Adoption of Paramparagat Krishi Vikas Yojana by Farmers in Bikaner District of Rajasthan, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

India's diverse heritage and rich culture are well-known throughout the world. When time passed and the population suddenly increased, farmers were obliged to utilise various agro-chemicals to feed the large population, even though they had previously grown a variety of crops without the use of these pesticides. In Bikaner district of Rajasthan state, coarse cereals are mostly grown without

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using any chemicals because Bikaner is a water scarce area and prone to crop failure hence farmer generally does not spend so much money on chemicals like fertilizers, insecticide-pesticides, herbicides etc. Looking to the virginity of land, the Rajasthan government has launched the Paramparagat Krishi Vikas Yojana (PKVY) in this district. As a result, the greatest numbers of clusters under PKVY were developed during 2015-18. Thus, the study was carried out in the purposely chosen Bikaner District of Rajasthan state in order to gauge the respondents' level of adoption of PKVY. There are eight tehsils in the Bikaner district; three tehsils, Nokha, Sridungarhgarh, and Bikaner, were specifically chosen for the current study due to the maximum number of clusters formed under PKVY. A total of 180 respondents, out of which 90 beneficiary who were registered in PKVY selected by using proportionate random sampling method and to constitute the other half of sample size same number of farmers i.e. 90 were also selected randomly from the same villages who have not registered in PKVY and they were called as non-beneficiary respondents included in the current investigation. The results of the study concluded that majority of the respondents had medium level of extent of adoption of PKVY in the study area. They had highest extent of adoption on the aspect of "nutrient management" and least extent of adoption of "technical knowledge". There was significant association found between education, mass media exposure, information seeking behaviour, information sharing behaviour and knowledge of respondents about PKVY.

1. INTRODUCTION

Particularly since the Green Revolution of the 1960s, Indian agriculture has become more and more reliant on chemical inputs like synthetic fertilisers, insecticides, and herbicides. Originally intended to increase agricultural yields and ensure food security, this shift towards chemical-intensive farming helped India become self-sufficient in staple crops like wheat and rice. Although the use of these pesticides has greatly enhanced agricultural output, there are worries about soil degradation, biodiversity loss and water body contamination due to their long-term usage. Farmers and consumers are now at danger for health problems as a result of exposure to harmful substances brought on by an over-reliance on chemicals. After comprehending this essential topic organic farming is gaining pace recognizing the challenges associated with chemical agriculture, growing expenses of production and its influence on environment and health. The use of organic farming practices to increase farming's ecological and financial sustainability is now widely acknowledged.

More than 91 per cent of producers, according to the FiBL 2023, were located in Asia, Africa, and Europe. India (15,99,010) was the nation that produced the most amount of organic food, followed by Uganda (4,04,246) and Ethiopia (2,18,175). The nations where organic agricultural land covers the greatest area as of 2021. Australia (35.7 million hectares), Argentina

(4.1 million hectares), and France (2.8 million hectares) have the largest amounts of organic agricultural land. With 2.66 million hectares of total organic agricultural land, India took sixth place. The majority of the almost 1.8 million producers were found in India. China (2.75 million hectares) and India (more than 2.66 million hectares) were the two largest Asian countries by area. In 2021, there were about 3.7 million organic farmers globally.

Over the past ten years, there has been a notable growth in the area used for certified organic farming. Over a ten-year period, the area under certified organic farming increased by about 1.5 times, to 55,50,405 ha in 2011–12. Nonetheless, over the course of the study, there have been variations in the area used for organic farming. Currently, 9,11,9,866 hectares of land are certified organically farmed, and India is among the top 10 nations in the world for the total area under organic farming (APEDA, 2022). Thus, in order to encourage organic farming, the government launched a nationwide programme in 2015 that was centrally financed. The Paramparagat Krishi Vikas Yojana (PKVY) is a programme within the Soil Health Management Scheme (SHM) of the National Mission of Sustainable Agriculture (NMSA). Its primary objective is to support and encourage organic farming, which would ultimately lead to an improvement in soil health. In light of the current situation, the present study was conducted with the objective to assess the extent of adoption of PKVY by farmers.

