ECONOMIC ANALYSIS OF TUR CULTIVATION
IN KARNATAKA, INDIA

Akram Basha Saheb B,
Research Scholar,
Dept. of Commerce, Gulbarga University,
Gulbarga, Karnataka, India.

Dr. Rajnalkar Laxman,
Professor of Commerce and Dean,
School of Business Studies,
Central University of Karnataka,
Gulbarga, Karnataka, India.

Dr. Channabasavanagouda P,
Director,
Millennium Institute of Management,
N.H.63, Gadag Road, Dadegal,
Koppal, Karnataka, India.

ABSTRACT

The three important concepts-cost, return, and profitability need to be analyzed while assessing the economics of any productive activity. Among these, the most controversial one is the computation of cost of cultivation. Estimation of imputed costs like family labour further adds to the problem of calculating the cost of cultivation of agricultural produce. An attempt has been made here to estimate the cost of production of Tur in Karnataka. Also an attempt is made to work out the relative profitability of Tur using Cost-Benefit Analysis, Net Present Value (NPV) and Internal Rate of Return (IRR). The analysis of the cost and return of the cultivation and production of Tur will provide a synthetic view of the economics of production of this pulse crop in Karnataka.

Keywords: Cost of Cultivation, Rate of Return and Profitability.
Introduction:

The cost of cultivation is very important in the formulation of agriculture price policies. Detailed inquiries into the cost of cultivation are very costly and cannot be conducted as an annual routine. At the farm level, the relative profitability, which is determined by the value of output and the cost of cultivation, is one of the important factors, influencing the allocation of resources, including land for alternative crops from the farmers (George 1988). The estimation of unit cost of production is an important item of information necessary for evolving rational price policies and development strategies of crop production. Such as price policy can influence the acreage allocations at the form level. Even without such estimates, farmers by their experiences formulate, though not scientifically, the relative profitability of various crops they are cultivating. Such a rough estimate is one of the reasons, along with price policy of the government, which influences the crop decision. Realizing the importance of reliable estimates of the cost of production of individual commodities, the Ministry of Agriculture, Government of India, through its comprehensive scheme to cost of cultivation of principal crops generates cost estimation of major crops at the state and national level.

Review of Literature:

The number of studies made on Economic analysis of Tur are very few. But the economic analysis of most of the perennial crops are similar therefore in this Section reviews relevant to the present study are presented from various comparable crops as under.

Neelappa Shetty (2002) studied the technical and allocative efficiency of paddy production in Tungabhadra project area. The per hectare cost of paddy cultivation was Rs.26,192 and Rs.25,938 in Bellary and Raichur districts, respectively. The variable costs (85%) constituted the major portion of the total cost of cultivation. The expenditure on human labour was found to be the major item of variable cost. The fixed cost per hectare was estimated to be Rs.33,896 and Rs.33,746 respectively, for Bellary and Raichur district farmers. Rental value of land formed the major component of fixed cost. The gross returns realised by the farmer in Bellary and Raichur districts for paddy was Rs.42,842 and Rs.40,735 per hectare.

Sandeep (2002) in his study on cropping systems in Bidar district of Karnataka revealed that under irrigated conditions the per hectare net profit was found highest in sugarcane cropping system in case of both small (Rs.52016.66) and large farms (Rs.42217.04) with a benefit cost ratio of 3.36 and 3.12, respectively. Under rainfed conditions, the net profit was highest in redgram cropping system in case of both small (Rs.12595.00) and large farms (Rs.12491.25) with a benefit cost ratio of 2.40 and 2.34, respectively. The ratio of MVP to MFC was greater than one for human labour, bullock labour, seeds, FYM and fertilizers indicating the scope for using additional units of these inputs to increase gross income.

Singh (2004) in his study on economics of efficiency in vegetable business system reported that cost of cultivation for tomato, onion, arvi, okra, brinjal and potato was estimated at Rs.12,599.00, Rs.13,338.10, Rs.9,742.10, Rs.10,046.40, Rs.11,274.60 and Rs.13,480.20 per hectare, respectively. Further, it also showed that about 95 per cent of the cost of cultivation of these vegetables constituted human labour and working capital cost. The cost on bullock labour for these vegetables ranged from 4 to 5 per cent. The per hectare net profit of vegetable growers for tomato, onion, arvi, okra, brinjal and potato were estimated to be Rs.31470.25, Rs.2644.34, Rs.22015.90 and Rs.31353.60, Rs.29205.40 and Rs.25328.25, respectively.

