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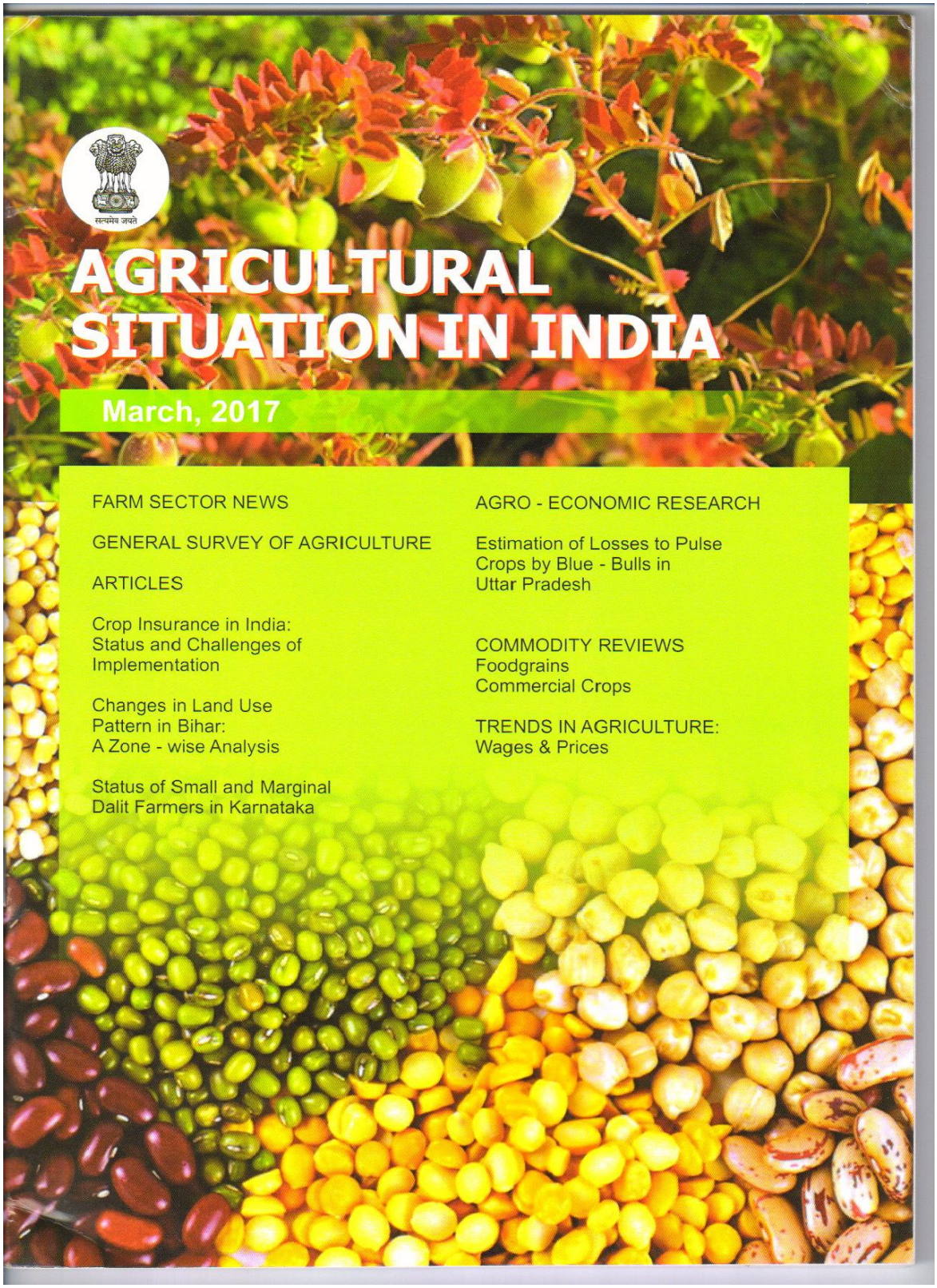

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Changes in Land Use Pattern in Bihar: A Zone-wise Analysis

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Abstract

Agriculture plays an important role in food and nutritional security in addition to overall development of the state. Land is an important input for the agriculture sector, any change in land use pattern has significant implications for food security of the state in particular and nation in general. This paper is based on secondary data published by Government of Bihar and an attempt has been made to investigate the land use pattern of state and also in its different agro-climatic zones. The study reveals that the net sown area has declined both at zonal and state level. Decline in net sown area in agro-climatic zone-III is more pronounced than that of Zone-I and Zone-II. As state capital is located in agro climatic Zone III, urbanization has been quite prominent in this part of the state. The other reasons for changes undergoing in land use pattern may be increasing population, fragmentation of land holdings and declining water table in this region. As Zone-I & Zone-II are primarily flood prone, farmers are forced to leave their land as current fallow due to fear of devastating flood threat causing damage to their crops. Land under trees and groves have also witnessed positive growth rate, this may be the other reason for decline in net sown area in the state. Motivating farmers to increase productivity to protect growing population and serving their demand for food and nutritional security, we have to make such kind of strategies which may lead to enhance the income of the cultivators as well as fulfill the food demand of growing population, keeping in mind the fast changing climatic conditions all over the world and protecting wasteful and careless use of natural resources for betterment of future generation.

