22.5	23.8	15	13.8	26.2
Lyasongoro	23.8	0	20	18.8	23.8	15	23.8
Mweka	15	1.3	13.8	17.5	5	3.75	21.2
Foo	28.8	2.5	17.5	23.8	8.8	10	28.8
Total	**93.8**	**3.8**	**73.8**	**83.8**	**52.5**	**42.5**	**100**

Source: Field Survey January 2011

In assessing factors affecting tourism resources and activities in Kilimanjaro National Park (KINAPA), the findings of this study indicate that both direct and indirect factors are responsible for affecting tourism resources and activities in KINAPA. However, the first and the second sections highlight different factors affecting tourism resources available in the area and tourism activities respectively. Information from KINAPA park ecologist revealed that the birds have migrated from one area to another due to drought hence affected birdwatching. Increased numbers of tourists due to seasonality affected campsite facilities and ecology. Viner and Agnew (1999) confirm that increased temperature and decreased precipitation affected wildebeest in Serengeti National Park and birds' migration in Manyara National Park of the northern tourism circuit.

Peoples'Perception on Vulnerability to the Impacts of Climate Change and Variability Patterns

Changes in both temperature and rainfall patterns were the main factors used by most people to determine impacts CC&V in the area.

Table 3: Indicators of climate change and variability

Indicators	Villages				
	Mshiri	Lyasongoro	Mweka	Foo	Total
Dry river beds	26.3	23.8	17.5	27.5	95
Decreased temperature.	2.5	3.8	0	1.3	7.5
Increased in temperature	25	20	20	27.5	92.5
Decrease in rainfall	20	16.3	20	26.3	82.5
Shortage of water.	26.3	21.3	18.8	26.3	92.5
Outbreak of disease (malaria).	21.3	18.8	15	18.8	73.8
Decrease of glacier and snowfall.	21.3	18.8	16.3	21.3	77.5
Increased forest fire.	22.5	13.8	3.8	5	45
Others (specify)	26.3	21.3	16.3	25	88.8

Respondent's responses by cases ***Source:*** Field Survey January 2011

As indicated in Table 3 above, 95% of the respondents in villages adjacent to KINAPA said that dried river beds were most indicator of climate

change and variability in the area followed by 92.5% of respondents indicated shortage of water. Direct field observation and information from key informants revealed that sources were having little water. Some household member's claims to have a little amount of water for a few hours in taps compared to the 10 past years in which the supply was there for 24hrs a day. Siltation was observed in some rivers at Mshiri, Foo and Mweka villages in which previously water levels were. About 82.5% reported that rainfall has decreased in KINAPA and to the adjacent villages. Interviews with porters and guides revealed that some of the campsites in the mountains like Mweka lacked water and it was a big problem for all climbers including tourists. This is confirmed by Kaser and Osmaston (2005); Molg *et al*; (2003) that hydroclimatological studies revealed a decline in running surface water in the coming decades.

An increased outbreak of diseases such as malaria was reported by 73.8% of the respondents. Interviews with villagers adjacent to the park reported an increase in mosquitoes, though they were not sure if they could transmit malaria. Githeko and Ndegwa (2001) proved increased temperature for about 4^0C in (1997-98) at Kenya and Tanzania highlands including Kilimanjaro leading to the outbreaks. 45% of the respondents reported that there were increased forest fires. Other indicators mentioned were crop failure, late onset of rains, increased wind and decreased humidity, these making up 88.8 % of the total respondents.

The level of education and sex of respondents determines ones perception on indicators of climate change and variability. Men in KINAPA and adjacent villages were mainly involved in climbing mountain as a tourism livelihood activity; and this accordingly influenced their perceptions on CC&V indicators, which differed from those of women.