Rajeshwari (2004) made an attempt to study the cost and returns of coconut based farming systems in Tumkur district of Karnataka. The farmers following Farming System comprising coconut, arecanut, ragi and dairy were getting the highest net farm income of Rs.85,600 per farm and the cost of cultivation was Rs.1,59,645. The major components of cost of production were amortized establishment cost, operational cost, rental value of land and material cost.

Saikumar (2005) studied the cost and returns structure of major farming systems in tank commands of north eastern Karnataka. The study revealed that, of the three major farming systems identified in the study area, dairy enterprise was found to be most common as a complimentary enterprise. The highest net returns realized was Rs.53,404.59 per hectare and per hectare cost of cultivation was Rs.84414.21 in Farming System comprising redgram+ kharif jowar+ groundnut+ followed by bengalgram+ rabi jowar+ dairy.

Methodology and Data Base:

The territorial spread of the field of investigation is confined to two major Tur producing districts in the state. A two stage stratified random sampling design has been used for sample selection. Three talukas, two from Gulbarga district and one from Bidar district, were selected, based on the area and production of this pulse crop. For the selection the study relied on the data supplies by the Directorate of Economics and Statistics, Government of Karnataka. The data were collected from three size classes, viz. small, medium and large holdings. Total 50 Tur growers were selected for the study. The data collected relate to the one complete agricultural year of 2011.

Concepts and Method of Cost Estimation:

There are a number of problems in estimating the cost of cultivation of individual crops. Farm cost is the combination of materials and services of heterogeneous nature and, therefore, a number of conceptual and methodological issues are involved
in estimating the cost of cultivation of individual crops. The controversial issues are involved in relate to the treatment of hired
and family labour, interest on fixed capital, interest on working capital, rental value of owned land, provisions for risk and
uncertainty, allocation of joint costs, evaluation of farm assets, etc. Before formulating various cost concepts suitable to local
situation, it is relevant to discuss some theoretical issues related to the cost and income concepts adopted by the Farm
Management Studies in India that are generally used for estimating cost and returns from crop production in agriculture. The
pertinent questions that emerge in the debate on cost and income concepts used in the farm management studies are:
• Is profit maximization or maximization of gross output or surplus over paid out the cost, which is the motivating factor
behind producers, decisions on the farm?
• Whether the use of owned inputs on a farm determined by market prices, or does other factors that govern its use.

No acceptable answer has been so far provided in regard to these questions. The concept C, used in Farm Management Studies,
which includes paid out cost and imputed costs of inputs like family labour and owned land have been criticized on various
grounds. When profits were calculated at cost C, level, Indian farming becomes un-remunerative. The reliability of cost C, as
an appropriate and valid concept for understanding decision making a peasant economy is at times questioned (Bharadwaj,
1974). The imputation norm for inputs especially family labour is justified on the ground of opportunity cost involved in the
family labour. Generally, the prevailing market wage rate is used to impute value of family labour. This question on the ground
that in Indian agriculture there exists a sizeable under-employed labour and hence the opportunity cost tends to zero. Similar
issues were raised regarding imputation of the rental value of owned land, interest on owned capital, etc. (Sau 1976).
Realising the seriousness of the problem involved, Government of India had appointed two special expert committees to review
and revise the methodology of estimating the cost of production of principal crops. In the present study the following cost and
income concepts are formulated for estimating the cost of production of Tur in the study area among three size groups. These
concepts slightly vary from the concepts developed by the Expert Committee headed by Hanumantha Rao (Government of
India, 1990) because wide classifications of costs are not essential for the present exercise. As per the recommendations of the
Expert Committee, the items of cost of cultivation cover both the paid out costs and the imputed costs. The paid cost includes
(1) hired labour (human + animal + machinery), (2) maintenance expenses on owned animals and machinery, (3) expenses on
material inputs, (4) depreciation on implementing, machinery and farm building, (5) land revenue, (6) miscellaneous
expenditure, (7) interest on working capital. The imputed costs consist of the value of family labour, rent of owned land and
interest on owned fixed capital for which the farmer does not incur any cash expense (Government of India, 1990). The
followings are presenting the classification of cost items according to different cost concepts.

