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Factors Affecting the Farming System of Gwaltar (Sindhuli) and Birta (Ramechhap) Village, Nepal

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Abstract

Farming in Nepal is subsistence-based and is mostly integrated with livestock. Farming is seasonal and weather dependent. Different factors of agricultural system such as soil, water, livestock, labor, climate change and other resources within a given environment have affected farming. Primary data was collected using the tools like household survey, key informants' interview, focus group discussion and field observations. In order to select the households for the household questionnaires, a random sampling technique was carried out. The study area consists of two villages viz. Birta and Gwaltar divided by a Sunkoshi River, Gwaltar having wet land on the other hand, Birta having dried land and thus 30 households from each village were selected. Despite of lying the village in the same region, there is variation in the selection of crops, cropping pattern and amount of production. It has found that policy, infrastructure, market, lack of irrigation water, climate change etc. are some of the major constraints for Birta while these factors affecting the farming in Gwaltar was less. Water scarcity in Birta was increasing, affecting the

agricultural production and resulting in food insecurity. They were accessed to limited irrigation, low income level, limited institutional capacity resulting these effects in crop types, production, household food security and household income.

Introduction

The primary economic sector in Nepal is agriculture, which provides livelihood for about 70% of the population. Although Nepal is recognized as an agricultural country, there are various challenges in this sector. The main issues that Nepal is facing includes lack of fertile irrigated plain land, shortage of fertilizer and a problem with support prices (Dhakal, 2022). Similarly, many factors such as markets, climate, and government policies have affected agriculture (Martin, Martin-Clouaire, & Duru, 2013). The variation in these factors may directly affect the crop types that are to be planted and the cropping calendar (Yang, Khanal, Koirala, & Nepal, 2014). In Hills and Terai regions of Nepal, the major factors affecting the change in cropping patterns are land size, distance, household size, crop profit, and market opportunities. (Shrestha, 2009). Similarly, Nepal has been experiencing severe impact of climate change in the current years with the rapid increase in temperature, uneven rainfalls within a short duration and increment in the extreme events such as flood, landslide, drought, premature onset and exhaustion of the monsoon (Nepal, Devkota & Bhattarai, 2012). The lack of adequate irrigation facility, Nepalese agriculture depends on monsoon rainfall. As a result, monsoon rainfall is the most

significant and primary supply of irrigation water for agriculture (Agrawala et al., 2003), where rained farming covers 48 percent of cultivated land (MoAD, 2016). Other various components of farming systems like demography, market, land use/cover, technology is changing which have also transformed the agricultural systems of Nepal (Rao & Parwez, 2005; Ray, 2007). Besides, climate and socio-economic dynamics, cultural, market and road accessibility have also directly impacted the agriculture of Nepal (Paudel & Shaw, 2016).

Various studies on farming system describe factors affecting farming and the difficulties face by the farmers due to various hindrances viz. climatic condition as well as other various causes. However, this research has been carried out regarding the agricultural system of the two villages lying in the same ecological region and one of the villages has the land facilitated with irrigation water and the other deprived from irrigation facility. Although farming system is varied by geographical regions, the direct observation of the study area shows a remarkable difference in farming as the two villages are located across the two banks of the Sunkoshi River.

Methods and Materials

Study area

Gwaltar and Birta of Sindhuli and Ramechhap district of Nepal respectively are chosen for the study. Gwaltar is extended between 27° 16' 51"N latitude and 86° 4'1"E longitude whereas Birta is extended in between 27° 16' 56"N latitude and 86° 4'57"E longitude.