2. METHODOLOGY

The current investigation was carried out in the Bikaner district of Rajasthan state, which was specifically chosen due to the highest number of clusters created under PKVY. Three tehsils namely Nokha, Sridungarhgarh, and Bikaner were chosen based on having the greatest number of farmers registered under PKVY. A detailed village-by-village list of farmers registered in the PKVY was obtained from the Panchayat Samiti, Bikaner, Rajasthan, in order to choose respondents for the current study. The respondents who had registered with PKVY were chosen using the proportionate random sampling method, and they were referred to as PKVY beneficiary farmers. The equal number of farmers who had not enrolled with PKVY was also chosen at random from the same villages to make up the other half of the sample size; these farmers were referred to as non-beneficiary farmers. Thus, 90 beneficiaries and 90 non-beneficiaries, or a total of 180 respondents, were included in the present investigation. An interview schedule was created in order to gather the information. 25 non-sampled respondents who were not part of the study were used to pre-test the interview schedule. The method used to acquire the data was the personal interview. Frequency, percentage, arithmetic mean, standard deviation, mean percent score, "t" test, "z" test, and spearman's rank correlation (r_s) were used to analyse the data.

3. RESULTS AND DISCUSSION

"Adoption is an individual matter or phenomenon or behavioral socio-economical phenomenon or mental process. It is a decision to make full use of an innovation or technology" (Rogers, 2003). Our agricultural experts are creating a lot of new things in the current day, but not everyone in the social system is adopting these inventions. Adoption of an innovation is contingent upon numerous aspects, including adopters' awareness and knowledge, innovativeness traits, and the innovation's perceived qualities. People typically assume that if someone is more knowledgeable about several facets of technology. He or she is probably going to adopt the improvements more quickly. The results regarding the extent of adoption of PKVY had been presented in Table 1. The respondents were categorized on the basis of mean (39.00) and standard deviation (22.54). Data presented in the Table 1 clearly depicts that among the beneficiary respondents, majority of them (67.78%) had medium level of adoption, followed by high (27.78%) and low (04.44%), respectively. Further, in case of non-beneficiary farmers, more than fifty per cent (51.11%) were low adopters, followed by medium adopters (45.56%). While, only 03.33 per cent of the non-beneficiary respondents were high adopters of PKVY. If we look at the data presented in the Table 1 as a whole irrespective of type of farmers *i.e.* beneficiary and non-beneficiary farmers, the data reveals that more than fifty-five per cent of the respondents (56.67%) were medium adopters of PKVY, followed by low (27.78%) and high (15.55%) adopters, respectively. The findings are in conformity with the findings of Motiwale (2018), Singh & Sharma (2019), Malviya et al. (2020) and Singh (2020) who revealed that majority of organic farmers had medium level of adoption of organic farming.

Further, the extent of adoption of various aspects of PKVY was also analyzed separately. The relative importance of extent of adoption for all the aspects of PKVY was illuminated by giving ranking to them in descending order on the basis of their Mean Percent Score and ranks have been presented in Table 2. The data in Table 2 shows that overall extent of adoption of PKVY by beneficiary respondents was good with 63.42 MPS. Thus, it can be concluded that in the investigation area beneficiary farmers were very conscious about various aspects of PKVY such as area under PKVY, advantages of PKVY, nutrient management, funding pattern, general information, cluster approach on PKVY and marketing knowledge with 100.00, 93.58, 91.34, 89.38, 60.18, 37.50 and 27.92 MPS, respectively. They had low level of extent of adoption in case of technical knowledge with 07.44 MPS.