Classification of Cost Items:

Cost A = Consists of cash and kind expenses (paid out costs) actually incurred by the cultivators. They include the value of
hired labour and bullock labour + value of owned bullock labour + hired machinery charges + value of purchased seeds,
manure, fertilizer and plant protection, repair and maintenance charges of implements and machinery, irrigation charges, land
revenue and land taxes, interest on working capital + other unforeseen expenses.

Cost B = Cost A + Depreciation of fixed Capital + interest on fixed capital

Cost C = Cost B + imputed value of family labour

Cost D = Cost C + Rental value of land

In the above classification Cost A represents the net paid out cost, Cost B is the gross paid out cost, Cost C, which includes
imputed family labour in the cost of production and cost D becomes the comprehensive cost of production.

Procedure Adopted for the Evaluation of Cost Items:
The issues involved mainly relate to treatment of hired human labour and family labour, cost of fixed capital and working
capital, rental value of owned land, managerial cost, allocation of joint costs, transport and marketing charges, etc.

Hired Human Labour Cost:
Hired human labour cost is one of the important constituents of the direct costs of crop production. It is evaluated from the actual
wages paid by the employer (farmer).

Family Labour Cost:
The valuation of family labour is a controversial issue among farm economists. Considering these discussions, it has been decided
to evaluate the family labour cost at the market wage rate prevailing in the locality. The managerial functions performed by the
family members are evaluated on the basis of the time spent with the family, the labour rate and the actual expenses incurred for
traveling, etc.
Cost of Fixed Capital (Excluding Land):

The cost of fixed capital or the interest on fixed capital is evaluated at the rate of 10 per cent per annum on the present value of fixed assets. In the present study depreciation charges of fixed assets are worked out by the Straight Line Method using the formula:

\[ \text{Depreciation} = \frac{\text{Original Cost} - \text{Junk Value}}{\text{Life of the Asset}} \]

In case the original values of the fixed capital are not available, depreciation is estimated on the basis of the present value and the remaining life of the asset.

Interest on Working Capital:

Two major problems are involved in the valuation of interest on the working capital. They are the rate of interest and the period over which interest is charged. In this study, working capital is evaluated in terms of (a) owned and (b) borrowed (institutional + non – institutional) capital. While for the borrowed capital the actual interest paid out is taken into account, the interest on owned capital is evaluated at the rate of 10 per cent per annum for the crop year.

Rental Value of Owned Land:

A number of alternative procedures to compute the rental value for owned land have been suggested. Important among them are 1) an appropriate rate of interest on the value of land, 2) Market rent and 3) a fixed proportion of the output. Since renting of land is common in the study areas and further, land values are very high due to pressures external to agriculture, we have resorted to estimate the rental value of owned land on the basis of prevailing rents in the village for the identical type of land. When such information is not available, especially for Tur, one- fifth of the value of agricultural produce from the land is considered as the rental value.

Allocation of Joint Costs:

The expenditure incurred or imputed for some of the cost items relate to the farm as whole. Such joint costs are allocated to individual enterprises in proportion of the area under each crop. Depreciation on farm buildings and implements, land rents, land revenue, cesses and taxes and interest on owned fixed capital, etc., are such costs, which are allocated to individual crop enterprises in proportion to their areas. For computing the cost share of i-th crop, the cost of joint inputs is apportioned in the following manner.
- Repair and maintenance of implements – in proportion to the time used for the cultivation of i-th crop to total use of the equipments.
- Fixed capital (excluding land) – in proportion to the time utilized for the cultivation of i-th crop to total use of these equipments.
- Manure, fertilizers and pesticides- in proportion to the standard area under the crop to total cropped area.
- Rental value of land- in proportion to the area under the crop to total area under cultivation.