Women were mainly involved in agriculture hence they perceive decreased of rainfall in cropping systems and affected livestock health as indicators. However men perceive changes of tourism seasonality and melting of glaciers as indicators of climate change

Vulnerability of Tourism to CC&V in KINAPA

With regard to vulnerability assessment results presented in table 4, 77.5% of the respondents reported that tourism in KINAPA was vulnerable to CC&V while 22.5% said that tourism it was not. Several reasons for the vulnerability of tourism to CC&V were given. Some of these reasons included decreased glacial cover at Kibo peak and the disappearance of unique flora and fauna due to forest fires. Fires were said to occur naturally but some were induced by human activities e.g. by local honey harvesters, poachers, and mountain climbers who are smokers both inside and adjacent to the park. Agrawala *et al.* (2003) argued that despite the KINAPA banning

of camp fires, decreased precipitation and increased temperature has resulted into current increased forest fires compared to the few cases reported in past years.

Table 4:4 Vulnerability of Tourism to climate change and Variability

Response	Frequency	Percent
Yes	62	77.5
No	18	22.5
Total	80	100

Source: Field Survey January 2011

Impacts of Climate Change and Variability on KINAPA

The results presented in table 5 below, indicate that out of 80 households interviewed, 96.2% of respondents said that there was an impact caused by CC&V in KINAPA and adjacent villages, particularly on natural, cultural, historical, and infrastructural resources which are the main tourist attractions in the area.

Table 5: Impacts of Climate Change and Variability in the area

Response	Frequency	Percent
Yes	77	96.2
No	3	3.8
Total	80	100

Source: Field Survey January 2011

Impact on Glacier and Snowfall

Research findings in table 6, indicated that 96.2% of the respondents said that there were impacts caused by glacier recession and snowfall. Direct field observation revealed that the glacier has decreased by 85% especially wall glacier since 1912. Interviews with key informants also showed that people who were climbing the mountain since the 1950s reported that there were changes in snow cover and the glacier. This was in agreement with Thompson *et. al*. (2002) who indicated that in the year 2000 the Kibo glacier covered only 2.6km^2 and was projected to disappear between 2015 and 2020.

Table 6: Impacts of CC&V on tourism resources in KINAPA and the adjacent Villages

Impacts	Frequency	Percent
Decrease in Glacier	77	96.2
Deforestation and Forest Degradation	64	80
Decreased Water in Rivers& Springs	68	85
Wildlife and Birds Migration	54	67.5
Impacts on Infrastructure	70	87.5
Impacts on Health	43	53.8
Impacts on Flora	48	60
Impacts on Fauna	71	88.8

Source: Field Survey January 2011

Respondents‘ responses by cases

Impact on Forests (Deforestation and Forest Degradation)

80% of the respondents reported that there was deforestation and forest degradation as a result of the impact of CC&V in KINAPA. The study done by Hemp (2006), revealed that over the last 100 years, Kilimanjaro has lost 300 km² of high altitude forest and the upper closed forest was lowered by 900m. Direct field observation confirmed impacts on land use change, ecosystem and biodiversity loss which attract tourists in the area. Over decades there has been a transformation of the landscape surrounding Mount Kilimanjaro into agricultural land and this has acted as a driver of ecosystem change and has affected the climate (Soini, 2005). Pitman *et al*. (2004) reported similar findings that changes in vegetation cover have a significant impact on regional and local climate.

Impact on water resources

85% of the respondents reported that water has decreased to a great extent due to several factors including deforestation. Labrechts *et al*. (2002) reported that 96% of the water flowing from Kilimanjaro was diminishing. The same report was obtained from downstream communities who reported water shortage in their areas. Agrawala *et al*. (2003) commented that the maintenance of Mount Kilimanjaro forest must therefore have high priority in terms of water supply to the regional population.

Impact on Wildlife and Bird Migration

With respect to wildlife and bird migration, 67.5% of the respondents reported that there was migration of wildlife and birds in KINAPA on the Marangu, Mweka and Machame routes. Only a few black and white colobus monkeys are seen seasonally. This has affected the quality of tourism because some of the species such as grey duiker and eland are endangered while the black rhinoceros (*Diceros bicornis)* is now extinct in KINAPA (Grimshaw *et al*., 2005; Agrawala *et al*., 2003). . IPCC, (2007) argued that shifts of wildlife populations and migratory birds may affect recreational opportunities for birdwatchers, wildlife enthusiasts and hunters.