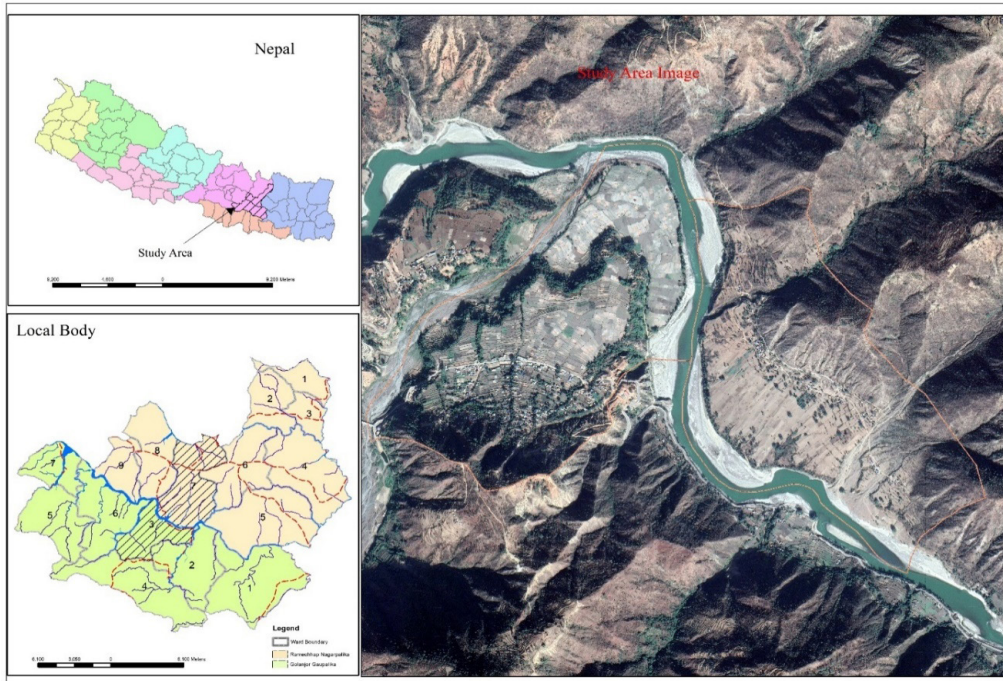


Figure 1. Location map of study area

Gwaltar village mainly faces toward North-East direction while Birta village mainly faces toward South-west direction. Formerly, Gwaltar was a village development committee in Sindhuli district. After re-structuring of the local level/unit, it is one of the wards of Golanjar Rural Municipality. The total area of Golanjar rural municipality is 184.13 sq. km while Birta is a village of Ramechhap Municipality. The total area of the Ramechhap Municipality is 1,564.33 square kilometers in which Birta village is a part of ward no.7. In Gwaltar, there are Chhetri, Brahmin, Magar, Newar, Kami, Damai, Sarki, Bhujel, Majhi, Tamang, Sunuwar, Rai, and other castes and tribes while in Birta the

majority are of Hayu caste. On the other hand, Birta village is located on the left bank of the Sunkoshi River, and Gwaltar is on the other side. The only way for the people of Birta village to reach Gwaltar is by crossing the Sunkoshi River via a 206m long suspension bridge. Gwaltar village mainly faces toward North-East direction and constitutes the moderate slope land. It is at the altitude of 516 masl. The average annual precipitation of the district is 1698.8mm.

Birta village is primarily south-west facing, with flat ground along the river. The elevation in this location is 508 meters above sea level. The soil in the area is primarily loam clay, with some coarse sand. According to climate data

from 2016, the minimum temperature in Ramechhap municipality is 0 to 8 degrees Celsius during the months of January and February, while the maximum temperature is 20 to 32 degrees Celsius during the months of May and June, with an annual temperature increase of 0.04 to 0.06 degrees Celsius. The average landholding size is about 0.5 ha and 0.3 ha per household in Gwaltar and Birta respectively while most of the land in Birta is rented. Paddy, maize, wheat, potatoes are the major crops cultivated in Gwaltar village. On the other hand, proso millet, horse gram and bean are the major crops grown in Birta village.

Tools and technique

Both qualitative and quantitative data were collected using various tools and techniques viz. household survey, key informants' interview, focus group discussion and field observation. In order to select the households for the household questionnaires, a random sampling technique was carried out and 60 households were randomly selected for the research work in which 30 households from each village were selected. The selected households were interviewed for information related to agriculture viz. crop and cropping pattern, agriculture yield, water resource management, situation of market and infrastructure and its role in farming purposes, climatic variability and its adverse effect in crops. Focus Group Discussion (FGD) was carried out in each village having 8 to 10 people in each group to find out the problem faced by the

farmers in farming system specially the role of water and its consequences in both of the villages. On the other hand, total four key informants were selected from each village for key informants interview conduction interviewing particularly with teacher and some experienced and old age farmers in order to identify the local issues related with the agriculture, availability of market and other services, water related problem in agriculture, climate change vulnerability, impact on agriculture.