Key words: Land use pattern, Net sown area, Agro-climatic zone, Compound Growth Rate (CGR), Bihar

Introduction

Land is considered as an important natural resource that includes the elements like the temperature, moisture, topography, soil matrix and physical structure. It connotes the past and present human activities. It is obvious that the land has the characteristics of its fixity in supply and scarcity. Land is thus a wider concept than soil or terrain. Variation in soils, or soils and landforms, is often the main cause of differences between land mapping units within a local area. It is for this reason that soil surveys are sometimes the main basis for definition of land mapping units. However, the fitness of soils for land use cannot be assessed in isolation from other aspects of the environment, and hence it is land which is employed as the basis for suitability evaluation. Land is a scarce resource, whose supply is fixed for all practical purposes. At the same time, the demand for land for various competing purposes is continuously increasing with the increase in human population and economic growth. The types of use considered are limited to those which appear to be relevant under general physical, economic and social conditions prevailing in an area. These kinds of land use serve as the subject of land evaluation. They may consist of major kinds of land use or land utilization types (FAO).

The physical, economic and institutional factors together determine the pattern of land use of a state in a particular period of time. Land use is not only important from the point of producing foodstuffs, cereals, fruits and vegetable for consumption purpose but also for generating surplus to match the increasing demand created by rising population and growing industrial sector (Premakumara & Seema, 2013). The agricultural land use refers to primary use of geographical area for different purposes and activities. Land use is the surface utilization of all developed and vacant land on specific point at given time and space (Mandal, 1982).

Agriculture holds a vital role in food and nutrition security of the state/country in addition to overall development. Any change or changes in the land use pattern and diversification of area cropped has significant implication in food security of the state/country. No doubt, Bihar agriculture is regarded as land based activity, where water and land act as basic inputs for life support system and also vital resource for the economic life of majority of people in the state. Due to urbanization, increase in population and fragmentation of land holdings, land use pattern has been undergoing changes over the years (Ashrit, 2014).

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The economy of Bihar is predominantly considered as an agrarian economy where 68 percent of population earns their livelihood from this sector. Agriculture contributes nearly 22% of the state GDP. Bihar agriculture is still interwoven in the clutches of vicious circle of poverty that it follows the sequences like low investment, low productivity, low income, low saving and again low investment. To meet the demands of an ever rising population, pressure on land is likely to increase further as demand for more food grains production gains ground in days to come. To obtain larger production from declining net sown area or declining area under most of the crops, there is an urgent need to raise the productivity of crops.

Since inception of Green revolution, the income level of the farming community has obviously enhanced, however, it is many fold lower as compared to developed states like Punjab & Haryana, even lower than national average. Nowadays a debate is going on that eastern India may be the potential area for food basket of India in the present century, where abundant untapped natural resources are available for rational uses. This may further scale up agricultural production and productivity, lead to rise in income of the agrarian masses of the state, ultimately add to the national income/ exchanger.

Land use pattern at any given point of time is determined by several factors including size of human and livestock population, the demand pattern, the technology in use, the cultural traditions, the location and capability of land, institutional factors like ownership pattern and rights and state regulation. The land use pattern, besides having economic implications, has also important ecological dimensions, which if ignored can have disastrous consequences. Land utilization pattern refers to proportion of area under different activities such as area under forest, land put to non-agricultural uses, Culturable waste land, permanent pastures, land under trees and groves, fallow land other than current fallow, current fallow and net sown area etc. In other words, land utilization pattern is the distribution of area on which different activities are undertaken. Agricultural land is becoming a scarce commodity and shrinking land is a challenge for agricultural development in Bihar. Data pertaining to the land use pattern in Bihar showed that the net sown area is declining and areas under current fallow and land under non-agricultural uses have increased over the last 10 years. An annual decline of about 15 thousand hectares in net area sown has been observed during last 10 years. (Singh, et al., 2014)

The present study is an attempt to understand the changes taking place in land use pattern in the state of Bihar, and different agro-climatic zones of Bihar to understand the dynamics and causes of changes after bifurcation of the state for decade 2003-2013, data for which was available.