Impacts on Tourism Infrastructure

87.5 of the respondents said that tourism infrastructure in the area such as trails in the mountains were eroded due to climate change and variability. Some routes such as Machame via the arrow glacier experience rock-falls which previously had killed tourists. An interview with the park ecologist revealed that incidences of rock-fall at the arrow glacier camp were due to natural weathering processes which can take place anywhere. The increased number of tourists has a negative impact on infrastructure such as

expansion of campsites and trail erosion caused by thousands of climbers including tourists, porters and guides reaching the mountain annually.

Impact on Flora and Fauna

Flora such as flowers attract tourists to Kilimanjaro National Park. 60% of the respondents reported that there were impacts on common Kilimanjaro flora associated with CC&V. The occurrence of fires destroyed attractive flowers such as *Protea sp, Carduu sp* and red hot poker which used to be seen on all climbing routes especially the Marangu route. In addition, 88.8% of the respondents confirmed that there were impacts on fauna such as wild dogs, elephants, mountain reedbuck, leopard and steenbok which were also important tourist attractions on Mt. Kilimanjaro. The destruction of flora and fauna had negative effects on tourism because they affected the aesthetic beauty of the area.

Impacts on Health

Malaria is one of the diseases currently rampant in Kilimanjaro National Park and the surrounding areas which were previously free of the disease. 53.8% of the interviewed respondents reported that there were health impacts due to CC& V in KINAPA and adjacent villages. Increase in temperature as a result of CC&V was the main reason. Studies done by de Savigny *et al*. (2004) confirm that in Tanzania malaria causes between 70,000 and 125,000 deaths annually and accounts for 19% of the national health expenditure.

Conclusion

The study was conducted in Kilimanjaro National Parks and adjacent villages. The study found out that CC&V affects tourism in terms of resources, activities and local people's livelihoods in KINAPA and the adjacent villages. Changes in temperature and rainfall were observed as major causes of the impacts on the human activities and resources in the area.

Natural, cultural and historical resources available in the study area were affected by CC&V differently. Mountain climbing was the main tourism livelihood activity affected by CC&V and this was inter-linked with agriculture. Tourist attractions such as birds and wildlife migrated from the area due to increased poaching and wildfire which foster forest degradation and affect their habitat.

Decreased ecological services such as water flow were revealed in the study area. Water sources, rivers and waterfalls have decreased with corresponding negative effects on domestic tourism. The decrease of Kibo

glacier to about 80% has had significant negative implications on tourism at KINAPA.

Regarding the perception of local communities on patterns of climatic change and variability, most people were aware of these. The majority of the respondents saw climate change as changes in temperature and rainfall patterns over a period of time in a specific area. Furthermore, they reported that climate change and variability trends were increasing in a negative pattern with severe impacts on tourism and livelihood activities.

Recommendation

Based on the presented results, discussion and conclusion, several issues would need to be addressed in order to reduce the impact of climate change and variability on tourism resources, activities and livelihoods in KINAPA and adjacent communities. The following recommendations are among the issues that can be addressed to improve the situation:-

Climate change impacts have already manifested themselves on tourism resources and activities. In KINAPA fire was mentioned to have a huge impact on park biodiversity and activities. Therefore, the establishment of fire prevention groups among local villagers and porters to control recurring fires in KINAPA is of great importance. Training should be given for rescue teams and park rangers to control fire risks.

Education and capacity building are required for the management and reduction of CC&V impacts on tourism. This is because the findings showed that communities were aware of CC&V but lacked the education on how to adapt to the impacts of CC&V. Adaptation education in proportion to local knowledge is also important. More research on tourism and climate change should be encouraged in KINAPA and the adjacent communities to reduce the impacts caused by climate change.

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