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An analysis of farm profitability of adopted and non-adopted KVK farms of Sant Kabir Nagar district of Uttar Pradesh

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Abstract

In this study, A step was taken to measure the farm profitability of adopted and nonadopted KVK farms of Sant Kabir Nagar district of Uttar Pradesh. A combination of purposive and random sampling within a multistage stratified design was employed to select the district, block, villages, and respondents. The primary data were collected through survey on schedule with the help of personal interviews. A list of all the villages falling under selected Pauli and Nath Nagar block were prepared and five villages were randomly selected. The farmers were categorized into two groups—adopters and non-adopters. In total, 100 respondents were selected for the detailed study. The data related to the agricultural year 2022–23, and both tabular and functional analytical methods were employed for data analysis. Present study based on randomly selected 100 respondents of 50 adopted and 50 non- adopted categories with the average size of land holding as 1.35 and 1.15 hectare, respectively. The list of results obtained in this research study concludes that size of land holding, net cultivated area and cropping intensity was found to be higher in case of adopted respondents as compared to nonadopted respondents. Illiteracy rate was higher in case of non-adopted respondents. Total cost incurred in paddy and wheat cultivation was found to be less in case of adopted as compared to non-adopted respondents. Profitability measures of paddy were found to favor adopted respondents over non-adopted respondents which clearly show that there is positive impact of KVK as adopted respondents performed well as compared to non-adopted respondents.

Keywords: Cost concepts, KVK adopted farmers, profitability comparison, social economic status

Introduction

One of the major objectives of the farmer is to earn higher profit with every passing year in addition to meeting his family requirement. The inabilities of farmers to fully exploit the available technologies result in lower efficiencies of production, which is one of the main reasons for low productivity and low profitability. Krishi Vigyan Kendras (KVKs) play a vital role in taking new technologies to farmers' fields, creating significant positive impacts. With strong technical expertise and on-farm demonstration facilities, they hold a distinct advantage over other service providers in delivering effective technology transfer. The KVKs are evolving as the future grass-root level institutions for empowering the farming community. KVKs have become integral to decentralized planning and implementation aimed at achieving growth in agriculture and allied sectors. They organize need-based training programs to support farmers and raise awareness about advanced agricultural technologies through various extension activities. KVKs also produce and supply essential quality inputs—such as seeds, planting materials, organic products, and biofertilizers—to the farmers under their adoption programs.

Socio-economic status plays a crucial role in shaping all aspects of social behavior in Indian society. It is well

recognized that an individual's position in the socio-economic hierarchy significantly influences his actions and interactions. Generally, people with higher socio-economic status tend to exhibit more modern attitudes and behaviors compared to those from lower socio-economic backgrounds. To analyze farm profitability, the focus was given to rice and wheat production because of the growing rice and wheat demand, especially with an increasing household's income in the cities, and also soil and climate are favorable for rice and wheat production in the research area. Unfortunately, in Eastern Uttar Pradesh, rice as well as wheat production is yet to be commercialized. Several factors, including natural and non-natural, were identified to be behind the low production. Factors such as the lower yields and profitability, price variability, low level of technology transfer, use of local seeds, high fertilizer cost, and lack of modern agricultural implements are among the key challenges holding back productivity in the state. In this context, the knowledge regarding good varieties (Wheat and Rice) in terms of yield and market price is highly essential for farmers. Economic considerations are a major determinant influencing the choice of new technologies. It is generally anticipated that adoption levels will rise when farmers experience higher profits from the technologies they adopt. The objectives of the study were

to examine the socio-economic status and farm profitability of Adopted farmers and non-adopted KVK farms in the Sant Kabir Nagar district of Uttar Pradesh. This comparative study between Adopted and non-adopted KVK farms would help to know whether the Krishi Vigyan Kendra had the potential to benefit the farmers or not, as well as this information is important for scientists, policymakers, administrators.

Materials and Methods

As the study focused on KVK-adopted farmers, a list of 50 adopted farmers was obtained, and an equal number of non-adopted farmers were selected using a proportionate random sampling method from nearby areas. This approach helped minimize differences in farm, farmer, and environmental characteristics between the two groups. Primary data were collected from the sample respondents through personal interviews using a pre-tested interview schedule. Secondary information was gathered from the annual reports and other publications of the Krishi Vigyan Kendra. The primary data corresponded to the agricultural year 2022–2023.