In case of non-beneficiary respondents, they had high adoption level in various aspects like nutrient management, area under PKVY, advantages of PKVY and general information with 44.37, 25.55, 19.50 and 18.11 MPS, respectively. They had low adoption level about marketing knowledge, funding pattern, cluster approach of PKVY, and technical knowledge with 16.25, 06.41, 05.13, and 02.22 MPS, respectively. If we look at the data presented in the Table 2 irrespective of beneficiary and non-beneficiary farmers, then it is observed that overall respondents had good adoption level regarding nutrient management, area under PKVY and advantages of PKVY with 67.85,

62.78 and 56.54 MPS, respectively. They had low levels of adoption of aspects of funding pattern, general information, marketing knowledge, cluster approach of PKVY and technical knowledge with 47.89, 39.14, 22.08, 21.32 and 04.83 MPS, respectively. Thus, it can be concluded that farmers were least bothered about these aspects of PKVY. The overall extent of adoption of the beneficiary farmers (63.42 MPS) was higher than the non-beneficiary farmers (17.19 MPS). The value of calculated rank correlation (r_s) was 0.81 which was positive and significant at one per cent level of significance, leading to conclusion that there was a similarity in rank assignment pattern of adoption of beneficiary and non-beneficiary farmers about PKVY, however there was a difference in the magnitude of MPS of beneficiary and non-beneficiary farmers. The findings are in conformity with the findings of Malviya et al. (2020) who concluded that majority of the respondents had medium level of adoption of bio-fertilizers in organic farming practices. Ingale (2020) also revealed that cent per cent of the respondents were aware about the advantages of organic farming.

Table 3 elucidates that among the eight important adoption aspects of PKVY, a highly significant difference found in the extent of adoption of beneficiary and non-beneficiary farmers in area under PKVY, general information, technical knowledge, cluster approach of PKVY, funding pattern, nutrient management, marketing knowledge and advantages of PKVY as their overall calculated 'Z' value was higher than the tabulated 'Z' value at one per cent level of significance leading to the conclusion that there was a noteworthy difference found in the extent of adoption of PKVY between beneficiary and non-beneficiary respondents.

Table 1. Distribution of respondents according to extent of adoption of PKVY

S. No.	Categories	Respondents					
		Beneficiary Respondents (n=90)		Non- beneficiary Respondents (n=90)		Overall Respondents (N=180)	
		F	%	F	%	F	%
1.	Low (<16.46 Score)	04	04.44	46	51.11	50	27.78
2.	Medium (16.46 to 61.54 Score)	61	67.78	41	45.56	102	56.67
3.	High (>61.54 Score)	25	27.78	03	03.33	28	15.55

Mean: 39.00   S.D.: 22.54

Table 2. Aspect-wise extent of PKVY by the respondents

S. No.	Adoption aspects	Respondents					
		Beneficiary respondents (n=90)		Non-beneficiary respondents (n=90)		Overall respondents (N =180)	
		MPS	Rank	MPS	Rank	MPS	Rank
1.	Area	100.0	I	25.55	II	62.78	II
2.	General Information	60.18	V	18.11	IV	39.15	V
3.	Technical Knowledge	07.44	VIII	02.22	VIII	04.83	VIII
4.	Knowledge on Cluster Approach of PKVY	37.50	VI	05.13	VII	21.32	VII
5.	Funding Pattern	89.38	IV	06.41	VI	47.89	IV
6.	Knowledge about Nutrient Management	91.34	III	44.37	I	67.85	I
7.	Marketing Knowledge	27.92	VII	16.25	V	22.08	VI
8.	Advantages	93.58	II	19.50	III	56.54	III
	Pooled	63.42		17.19		40.31	

r_s= rank correlation r_s = 0.81
MPS = Mean Percent Score   t = 3.36[**]
** Significant at 0.01 level of probability