Results and discussion

Factors affecting the agricultural changes

Farming is an integrated activities that many components and factors are associated with this activity and these factors are associated with this activity and these factors are affected by existing environmental, socio-economic, cultural and policy related factors. The major factors affecting agricultural activities are discussed below.

(a) Physical factors

Various physical factors have played the vital role in the agricultural changes of the study area. Among them, climate change is the major factor.

(b) Climate change

Climate change is defined as a variation in climate over time caused by natural processes or human involvement with the environment (IPCC, 2014). Various

studies have already discovered evidence of climate change impacts such as glacier melt, early plant blossoming, increased drought and other disasters, and so on. (IPCC, 2018). Climate change has an impact in Nepal in a variety of sectors, including agriculture, livestock, water sources, soil, tourism, health and biodiversity, (MoPE, 2017). Meteorological data of last three decade was collected from Department of Meteorology and Hydrology to analyze the changes on rainfall and temperature. Climate change has also found to be perceived by the local people of the study area and its impact in their crops. Most of the respondents have experienced delayed with short period of heavy rainfall with the increment in the temperature. Farmers in Birta are being suffering from long period of dryness due to the climate change. According to the respondents, due to delay in monsoon, the cropping calendar is shifted about a couple of weeks to a month. In Gwaltar, people plant rice 15 to 30 days later that what they used to plant before 15 years.

Rainfall and temperature trend of study area

The rainfall data was analyzed to observe the trend of rainfall (from the year 1992-2018) i.e., over the past 26 years. The total annual rainfall in the study area is in a decreasing trend. The winter rainfall is also perceived to be decreased along with monsoon rainfall and there is almost no rainfall in some years during post

monsoon period. Similarly, the analysis of annual maximum and minimum temperature has been done within 11 years though there is no significant change in minimum and maximum temperature, it shows that the temperature is maximum in the year 2008.