Cost of crop production

In India, the cost-concept approach is commonly applied to assess crop production profitability. The major cost components used in this method include Cost A_1 , A_2 , B_1 , B_2 , C_1 , C_2 , and C_3 .

Cost A_1 : This cost includes actual expenditure incurred in cash and kind.

1. Value of hired human labour and machinery labour.
2. Value of seed (both forms produced and purchased).
3. Value of manure (owned and purchased).
4. Value of insecticides, pesticides, and chemical fertilizer.
5. Deprecation on implements, farm machinery and farm buildings.
6. Irrigation charges.
7. Land revenue, and other taxes.
8. Interest in working capital.
9. Miscellaneous expenses.

Cost A_2 : Cost A_1 + rent paid for leased in land. Cost B_1 : Cost A_2 + interest on value of owned fixed capital assets (including land).

Cost B_2 : Cost B_1 + rental value of owned land. Cost C_1 : Cost B_1 + imputed value of family labour.

Cost C_2 : Cost B_2 + imputed value of family labour.

Cost C_3 : Cost C_2 + 10% of C_2 (managerial cost).

Income measure

Following income measures would be calculated: -

Gross income: It is the total value of main product. $GI = (Q_m \times P_m)$

Where, GI = Gross income Q_m = Quantity of main product

P_m = Price of main product

Returns over variable cost (RVC): $RVC = \text{Gross income} - \text{Cost } A_1$

Farm business income (FBI): $FBI = \text{Gross income} - \text{Cost } A_2$

Family labour income (FLI) or returns to family labour: $FLI = \text{Gross income} - \text{Cost } B_2$

Net income (NI): $NI = \text{Gross income} - \text{Cost } C_2$

Returns to management $RM = \text{Gross income} - \text{Cost } C_3$

Returns per rupee (RPR) $RPR = \text{Gross income per hectare} / \text{Cost } C_2 \text{ per hectare}$.

Income over cost $A_2 + FL = \text{Gross income} - (\text{cost } A_2 + FL)$

The input use for the study is mentioned below:

- Seed
- Fertilizer
- Manure
- Pesticide
- Irrigation

The output is taken for the study are:

- Main product yield (kharif)
- By product yield (kharif)
- Main product yield (rabi)
- By product yield (rabi)

Results and Discussion

Socio-economic Characteristics of Respondents

The study aimed to examine the socio-economic characteristics of adopted and non-adopted KVK respondents, including land utilization patterns, age, family size, educational status, non-farm income, cropping pattern and cropping intensity. The detailed socio-economic profiles of the respondents were analyzed using field survey data and are presented below.

Land utilization pattern

The operational landholding characteristics of respondents, both adopted and non-adopted, include total holding size, uncultivated area, cultivated area, irrigated area, area sown more than once, and gross cropped area. On average, adopted respondents had a larger holding size of 1.35 hectares compared to 1.15 hectares for non-adopted respondents, reflecting a 17.39% higher holding. The uncultivated area was slightly higher for non-adopted respondents (0.22 ha) than for adopted respondents (0.25 ha). Net cultivated area averaged 1.13 hectares for adopted farmers and 0.96 hectares for non-adopted farmers. Additionally, adopted respondents had higher irrigated area, area sown more than once, and gross cropped area, exceeding non-adopted respondents by 25.00%, 10.75%, and 16.12%, respectively. Presented in (Table 1).

Table 1: Land utilization pattern of respondents

Particular	Adopted	Non -Adopted	% Difference
Size of Holdings	1.35	1.15	17.39
Cultivated area	1.13	0.96	21.50
Uncultivated area	0.22	0.25	-12.00
Irrigated area	1.35	1.08	25.00
Re-cultivated area	1.03	0.93	10.75
Gross cropped area	2.16	1.86	16.12

Age and family size of the respondents in the area under study

The data indicated that the average age of respondents was 37 years for adopted farmers and 39 years for non-adopted farmers. The average family size was 7 for adopted respondents and 9 for non-adopted respondents. Male members averaged 2 in adopted families and 3 in non-adopted families, while the number of children was the same in both groups, at 2. Female members were higher among non-adopted respondents (3) compared to adopted

respondents (2). The number of dependent family members was also greater in non-adopted respondents (6) than in adopted respondents (4). Consequently, the total family size was larger for non-adopted respondents (9) compared to adopted respondents (7). Presented in (Table 2).