Table 3. Aspect-wise comparison of extent of adoption of PKVY by the respondents

S. No.	Adoption aspects	Beneficiary respondents (n=90)		Non-beneficiary respondents (n=90)		'Z' Value
		Mean	SD	Mean	SD	
1.	Area	1	∞	00.25	00.43	∞
2.	General Information	22.26	03.44	06.70	03.70	35.51**
3.	Technical Knowledge	00.96	00.18	00.28	00.45	17.00**
4.	Knowledge on Cluster Approach of PKVY	03.00	00.63	00.41	00.66	28.78 **
5.	Funding Pattern	08.04	01.57	00.57	01.64	31.38**
6.	Knowledge about Nutrient Management	13.70	01.88	06.65	01.81	26.11**
7.	Marketing Knowledge	02.23	00.63	01.96	00.31	03.86**
8.	Advantages of PKVY	08.42	01.07	01.75	02.18	08.34**
	Pooled	07.45	01.17	02.32	01.39	18.87**

**Significant at 0.01 level of probability
SD=Standard deviation

Thus, it is evidently proved that the adoption of PKVY was more among beneficiary farmers as compared to the non-beneficiary farmers as the significant difference found between the beneficiary and non-beneficiary farmers regarding various adoption aspects of PKVY in the study area. It might due to the reason that the beneficiary respondents remained in the continuous touch with the extension personnel's throughout the session of the training so they might have acquired sufficient skill pertaining to PKVY. Thus, they were more likely to practice the learnt skill in their own fields. The findings are in line with the findings of Jangid et al. (2016) who depicted that there had been a significant difference between the organic and conventional farmers regarding their extent of adoption of the six aspects of organic farming *viz.* NADEP compost, vermicompost, Ha NPV, trichocards, organic weed management and bio-fertilizers. Hammad et al. (2020) also revealed that "the addition of the organic manures significantly increased soil NPK and organic matter content as compared to the unfertilized control and inorganic fertilizers" and Kumar & Keerthana (2020) inferred that "organic cultivation was found to be economically viable because organic farmers were getting more price of their produce than the inorganic produce".

Association between extent of Adoption of Beneficiary and Non-beneficiary Respondents of PKVY with Selected Independent Variables: To find out the association between selected personal characteristics (independent variables) of PKVY respondents with the dependent variable *viz.*

extent of adoption of PKVY, correlation analysis and multiple linear regression analysis was done. The correlation coefficient, whose limit ranges from minus to plus units, is used to quantify the strength of the relationship between two attributes. A positive relationship is one in which an increase in one variable causes an increment in another, and a negative relationship is one in which an increase in one variable results in a decrease in another. Two variables are not correlated if increases or decreases in one variable have no effect on the other. The partial regression coefficient (b) gives information about how well dependent variables are predicted from independent variables. By using the multiple linear regression analysis, the prediction of dependent variable *i.e.* adoption from independent variables (selected characteristics) has been studied. The unit increase in the dependent variable can impart the same change in the independent one also. Paradigm showing the association between socio-personal, socio-economic and communication pattern characteristics with extent of adoption of PKVY by respondents.

Correlation Analysis between Independent Variables with extent of Adoption of PKVY by the Respondents: The r-values in Table 4 indicated that the education (0.500**) and knowledge (0.457**) of beneficiary respondents were positively related with extent of adoption of respondents of PKVY and the association was found significant at one per cent level of significance. Information seeking behaviour (0.290*) and information sharing behaviour (0.226*) were found positive and significantly

related with adoption of PKVY at five per cent level of significance. The r-values of age, social participation and major occupation showed negative and non-significant relation with adoption of PKVY by respondents. Caste, annual income, land holding, source of irrigation, mass media exposure and extension agency contact of beneficiary respondents showed non-significant relation with adoption of PKVY by respondents.