Method of Cost Estimation:

In the present study, cost and yield per unit of Tur cultivated in three talukas and three size groups each estimated. The estimated cost and yield of this pulse crop at the taluka level and size level are then used to examine the relative profitability. Initially the cost is estimated for each size. The simple average of these size group level estimates is then taken to generate the estimates at the Taluka level and then for the whole study area level. The procedure for estimating the cost at the farming group level is as follows:
Let \( C_{jk} \) be the cost incurred by the k-th holding in the j-th size group and \( n_j \) is the number of holdings selected from the j-th size group. Then,

\[ \bar{C}_j = \frac{\sum_{k=1}^{n_j} C_{jk}}{n_j} \]

is an unbiased estimate of the cost per holdings in the j-th age group. Hence,

\[ \hat{C}_j = N_j \bar{C}_j \]
\[ \hat{O}_j = N_j \bar{O}_j \]

Where \( \hat{C}_j \) is the total cost of the j-th size group, \( N_j \) is the total number of holdings selected from the j-th size group and \( \bar{C}_j \) is
the cost per holding in the j-th size group. And \(\bar{O}_j\) is the total output of the j-th size group and \(\bar{O}_j\) is output per holding in the j-th size group.

Now,

\[
\hat{C} = \frac{\sum_{j=1}^{d} \hat{C}_j}{\sum_{j=1}^{d} A_j}
\]

Gives the estimate of the cost per acre and

\[
\hat{Y} = \frac{\sum_{j=1}^{d} \bar{O}_j}{\sum_{j=1}^{d} A_j}
\]

Gives the estimate of yield per acre.

Where \(\hat{C}\) is the total cost of the whole size groups, \(A_j\) is the number of acres of land put into cultivation under j-th size group.

Dividing \(\hat{C}\) by \(\hat{Y}\) we get an estimate of cost per unit produce. In the present study cost per acre and cost per unit produced is used for the analysis. The procedure given above is adopted for the estimation of per acre cost and yield of Tur.

**Relative Profitability Analysis:**

To analyse the relative profitability of Tur, we made use of financial evaluation measure like Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) (Harberger, 1972). An on-farm benefit-cost analysis is the most appropriate analytical tool to measure the overall profitability of farming operation for an individual farmer or a group of farmers. While different parameters may be used for the analysis at different levels, a positive NPV provides a necessary, but insufficient indication of the acceptability of a particular crop or crops. A rational landholder will prefer more satisfaction to less in terms of land uses and NPV. Hence, he prefers the land use, with the highest NPV at any given level of risk. Land use, which has a higher NPV than another at any given level of risk, is said to statistical dominate the other (Anderson et al., 1977). If a farmer does not receive adequate net income from following a crop practice he will not continue it, while another farmer may solve such problems intuitively or through practical experience. Unfortunately, such an estimate may not properly incorporate all the variables from the cost side. To redress this problem one has to scientifically estimate the cost and return with appropriate methods.

For financial evaluation of Tur crop under consideration we require a stream of cost incurred over the years. As the study is confined to Tur groups are obtained through a survey. We use the NPV, BCR and IRR investment criteria to measure the profitability of Tur. This will give the relevant criteria to measure profitability of Tur crops. This will also be helpful in identifying the extent of the influence of economic motive behind the crop selection. The computational formulas are given below:

**Net Present Value (NPV)**

\[
NPV = \sum_{t=1}^{n} \frac{B_t}{(1 + \delta)^t} - \sum_{t=1}^{n} \frac{C_t}{(1 + \delta)^t}
\]

**Benefit Cost Ratio (BCR)**

\[
BCR = \frac{\sum_{t=1}^{n} \frac{B_t}{(1 + \delta)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1 + \delta)^t}}
\]

**Internal Rate of Return (IRR)**

\[
IRR = \sum_{t=1}^{n} \frac{B_t - C_t}{(1 + \delta)^t} = 0
\]

Where,

- \(B_t\) is the benefit obtained in the year ‘t’,
- \(C_t\) is the cost incurred during the year ‘t’.
- \(\delta\) is the discount rate.