Table 2: Average Family size, educational status and Extent of non-farm income

Average Family Size		
Parameter	Adopted	Non adopted
Male	2 (28.57)	3 (33.33)
Female	2 (28.57)	3 (33.33)
Children	3 (42.85)	3 (33.33)
Dependent	6 (85.71)	8 (88.88)
Family size	7 (100.00)	9 (100.00)
Age (in years)	37	39
Education level		
Illiterate	15 (30.00)	23 (46.00)
Primary	14 (28.00)	13 (26.00)
Secondary	5 (10.00)	4 (8.00)
Higher Secondary	6 (12.00)	5 (10.00)
Senior Secondary	5 (10.00)	3 (6.00)
Graduation	4 (8.00)	2 (4.00)
Post-Graduation	1 (2.00)	0 (0.00)
Total	50 (100.00)	50 (100.00)
Non-farm income		
<10000	35 (70.00)	32 (64.00)
10001-50000	9 (18.00)	10 (20.00)
50001-100000	3 (6.00)	5 (10.00)
100001-500000	2 (4.00)	3 (6.00)
>500001	1 (2.00)	0 (0.00)
Total	50 (100)	50 (100)

Educational status

The education status of the adopted and non-adopted respondents depicts that illiteracy found to be higher in non-adopted (46%) as compared to adopted (30%). The maximum number of the respondents were found to be educated up to primary level (28%) and (26%) among adopted and non-adopted respectively. These findings suggest a potential connection between education level and adoption. But further research is needed to establish causality and explore underlying factors. Taking into account the limitation of the study, such as sample size and context, future analysis and investigation will provide a more comprehensive understanding of relationship. Presented in (Table 2).

Extent of non-farm income in the area under study

The maximum percentage of respondent were found to earn less than 10000 rupees in case of adopted (70.00%) and non-adopted (64.00%) respondents respectively, while 18.00 and 20.00% adopted and non-adopted respondent were found to earn income between Rs.10001-50000 and 6.00 and 10.00% earned income between Rs.50001-100000 and 4.00 and 6.00% income lies between 100001-500000 while only 2.00% adopted respondents are income earn more than 500000 rupees per annum. Presented in (Table 2).

Cropping pattern and cropping intensity of selected respondents

Approximately 50% of the area was allocated to different

crops during the Kharif and Rabi seasons. Among both adopted and non-adopted respondents, paddy was the major Kharif crop, covering 40.78% and 39.49% of the gross cropped area, respectively. During the Rabi season, wheat (49.56% for adopted and 59.23% for non-adopted) followed by mustard (12.28% and 12.73%) were the principal crops grown in the study area. Overall, the area under Kharif and Rabi crops was 45.22% higher for adopted respondents compared to non-adopted respondents.

Adopted respondents allocated 125% and 66.66% more area to urd and maize, respectively, than non-adopted respondents during the Kharif season. In the Rabi season, they devoted 40% and 33.33% more area to mustard and gram, respectively, compared to non-adopted respondents. In the Zaid season, chari and vegetables were the main crops for adopted respondents, accounting for 3.50% and 6.14% of their gross cropped area, whereas non-adopted respondents cultivated only vegetables, covering 1.27% of their total gross cropped area. (Table 3)

Table 3: Cropping pattern and cropping intensity of selected respondents

Particulars	Adopted	Non-Adopted	% Difference
Paddy	0.59(25.87)	0.39(24.84)	51.28
Maize	0.2 (8.77)	0.12(7.64)	66.66
Urd	0.09 (3.94)	0.04 (2.54)	125.00
Bajra	0.05 (2.19)	0.07 (4.45)	-28.57
Area Kharif	0.93 (40.78)	0.62 (39.49)	50.00
Wheat	0.65 (28.50)	0.57 (36.30)	14.03
Gram	0.08 (3.50)	0.06 (3.82)	33.33
Pea	0.12 (5.26)	0.1 (6.36)	20.00
Mustard	0.28 (12.28)	0.2 (12.73)	40.00
Area Rabi	1.13 (49.56)	0.93 (59.23)	21.50
Chari	0.08 (3.50)	0 (00)	0.00
Vegetable	0.14 (6.14)	0.02 (1.27)	600.00
Area Zaid	0.22 (9.64)	0.02 (1.27)	1000.00
Gross Cropped area	2.28 (100)	1.57 (100)	45.22
Net cultivated area	1.13	0.93	21.5
Cropping Intensity	201.76	168.81	19.51