Methodology

The study is based on secondary data collected from various published sources like various issues of Bihar through Figures, Statistical Handbook of Agriculture, Bihar Economic Survey and also various online resources like websites of Agriculture Department and Horticulture Mission of Government of Bihar for the period under reference, i.e., 2003-2013.

Bihar has been divided into three agro-climatic zones such as Zone-I, Zone-II and Zone-III based on soil, land use, topography and other such natural parameters. Zone-I & Zone-II are located north of river Ganga and are named as North Western and North Eastern Alluvial Plains Zone, respectively are characterized as flood prone compared to Zone-III, which falls under South of river Ganga and are called as South Bihar Alluvial Plains Zone.

Compound Growth Rate (CGR) was worked out using exponential equation

$$Y = ab^t$$

$$r = (\text{antilog } 'b' - 1) \times 100$$

Where Y = different components of land use pattern (in '000 ha)

a = Intercept

b = Regression coefficient

t = Time periods (t = 1,2,3,.....10)

r = Compound Growth Rate (CGR) per annum.

Results and Discussion

Changes in Land Use Pattern in Bihar

Table 1 reveals the changes in land use pattern during the periods between TE-2003 and TE-2013, showing the changes in different activities over the periods. The higher the proportion of net sown area to the total geographical area higher the agricultural production (Malik, 2012). It is observed that the net sown area for the state as a whole has markedly reduced from 63.73 percent during TE-2003 to nearly 57.19 percent during the year TE-2013, the compound growth rate for the same was also found to be negative

(– 0.29%). Rise in the area under non-agricultural uses, land under trees & groves as well as area under current fallow may also be the one of the reasons for decline in net sown area. The area put to non agricultural uses has sharply ascended from 17.53 to 18.20 percent, the area under this category increased at 0.20 percent per annum. The reason

for sharp increase in area under this activity may probably be attributed to settlement of rising human population, construction of recreation grounds, development of infrastructural facilities for public, set up of factories/ companies etc. The land under trees & groves set the rising trend at 0.16 percent per annum. Thus, the total uncultivable land has jumped up from 39.27 to 42.81 percent during the period under study. Further, it was observed that the land under current fallow has risen at 2.21 percent per annum during the study period. Swift rise in current fallow may probably be due to the global warming situation causing erratic rainfall, decline in water table, rising cost of production as well as leaving the soil fallow for maintaining soil fertility/ health.

TABLE 1: LAND UTILIZATION PATTERN IN BIHAR (AREA IN '000 HA)

Sl. No.	Particulars	TE-2003	TE-2013	CGR (2003-13)
1.	Geographical area	9359.57 (100.00)	9359.57 (100.00)	-
2.	Forests	619.91 (6.62)	621.64 (6.64)	0.00
3	Barren and unculturable Land	436.46 (4.66)	431.71 (4.61)	-0.06
4	Land put to non -agricultural use	1641.05 (17.53)	1703.50 (18.20)	0.20
	(a). Land area	1278.98 (13.66)	1346.77 (14.39)	0.27
	(b). Permanent water area	207.39 (2.22)	207.39 (2.22)	0.00
	(c). Temporary water area	154.68 (1.65)	149.02 (1.59)	-0.18
5	Culturable waste land	46.22 (0.49)	45.15 (0.48)	0.09
6	Permanent pasture	17.77 (0.19)	15.67 (0.17)	-0.66
7	Land under trees & groves	234.21 2.50	245.10 (2.62)	0.16
8	Fallow land other than current fallow	134.21 (1.43)	121.59 (1.30)	-0.43
9	Current fallow	545.86 (5.83)	822.72 (8.79)	2.21
10	Total unculturable land(2 to 8)	3675.70 (39.27)	4007.08 (42.81)	0.41
11	Net area sown	5683.87 (60.73)	5352.49 (57.19)	-0.29

Source: Various issues of Bihar through Figures, Bihar Economic Survey Govt. of Bihar, Patna
Figures in parentheses indicate percentage values
CGR: Compound Growth Rate

Agro-Climatic Zone-wise land use pattern in Bihar.

Land use pattern in agro-climatic Zone-I (Table 2) reveals that the net sown area has declined from 66.01 to 64.23 percent during the period TE-2003 & TE-2013, per annum decline in it (growth rate) was estimated as negative (- 0.10%). The area under another activity such as non-agricultural uses has been recorded as to escalate at 0.13 percent compound growth rate.