The estimations of BCR and NPV are done at Cost C and Cost D levels. The costs and benefits are discounted at a rate of 10 per cent and 12 per cent.

For the present analysis cost has been examined in two dimensions, viz., cost per unit area and cost per unit produce. Cost per
unit area will provide us with a glimpse of the intensity of input use and the technological variations between new entrants to the production of this major pulse and the farmers as well as planters already established in the production of pulse. To assess production efficiency and to provide a guideline for price fixation, cost per unit produce is worked out. Also the study examines the cost variation, if any, between different centers as well as different sizes. Finally, the relative profitability of this major pulse using benefit-cost ratio concepts is discussed.

Results and Discussion:

Cost per Acre:

It is evident from the analysis that cost per acre is the highest in large size groups followed by medium and small size groups. As the cost is high, yield also is high compared to the other two size groups. When we make a thorough analysis about the cost components of different size groups, it is clear that under large size group the outlay on all the components are high except depreciation of fixed capital (Which is Rs. 136.10 and Rs. 131.66 in medium and small size respectively). The table 1 represents the average cost of different components and yield of the crop per acre.

<table>
<thead>
<tr>
<th>Cost Estimation</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hired labour</td>
<td>977.22</td>
<td>1517.50</td>
<td>2140.00</td>
<td>1544.91</td>
</tr>
<tr>
<td>Seeds</td>
<td>131.55</td>
<td>153.40</td>
<td>172.05</td>
<td>152.33</td>
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<tr>
<td>Manure and Chemical Fertilizer</td>
<td>864.44</td>
<td>1489.50</td>
<td>1747.62</td>
<td>1367.19</td>
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<tr>
<td>Plant Protection</td>
<td>533.33</td>
<td>545.00</td>
<td>595.24</td>
<td>557.86</td>
</tr>
<tr>
<td>Miscellaneous Expenses</td>
<td>588.88</td>
<td>712.50</td>
<td>848.09</td>
<td>716.50</td>
</tr>
<tr>
<td>Interest on Working Capital</td>
<td>350.00</td>
<td>575.40</td>
<td>715.71</td>
<td>547.04</td>
</tr>
<tr>
<td>Cost-A</td>
<td>3445.42</td>
<td>4993.30</td>
<td>6218.71</td>
<td>4885.83</td>
</tr>
<tr>
<td>Depreciation of Fixed Capital</td>
<td>131.66</td>
<td>136.10</td>
<td>127.14</td>
<td>131.63</td>
</tr>
<tr>
<td>Interest on Fixed Capital</td>
<td>117.77</td>
<td>303.75</td>
<td>407.38</td>
<td>276.30</td>
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<tr>
<td>Cost-B</td>
<td>3694.85</td>
<td>5433.15</td>
<td>6753.23</td>
<td>5293.76</td>
</tr>
<tr>
<td>Family labour</td>
<td>966.11</td>
<td>1103.75</td>
<td>966.66</td>
<td>1012.17</td>
</tr>
<tr>
<td>Cost-C</td>
<td>4660.96</td>
<td>6536.90</td>
<td>7719.89</td>
<td>6305.93</td>
</tr>
<tr>
<td>Rental value of land</td>
<td>1288.88</td>
<td>1340.00</td>
<td>1623.80</td>
<td>1417.56</td>
</tr>
<tr>
<td>Cost-D</td>
<td>5949.84</td>
<td>7876.90</td>
<td>9343.69</td>
<td>7723.49</td>
</tr>
<tr>
<td>Yield (in Kg)</td>
<td>325.00</td>
<td>425.00</td>
<td>428.00</td>
<td>392.70</td>
</tr>
</tbody>
</table>

Source: Computed from field survey.

As clear from Table 2 cost per kilogram of Tur is also the highest in large size group and lowest in the small size group. The size wise and total break-up cost per kilogram of Tur reveals that the estimate unit cost under small, medium, large and the total group size is Rs. 19.12, Rs. 19.90, Rs. 22.89 and Rs. 22.75 respectively. The component of the imputed value of family labour is estimated Rs 2.89 which is highest as compared with the medium (2.69) and large (Rs 2.46) size groups.