Per hectare Cost of crop production of paddy in the area under study

For adopted and non-adopted respondents, the average total cost per hectare was ₹55,978.41 and ₹59,245.93, respectively, indicating that adopted respondents incurred 5.51% lower costs compared to non-adopted respondents. out of total cost incurred, the proportion of variable, fixed and managerial cost was found to be 62.19, 28.70 and 9.09 per cent respectively in case of adopted respondents and 63.78, 27.12 and 9.09 respectively in case of non-adopted respondent. Variable cost was found to be 7.86 per cent less and fixed and managerial cost was same in case of adopted over non-adopted respondents.

The working capital in case of adopted and non-adopted respondent was found to be Rs.33478.92 and Rs.36335.14 respectively which is higher by 7.86 per cent in case of adopted over non- adopted respondents. The adopted and non-adopted respondents used to invest on fertilizer (9.98% and 10.05%) followed by irrigation (9.42% and 9.37%), seed (6.99% and 8.35%) and plant protection (1.32% and 1.34%) of their total cost. Presented in (Table 4).

Table 4: Per hectare Cost of crop production of paddy in the area under study

S. No.	Particulars	Adopted	Non-Adopted	% Difference
1.	a. Family Labour	4990.2(8.91)	5560.75 (9.38)	-10.26
	b. Hired Labour	7278.46(13.00)	7985.45 (13.47)	-8.84
	Total human Labour	12268.66 (21.91)	13546.20 (22.86)	-9.43
2.	Machinery Charges	5685.46 (10.15)	5535.26 (9.34)	2.71
3.	Seed Cost	3917.6 (6.99)	4947.69 (8.35)	-20.81
4.	Manures and Fertilizers	5590.61 (9.98)	5954.81 (10.05)	-6.11
5.	Irrigation	5275.94 (9.42)	5554.59 (9.37)	-5.01
6.	Plant Protection	740.65 (1.32)	796.59 (1.34)	-7.02
7.	Total Working Capital	33478.92 (59.80)	36335.14 (61.32)	-7.86
8.	Interest on Working Capital	1339.15 (2.39)	1453.40 (2.45)	-7.86
A.	Variable Cost	34818.07 (62.19)	37788.54 (63.78)	-7.86
9.	Land Revenue	20.00 (0.03)	20.00(0.03)	0.00
10.	Imputed rent of owned land	15000.00 (26.79)	15000.00 (25.31)	0.00
11.	Interest charged on fixed assets	1051.40 (1.87)	1051.40 (1.77)	0.00
B.	Fixed Cost	16071.40 (28.70)	16071.40 (27.12)	0.00
12.	Sub- Total	50889.47 (90.90)	53859.94 (90.90)	-5.51
13.	Managerial Cost	5088.94 (9.09)	5385.99 (9.09)	-5.51
	Grand Total	55978.41(100.00)	59245.93 (100.00)	-5.51

Cost and return of paddy cultivation per hectare in the area under study

The data in Table 5 shows that the total cost of paddy production was ₹55,978.41 for adopted farmers and ₹59,245.93 for non-adopted farmers, indicating a 5.51% lower cost for the adopted group. The shares of Cost A₁ and Cost A₂ were nearly identical for both groups. Cost B₁ and B₂ accounted for 55.19% and 81.99% of the total cost for adopted farmers, compared to 56.20% and 81.52% for non-adopted farmers. All costs A₁/A₂, B₁, B₂, C₁, C₂ and C₃ were found to be less by 7.45 per cent, 7.20 per cent, 4.96 per cent, 7.61 per cent, 5.49 per cent and 5.51 per cent as compare to

non-adopted respondents. gross income was found to be 9.82 per cent more in case of adopted respondents over non-adopted respondents which was Rs. 98026.00 and Rs.89254.00 respectively. Family labour income was found to be Rs.52126.73 in case of adopted respondents and Rs.40954.81 in case of non-adopted respondents, which is higher by 27.27 per cent in case of adopted over non-adopted respondents. The net income of adopted respondents was found to be Rs.47126.53 and non-adopted respondents was Rs.35394.06. Adopted respondents has high net income by 33.14 per cent as compare to non-adopted respondents. Presented in (Table 5).