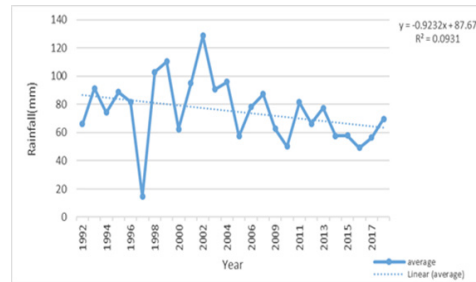


Figure 2. Average annual rainfall, 1992-2018

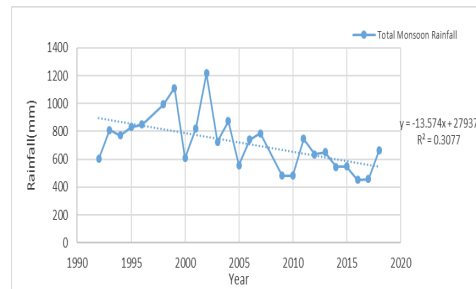


Figure 3. Total monsoon rainfall, 1992-2018

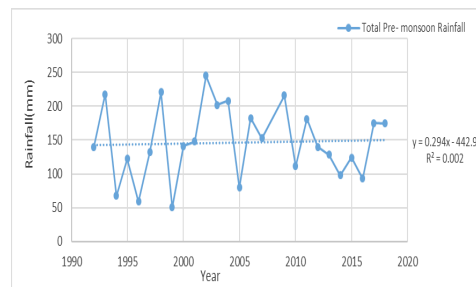


Figure 4. Total pre monsoon rainfall (March-May), 1992-2018

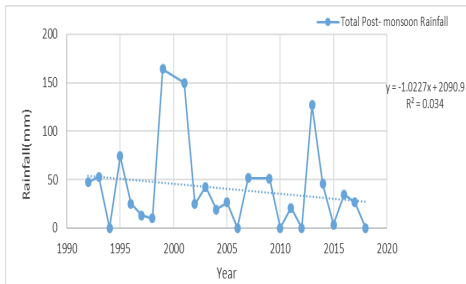


Figure 5. Total post monsoon rainfall (Oct-Nov), 1992-2018

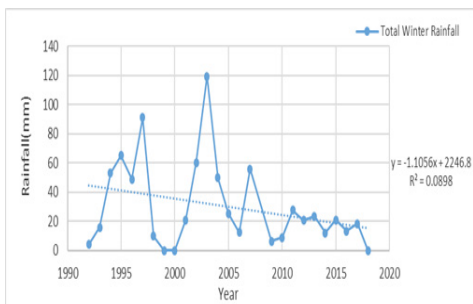


Figure 6. Total winter rainfall (December-February), 1992-2018

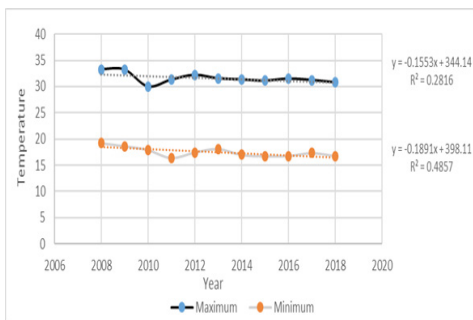


Figure 7. Annual maximum and minimum temperature, 2008-2018.

Source: DHM, 2021

Figure 8 and 9 represent the peoples' perception about temperature change and precipitation of both the study area. Majority of the respondents in Gwaltar

(83.34%) and in Birta (80%) said that they have perceived the temperature increment. Likewise, most of the respondents (63.34%) in Gwaltar and about (73.34%) in Birta perceived the decreased rainfall.

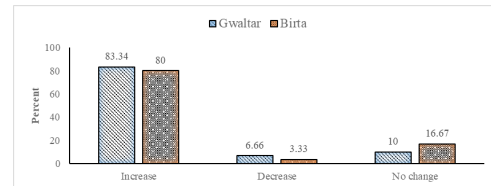


Figure 8. Perception on temperature

Source: Field survey, 2019

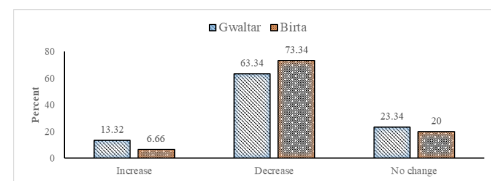


Figure 9. Perception on precipitation

Source: Field survey, 2019

Likewise, about 26.7 percent of households in Birta and 23.3 percent households in Gwaltar have observed the emergence of insects/pests in their crops. Mostly, the pests has been appearing in wheat from past few years in Gwaltar. However, the use of improved seeds, fertilizer and irrigation to some extents in Gwaltar have played the important role for the increment in the crop production for more than 70 percent households.

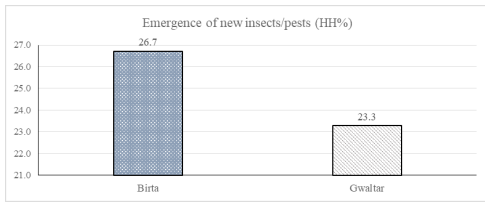


Figure 10. Emergence of pests/insects
Source: Field survey, 2019

(c) Socio-economic factors

These are human induced factors including market, infrastructures, technology viz. irrigation and other extension services.

Irrigation water

The water availability and its distribution were found to be satisfactory to some extent in Gwaltar. Gwaltar area is facilitated with irrigation. There are altogether four canals by the side of road and through the cropping lands so the land of this area is found to be drained and if the amount of water from canal is not sufficient then the local people use pumping method to pull the water from Sunkoshi River.

On the other hand, Birta, has no irrigation canal to irrigate their cultivated land. Birta has suffered a lot and is deprived from the irrigation facility for most of the households and is totally depend in rainfall water. The waling river which was one of the largest sources of water of that place has totally dried up after the earthquake 2015. So, the people of

Birta are using drinking water from the Sunkoshi River by lifting the river water. If there is no electricity, then people have to go to Sunkoshi on foot for water. A few household i.e., nearly 10 to 12 households of the Newar community in Birta has jointly invested to use Sunkoshi river water for irrigation purposes using pumps. Rest of the households who have not able to invest for water pumping have been deprived from the irrigation water.