TABLE 2: LAND USE PATTERN IN AGRO-CLIMATIC ZONE-I OF BIHAR (AREA IN '000 HA)

Sl. No.	Particulars	TE-2003	TE-2013	CGR (2003-13)
1.	Geographical area	3449.10 (100.00)	3449.10 (100.00)	-
2	Forests	91.86 (2.66)	91.86 (2.66)	0.00
3.	Barren and unculturable Land	101.37 (2.94)	100.00 (2.90)	-0.08
4.	Land put to non- agricultural use	685.05 (19.86)	703.28 (20.39)	0.13
	(a). Land area	526.64 (15.27)	547.33 (15.87)	0.20
	(b). Permanent water area	88.85 (2.58)	88.85 (2.58)	0.00
	(c). Temporary water area	69.57 (2.02)	66.95 (1.94)	-0.22
5.	Culturable waste land	5.47 (0.16)	5.11 (0.15)	-0.30
6	Permanent pasture	5.84 (0.17)	5.35 (0.16)	-0.41
7.	Land under trees & groves	144.64 (4.19)	150.48 (4.36)	0.16
8.	Fallow land other than current fallow	25.37 (0.74)	23.14 (0.67)	-0.42
9.	Current fallow	112.87 (3.27)	154.43 (4.48)	0.98
10.	Total unculturable land (2 to 8)	1172.47 (33.99)	1233.66 (35.77)	0.19
11.	Net area sown	2276.63 (66.01)	2215.44 (64.23)	-0.10

Figures in parentheses indicate percentage values

Further, the land under tree crops & groves has also gone up at 0.16% per annum growth rate. The barren and unculturable land includes lands in mountains and hill slopes, desert, plateaus, rocky area and extremely degraded lands. These lands cannot be brought under cultivation unless at a very high input cost with possible low returns. So it is not beneficial to bring these lands under cultivation because it demands a very high input cost with possible low returns (Malik, 2012). It is observed that the area under barren and unculturable land have been reduced marginally over the period under study.

It can be inferred that the decline in net sown area may be on account of shift of agricultural lands towards non-agricultural uses such as settlement for rising population, expansion for public infrastructures, recreation grounds and development of industries etc. as well as also on account of putting more area under trees and groves and current fallows. On the other hand, the reason for rise in current fallow may be due to continued global warming situation, leading to erratic rainfall, declining water table, growing cereal crops like paddy and wheat becoming un-remunerative due to high cost of production as well as leaving the land fallow for maintaining the soil fertility.

Land use pattern in agro-climatic Zone-II of the state has been presented in Table 3. A perusal of the figures presented in table indicates that net sown area continued to decline as its growth rate declined at the rate of (-) 0.03 percent per annum.

TABLE 3: LAND USE PATTERN IN AGRO-CLIMATIC ZONE-II OF BIHAR (AREA IN '000 HA)

Sl. No.	Particulars	TE-2003	TE-2013	CGR (2003-13)
1.	Geographical area	1798.12 (100.00)	1798.12 (100.00)	-
2.	Forests	3.09 (0.17)	3.09 (0.17)	0.00
3.	Barren and unculturable Land	100.13 (5.57)	99.16 (5.51)	-0.06
4.	Land put to non-agricultural use	323.64 (18.00)	335.28 (18.65)	0.18
	(a). Land area	241.30 (13.42)	252.97 (14.07)	0.24
	(b). Permanent water area	58.81 (3.27)	58.81 (3.27)	0.00
	(c). Temporary water area	23.53 (1.31)	23.48 (1.31)	0.01
5.	Cultuiable waste land	6.56 (0.36)	6.01 (0.33)	-0.42
6	Permanent pasture	2.90 (0.16)	2.45 (0.14)	-0.86
7.	Land under trees & groves	59.84 (3.33)	61.79 (3.44)	0.11
8.	Fallow land other than current fallow	33.90 (1.89)	33.41 (1.86)	0.28
9.	Current fallow	100.39 (5.58)	122.40 (6.81)	1.19
10.	Total unculturable land(2 to 8)	630.46 (35.06)	663.59 (36.90)	0.07
11.	Net area sown	1167.66 (64.94)	1134.53 (63.10)	-0.03

Figures in parentheses indicate percentage values

Following the same trend as in Zone-I, the area put to non-agricultural uses and the land under tree crops and groves in Zone II also showed an increasing trend which recorded to have CGR of 0.18 percent and 0.11 percent, respectively. The reasons for decline in the net sown area and rise in the land under tree crops and groves may probably be the same as has been explained earlier. The interesting point to note is that in Zone-II, area concerning fallow land other than current fallow has registered increasing trend, revealing the CGR at 0.28 percent. The growth in current fallow area was recorded comparatively larger (1.19%). Since, Zone-II is more flood prone area, thus the fallow lands of both categories in this zone may have increased due to the reasons that the farmers may have kept their land as fallow on account of recurring devastating flood.