Table 5: Cost and return of paddy cultivation per hectare in the area under study

Particulars	Adopted	Non-Adopted	% Difference
COST A ₁	29844.87 (53.31)	32247.79 (54.43)	-7.45
COST A ₂	29844.87 (53.31)	32247.79 (54.43)	-7.45
COST B ₁	30899.27 (55.19)	33299.19 (56.20)	-7.20
COST B ₂	45899.27 (81.99)	48299.19 (81.52)	-4.96
COST C ₁	35899.47 (64.13)	38859.94 (65.59)	-7.61
COST C ₂	50899.47 (90.90)	53859.94 (90.90)	-5.49
COST C ₃	55978.41 (100.00)	59245.93 (100.00)	-5.51
Yield of Main Product (q/ha)	42.15	38.87	8.54
Value of Main Product (Rs/ha)	85986.00	79294.00	8.43
Value of by Product	12040.00	9960.00	20.88
Gross Income	98026.00	89254.00	9.82
Return over Variable Cost	68181.13	57006.21	19.60
Farm Business Income	68181.13	57006.21	19.60
Family Labour Income	52126.73	40954.81	27.27
Net Income	47126.53	35394.06	33.14
Income Over A ₂ +FL	34835.07	37808.54	-7.86
Return to Management	42047.59	30008.07	40.12
Return per Rupee	1.92	1.65	16.36

Per hectare Cost of crop production of Wheat In the area under study

For wheat cultivation, the average total cost for adopted farmers was ₹55,258.66 per hectare, compared to ₹57,944.16 per hectare for non-adopted farmers-reflecting a 4.63% lower cost for the adopted group. Of the total cost, adopted farmers spent 61.82% on variable costs, 29.08% on fixed costs, and 9.09% on managerial costs, while the corresponding

proportions for non-adopted farmers were 63.17%, 27.73%, and 9.09%. Variable costs were 6.66% lower for adopted farmers, whereas fixed and managerial costs remained the same for both groups. The working capital in case of adopted and non-adopted respondent was found to be Rs.32849.76 and Rs.35197.23 respectively which is higher by 6.66 per cent in case of adopted over non- adopted respondents. The adopted and non-adopted respondents used to invest on seed

(9.38% and 10.60%) followed by fertilizer (8.66% and 1.07% and 1.47%) of their total cost. Presented in (Table 6). 9.70%), irrigation (6.47% and 7.62%) and plant protection

Table 6: Per hectare Cost of crop production of Wheat in the area under study

S. No.	Particulars	Adopted	Non-Adopted	% Difference
1.	a. Family Labour	5383.29 (9.74)	5884.57 (10.15)	-8.51
	b. Hired Labour	8596.7 (15.55)	7756.26 (13.38)	10.83
	Total Human Labour	13979.99 (25.29)	13640.83 (23.54)	2.48
2.	Machinery Charges	4715.48 (8.53)	4515.59 (7.79)	-4.42
3.	Seed Cost	5186.36 (9.38)	6146.52 (10.60)	-15.62
4.	Manures and Fertilizers	4790.78 (8.66)	5620.8 (9.70)	-14.76
5.	Irrigation	3580.66 (6.47)	4420.00 (7.62)	-18.98
6.	Plant Protection	596.49 (1.07)	853.49 (1.47)	-30.11
7.	Total Working Capital	32849.76 (59.44)	35197.23 (60.74)	-6.66
8.	Interest on Working Capital	1313.99 (2.37)	1407.88 (2.42)	-6.66
A.	Variable Cost	34163.75 (61.82)	36605.11 (63.17)	-6.66
9.	Land Revenue	20.00 (0.03)	20.00 (0.03)	00.00
10.	Imputed rent of owned land	15000.00 (27.14)	15000.00 (25.88)	00.00
11.	Interest charged on fixed assets	1051.4 (1.90)	1051.4 (1.81)	00.00
B.	Fixed Cost	16071.4 (29.08)	16071.4 (27.73)	00.00
12.	Sub- total	50235.15 (90.90)	52676.51 (90.90)	-4.63
13.	Managerial Cost	5023.51 (9.09)	5267.65 (9.09)	-4.63
	Grand Total	55258.66 (100.00)	57944.16(100.00)	-4.63