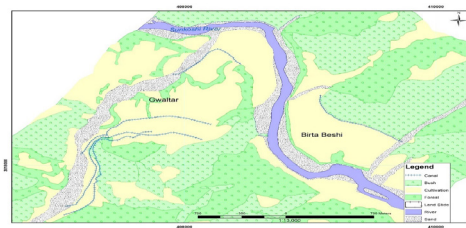


Figure 11. Canal system in the study area
Source: Field survey, 2019

The majority of household in Gwaltar use canal which is about 91.7 percent whereas 5 percent of household use pump to fulfill the amount of insufficient water received from canal and 3.3 percent of household have left their land abandoned as their farmlands are beyond the reach of water facility. Similarly, majority of household in Birta lacks water management facility which is about 63.3 percent and totally depend in rainfall to cultivate the whole land, 27.4 percent of household of Newar community of Birta use lift water whereas 9.3 percent households have left their land abandon due to various reasons.

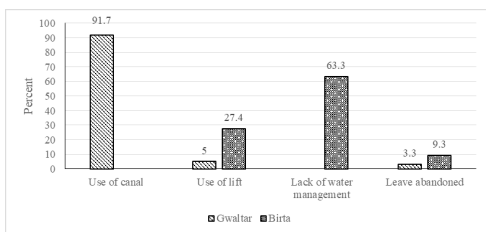


Figure 12. Water Management in the study area

Source: Field survey, (2019)

Irrigation water sufficiency

Figure 13 shows whether the irrigation water is sufficient from the use of canal or not for the agricultural production in which the land of 53 percent of the household has got sufficient irrigation water from various sources and rest 47 percent household has found to have insufficient irrigation water mainly in the month of March and April in Gwaltar area as the land lies at the far distant that cannot be facilitated with either canal or with pumping method in order to irrigate the crops.

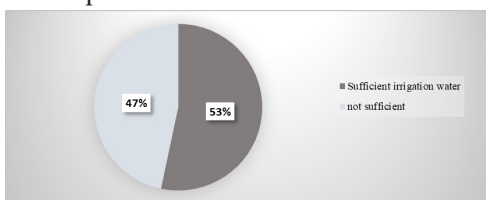


Figure 13. Irrigation water sufficiency in Gwaltar

Source: Field survey, (2019)

Similarly, in Birta, maximum households have to struggle daily for the drinking water so there is no question for the water sufficiency for the irrigation purposes.

Market and infrastructure

Gwaltar is linked with the road due to which the local people have got the provision to access the market. It has been easing for the farmers to buy the improved seeds and chemical fertilizers from distant market whenever not available in the village as the village is connected by the motor road. Also, the vegetable farming has become easy because of the access of the road development. After the construction of roads in Gwaltar, the accessibility to nearby markets centers has been increased. Khurkot or Sindhuli Madi is the main business center outside of Gwaltar. Mostly, locals prefer to travel to Khurkot, which is only 12 kilometers distant and takes half an hour to reach. On the other hand, Ramechhap bazaar is the nearest market center. People sell and buy local products including foods and clothes in the periodic market which falls in every Thursday. Local people used to carry their products to the different markets eg. Khurkot either through tempo or through bus that runs to Kathmandu through the village including Khurot and sometimes if the goods (crops mostly paddy, cauliflower, potatoes) have to carry through Ramechhap market or Khurkot they used to reserve small vans or pick up. Likewise, the village is with the reach of police station, health post, bank, schools, suspension bridge, canals and so on. On the other hand, these services and infrastructure found to be absent in Birta.

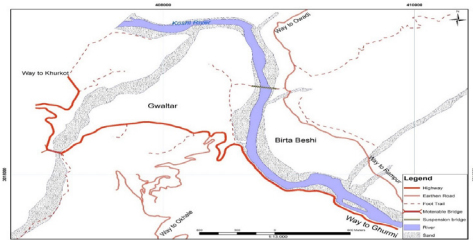


Figure 14. Road network of study area
Source: Survey Department

On the other hand, Birta is connected by a suspension bridge from Gwaltar. The 206m suspension bridge across the Sunkoshi River allowing the Birta community to come across and make use of tailors, hospital, police office and financial services located at Gwaltar. One and only a primary school is located in Birta village. Similarly, the village has very limited access to water, travel, education and as well as poor road condition. Besides, the poor road infrastructures, the village lacks public awareness regarding sanitation and health center.