Table 4 consists of land use pattern of agro-climatic Zone-III of the state revealed the extent of changes accrued so far in different activities, included in the table over the period under study.

TABLE 4: LAND USE PATTERN IN AGRO-CLIMATIC ZONE-III OF BIHAR (AREA IN '000HA)

Sl. No.	Particulars	TE-2003	TE-2013	CGR (2003-13)
1.	Geographical area	4112.36 (100.00)	4112.36 (100.00)	0.00
2.	Forests	524.95 (12.77)	526.68 (12.81)	0.00
3.	Barren and unculturable Land	234.96 (5.71)	232.55 (5.65)	-0.06
4	Land put to non- agricultural use	632.36 (15.38)	664.94 (16.17)	0.27

TABLE 4: LAND USE PATTERN IN AGRO-CLIMATIC ZONE-III OF BIHAR (AREA IN '000HA)—*CONTD.*

Sl. No.	Particulars	TE-2003	TE-2013	CGR (2003-13)
	(a). Land area	511.04 (12.43)	546.47 (13.29)	0.35
	(b). Permanent water area	59.73 (1.45)	59.73 (1.45)	0.00
	(c). Temporary water area	61.58 (1.50)	58.59 (1.42)	-0.22
5.	Culturable waste land	34.19 (0.83)	34.03 (0.83)	0.00
6.	Permanent pasture	9.04 (0.22)	7.87 (0.19)	-0.76
7.	Land under trees & groves	29.73 (0.72)	32.84 (0.80)	0.23
8.	Fallow land other than current fallow	74.94 (1.82)	65.04 (1.58)	-0.77
9.	Current fallow	332.60 (8.09)	545.88 (13.27)	2.84
10.	Total unculturable land(2 to 8)	1872.77 (45.54)	2109.83 (51.30)	0.66
11.	Net area sown	2239.59 (54.46)	2002.52 (48.69)	-0.62

Figures in parentheses indicate percentage values

So far as the net sown area is concerned, the compound growth rate was estimated negative (- 0.62%), indicating thereby decline in net sown area over the periods TE-2003 to TE-2013. There has been a rapid increase in the area put to non-agricultural uses as it was upheld by the comparatively larger compound growth rate (0.27%). Larger growth in this category of land may be assigned to the fact that the pace of urbanization, zone being the centre/ capital of the state, was comparatively high in this zone.

The other reason may be concentration of industries, fast pace of expansion of infrastructures in this zone. The land covered under trees & groves has also gone up at 0.23 percent compound growth rate, because cultivators of this zone are leaving their lands under this category due to scarcity of irrigation water sharpened by declining water table in the area. On the other hand, the current fallow land has been found rising at 2.84 percent per annum growth rate, this may probably be also on account of scarcity for irrigation water arising from declining water table in the zone, farmers are putting their land as current fallow.

Conclusions

It is quite apparent from the agro-climatic zone-wise analysis above, that net sown area has reduced sharply in Zone-III as compared to Zone-I and Zone-II. Further, net sown area for the state as a whole has also shown a declining trend which might be due to increase in the following categories of land such as area under non-agricultural uses, area put to trees and groves and area under current fallow in the state. The pressure of rising population on land has led to shift of cropped land towards the categories of non-agricultural uses. The scarcity of irrigation water, labour etc may be the probable cause for shift of land to tree crops current fallows. Other studies have also found that decline in net sown area is mainly due to unabated and massive conversion of agricultural land for building houses and construction of infrastructure. Similarly, increase in current fallows might be due to erratic rainfall, peak time scarcity of labour, unreliable and costly irrigation and tiny unviable farm holdings in Bihar. Policy makers are not realizing the challenge posed to agriculture due to decline in net area sown and increasing fallow land in the state which warrants their immediate attention (Singh et al. 2014).

On account of rapid changes in the climate world over, water table in the state has also gone down leading to rising cost of irrigation. Further, due to shortage of electricity, the state largely uses diesel pumps for irrigation this along with declining water table puts the small and marginal farmers of the state under tremendous pressure as to how raise the productivity/income from per unit decreasing crop land. Contemplating the foregoing discussion, it may be suggested that timely supply of quality seeds, fertilizers larger use of electrical and solar devices for extraction of irrigation water, desiltation of canals and also linking different canals as well as proper marketing of agricultural produces will certainly encourage the farmers for not putting their land as current fallow and also help them in harvesting/garnering more income from per unit of land area.

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