Cost and return of wheat cultivation per hectare in the area under study

The data in Table 7 shows that the total cost of wheat cultivation was ₹55,258.66 for adopted farmers and ₹57,944.16 for non-adopted farmers, indicating a 4.63% lower cost for the adopted group. The shares of Cost A₁ and Cost A₂ were similar across both groups. Cost B₁ and B₂ accounted for 54.02% and 81.16% of the total cost for adopted farmers, compared to 56.86% and 80.75% for non-adopted farmers. All cost components—A₁/A₂, B₁, B₂, C₁, C₂, and C₃—were lower among adopted farmers by 6.31%,

6.10%, 4.14%, 6.47%, 4.63%, and 4.63%, respectively.

Regarding returns, the average wheat yield for adopted farmers was 42.65 q/ha, whereas non-adopted farmers achieved 37.29 q/ha. With a market price of ₹2,015 per quintal, the yield advantage for adopted farmers amounted to 14.37% over non-adopted farmers.

Gross income was found to be 14.79 per cent more in case of adopted respondents over non-adopted respondents which was Rs. 100196.62 and Rs.87285.92 respectively Presented in (Table 7).

Table 7: Cost and return of wheat cultivation per hectare in the area under study

Particulars	Adopted	Non-Adopted	% Difference
COST A ₁	28800.46 (52.11)	30740.54 (53.05)	-6.31
COST A ₂	28800.46 (52.11)	30740.54 (53.05)	-6.31
COST B ₁	29851.86 (54.02)	31791.94 (54.86)	-6.10
COST B ₂	44851.86 (81.16)	46791.94 (80.75)	-4.14
COST C ₁	35235.15 (63.76)	37676.57 (63.29)	-6.47
COST C ₂	50235.15 (90.90)	52676.51 (90.90)	-4.63
COST C ₃	55258.66(100.00)	57944.16 (100.00)	-4.63
Yield of Main Product (q/ha)	42.65	37.29	14.37
Value of Main Product (Rs/ha)	85939.75	75139.35	14.37
Value of By Product	14256.87	12146.57	17.37
Gross Income	100196.62	87285.92	14.79
Return over Variable Cost	71396.16	56545.38	26.26
Farm Business Income	71396.16	56545.38	26.26
Family Labour Income	55344.76	40493.98	36.67
Net Income	49961.47	34609.41	44.35
Income Over A ₂ +FL	34183.75	36625.11	-6.66
Return to Management	44937.96	29341.76	53.15
Return per Rupee	1.99	1.65	20.60

Conclusion

The study revealed clear differences between farmers who adopted KVK recommendations and those who did not. Adopted farmers generally held slightly larger land areas and followed a similar cropping pattern as non-adopted farmers, with paddy dominating during the kharif season and wheat in

the rabi season. However, adopted farmers achieved a noticeably higher cropping intensity, indicating better land use efficiency. They were also younger on average and lived in comparatively smaller families. Their educational levels were higher, with fewer illiterate individuals and more farmers educated up to higher secondary and graduation

levels.

Non-farm income patterns were similar across both groups, though a small share of adopted farmers earned higher incomes beyond the mid-range category. In crop production, adopted farmers managed to reduce overall cultivation costs mainly through lower variable expenses while maintaining similar fixed costs. They obtained higher yields, earned more net income, and secured better returns on investment for both paddy and wheat. Overall, the findings indicate that adoption of KVK interventions contributed to improved efficiency, profitability, and socio-economic conditions for farmers.

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Author contributions

Devansh managed topic selection, methodology, experiments, and manuscript preparation. Shubham Singh reviewed and edited with critical input. Shivangi contributed to reading and editing, and Vikas Chandra Gautam assisted with review and feedback.

Data availability: All data analyzed during this study are included in this original article.

Competing Interests: The authors declare no competing interests

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