Extension trainings/services

Government of Nepal has implemented a number of programs aimed at increasing agricultural productivity and production in order to enhance farmers' livelihoods (Chaudhary, 2018). Various trainings are provided to assist local farmers in cultivating new crops. According to the respondents, vegetables like cauliflower, cabbage, broccoli, green leaves, coriander, onion, garlic in Gwaltar were mainly introduced through the programs conducted by INGOs/NGO's from last 6-7

years. From the household survey it was found that, some respondents in Gwaltar used to sell the vegetables after getting the improved seeds of vegetables from NGOs. Similarly, it was also found that, different cooperative organizations in the study area used to distributed chemical fertilizers and seeds in the cheaper price as compared to the market so as to ease the local farmers. On the other hand, majority of farmers in Birta has less access to fertilizers, improved seeds as there is lacking of active participation in farming.

Distance from home

Some households have their land plots that are very far that may take an hour by walking from their house. So, it is found that such distant plots are left abandoned, it has made the soil deteriorating year by year. Some respondents said that they can cultivate different variety of crops and vegetables as they have the access of water, equipment and labors, improved seeds, chemical fertilizers and manure but they are not doing in the land at far distance from their home. They said the main reason is that their land is far distant, out of their reach to cultivate so rather they have made grass land and planting trees instead of growing crops.

Socio-cultural condition

In Gwaltar most of the people are found to be actively involved in agriculture sector and mostly they have their own land. On the other hand, the other side of the study area, Birta is dominated

by Hayu caste having their own social, economic and cultural values. Hayus are marginal and poor indigenous people of Nepal, numbering only a few hundred families. They have mainly occupied the rented land from Newar community for the farming purpose.

(d) Political factors

Land holding size

The land in Nepal is not equally distributed. The land holding size in the study area also varies. Some households are holding huge and large number of plots while some are holding only a small plot. The farmers who have very small plot don't usually seem to actively participate in the agriculture. Some respondent said that they have only a small plot so it has becoming difficult to cultivate, neither they can find the labors in wages in time nor can use other machinery equipment for that small plot because it costs high so they are engaged in other sectors. This has also making hindrance in adopting and learning new technologies.

Land tenure system

The land tenure system helps cultivators in establishing land ownership rights. The land tenure system makes land ownership more secure and durable, which is essential for agricultural development. The average size of agricultural land per household in Nepal is declining from 0.8 hectares in 2001 to 0.6 hectares in 2008 (FAO 2010). More than 1.5 million people are landless, and the problem of

squatter settlements is becoming more prevalent (FAO, 2010).

In Gwaltar, difference in cropping pattern can be seen. The farmers who owed their own land used to cultivate vegetables along with other major crops but the farmers who rented in the land to cultivate have seldom grown vegetables. The reason is that there is possible to divide the crops to the land owner but the vegetables is not possible to divide. So, the farmers who is tenant and have taken the land as tenancy in order to cultivate are beyond to introduce new and commercial vegetables despite of availability of water, labor, market, fertilizers and so on. On the other hand, as the tenants farmers has got no provision of claiming loan for agriculture purpose so the tenant farmers in Gwaltar are deprived from investing in land in order to improve the land productivity. On the other hand, almost all Hayus in Birta have rented in the land of Newar. Each Hayu family has the large plot of rented land for the cultivation purpose but there is totally lack of agriculture innovation. Most of them are not applying fertilizers and chemicals in their rented land.

There is evidence that households who manage their own land are more productive and earn more money than those who manage leased land (Smith, 2004). The main reason is that they are unable to strengthen their farming system because they do not have their own land. As a result, they are unable to invest in land by borrowing money from any

institutions. Farmers' land ownership status is a major determinant of agricultural development and production. So, land tenure security has clearly played vital role in the farming system.

Conclusion

The study showed that, various factors have occurred within the villages that have led the variation in the local farming system. Infrastructure development, connectivity, climate change, extension training and services, market etc. have played the major role for change of farming system. Irrigation water is found to be the major factor that has brought the variation in the farming system of Gwaltar and Birta villages. The availability of irrigation water in Gwaltar has led the development of infrastructure, services as well as market. One of the notable effects of irrigation in Gwaltar is the shift in agricultural practices to multiple cropping. However, the cropping calendar have slightly changed, in Birta village people depends fully on rainfall for the cultivation is being affected a lot.

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