<table>
<thead>
<tr>
<th>Cost Estimation</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hired labour</td>
<td>3.13</td>
<td>3.85</td>
<td>5.30</td>
<td>4.09</td>
</tr>
<tr>
<td>Seeds</td>
<td>0.41</td>
<td>0.39</td>
<td>0.43</td>
<td>0.41</td>
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<tr>
<td>Manure and Chemical Fertilizer</td>
<td>2.68</td>
<td>3.56</td>
<td>4.20</td>
<td>3.48</td>
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<tr>
<td>Plant Protection</td>
<td>1.65</td>
<td>1.38</td>
<td>1.46</td>
<td>1.50</td>
</tr>
<tr>
<td>Miscellaneous Expenses</td>
<td>1.83</td>
<td>1.84</td>
<td>2.07</td>
<td>1.91</td>
</tr>
<tr>
<td>Interest on Working Capital</td>
<td>1.66</td>
<td>1.50</td>
<td>1.73</td>
<td>1.63</td>
</tr>
<tr>
<td>Cost-A</td>
<td>11.36</td>
<td>12.52</td>
<td>15.19</td>
<td>13.02</td>
</tr>
<tr>
<td>Depreciation of Fixed Capital</td>
<td>0.42</td>
<td>0.34</td>
<td>0.33</td>
<td>1.09</td>
</tr>
<tr>
<td>Interest on Fixed Capital</td>
<td>0.37</td>
<td>0.76</td>
<td>0.95</td>
<td>2.08</td>
</tr>
<tr>
<td>Family labour</td>
<td>2.89</td>
<td>2.69</td>
<td>2.46</td>
<td>2.68</td>
</tr>
<tr>
<td>Cost-C</td>
<td>15.04</td>
<td>16.31</td>
<td>18.93</td>
<td>18.87</td>
</tr>
<tr>
<td>Rental value of land</td>
<td>4.08</td>
<td>3.59</td>
<td>3.96</td>
<td>3.88</td>
</tr>
<tr>
<td>Cost-D</td>
<td>19.12</td>
<td>19.90</td>
<td>22.89</td>
<td>22.75</td>
</tr>
</tbody>
</table>
Source: Computed from field survey.

Relative Profitability of Tur:

To estimate the profitability of Tur crop a Profitability Index Method (Benefit-Cost Ratio Analysis) based on two districts and three size groups are employed. The B/C ratio is used to compare and contrast the profitability of Tur. The Net Present Value (NPV) represents the benefit over and above the compensation per time and risk and the decision rule associated with the NPV criterion. The Internal Rate of Return (IRR) is the discount rate which makes its net present value equal to zero. The IRR method takes into account the time value of money. The Table 4 presents the NPV at different discount rates, B/C ratio at different rates, and IRR for Tur.

### Table 3: Economic Appraisal of the Tur at Cost ‘D’ level

<table>
<thead>
<tr>
<th>Cost-D level</th>
<th>@ 10 per cent</th>
<th>@ 12 per cent</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPV</td>
<td>B/C</td>
<td>NPV</td>
</tr>
<tr>
<td></td>
<td>19418</td>
<td>1.54</td>
<td>16430</td>
</tr>
</tbody>
</table>

Source: Computed from field Survey.

It is evident from the table that the cultivation of the tur is economic upto cost D level @ 10 per cent and 12 per cent discount rates. NPV is positive, B/C ratio is greater than one and IRR is 26.8 per cent.

Conclusion:

In this paper an attempt was made to estimate the cost, returns and relative profitability of Tur crop, based on the primary survey conducted in selected taluks. The empirical result out of the analysis portrays that the cost of cultivation of Tur is significantly high in Karnataka as compared to other pulse crops. From the size-wise analysis, it is clear that the cost of production per unit is high in the large size group as compared to medium and small size groups. The Cost of family labour is higher in a small size group than medium and large groups. A thorough analysis of cost components revealed that the small size cultivators are applying more manure and cow dung and also family labour their imputed value is higher than compared to the other counterparts. Yield per acre is low among small size cultivators.

References:


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