Similarly, education (0.494**) and knowledge (0.328**) of non-beneficiary respondents were also found positively related with extent of adoption of PKVY at one per cent level of significance. Information seeking behaviour (0.215*) and information sharing behaviour (0.218*) of non-beneficiary respondents were found positive and significantly related with extent of adoption of PKVY at five per cent level of significance. The r-values of caste, land holding and extension agency contact of non-beneficiary respondents showed negative and non-significant relation with the extent of adoption of PKVY. Age, social participation, major occupation, annual income, source of irrigation, mass media exposure and extension

agency contact of non-beneficiary respondents also showed non-significant relation with adoption of PKVY by the respondents. Further analysis of Table 4 to know the relationship variables with adoption of respondents about PKVY indicated that education (0.548**), information seeking behaviour (0.295**), information sharing behaviour (0.246**) and knowledge (0.506**) of overall respondents were also found positively related with adoption of PKVY and the association was found significant at one per cent level of significance. The findings are in conformity with findings of Motiwale (2018), Singh & Sharma (2019) and Singh et al. (2020) who reported that "age, social participation and occupation were found negative and non-significant relationship with adoption of organic farming practices and education of the respondents was found highly significant with the extent of adoption of organic farming practices". The findings are contradictory with the findings of Singh & Sharma (2019) who concluded that "mass media exposure and extension contact had highly significant relation with the extent of adoption of organic farming technologies by the respondents".

Table 4. Correlation analysis between independent variables with adoption of PKVY by the respondents

S. No.	Variables	Correlation coefficient		
		Beneficiary respondents (n=90)	Non-beneficiary respondents (n=90)	Pooled (N=180)
A.	**Socio-personal Variables**			
1.	Age	-0.092[NS]	0.026[NS]	-0.024[NS]
2.	Caste	0.181[NS]	-0.102[NS]	-0.065[NS]
3.	Education	0.500**	0.494**	0.548**
4.	Social Participation	-0.057[NS]	0.181[NS]	0.127[NS]
B.	**Socio-economic Variables**			
5.	Occupation	-0.024[NS]	0.132[NS]	0.028[NS]
6.	Annual Income	0.169[NS]	0.022[NS]	0.075[NS]
7.	Land Holdings	0.116[NS]	-0.11[NS]	0.081[NS]
8.	Source of Irrigation	0.161[NS]	0.149[NS]	0.156[NS]
C.	**Communication Pattern**			
9.	Mass Media Exposure	0.113[NS]	0.202[NS]	0.193[NS]
10.	Extension Agency Contact	0.193[NS]	-0.030[NS]	0.097[NS]
11.	Information Seeking Behaviour	0.290*	0.215*	0.295**
12.	Information Sharing Behaviour	0.226*	0.218*	0.246**
13.	Knowledge	0.457**	0.328**	0.506**

*** Significant at 0.01 level of probability*
**Significant at 0.05 level of probability*
NS= Non-Significant

Table 5. Regression analysis between socio-personal, socio-economic and communication pattern characteristics with extent of adoption of PKVY by the respondents

S. No.	Variables	Beneficiary Respondents (n=90)			Non-beneficiary Respondents (n =90)			Pooled (N =180)		
		b value	Standard error	t value	b value	Standard error	t value	b value	Standard error	t value
A.	**Socio-personal Variables**									
1.	Age	-0.006	0.074	-0.082^{NS}	-0.015	0.087	-0.168^{NS}	-0.011	0.059	-0.191^{NS}
2.	Caste	0.167	0.199	1.592^{NS}	-0.102	0.195	-0.959^{NS}	-0.036	0.168	0.478^{NS}
3.	Education	0.110	0.050	3.191**	0.294	0.053	2.889**	0.227	0.041	3.117**
4.	Social Participation	-0.149	0.140	-1.069^{NS}	0.247	0.340	0.726^{NS}	-0.002	0.136	0.015^{NS}
B.	**Socio-economic Variables**									
5.	Occupation	0.069	0.124	0.557^{NS}	0.190	0.124	1.537^{NS}	0.074	0.089	0.832^{NS}
6.	Annual Income	0.152	0.123	1.234^{NS}	0.095	0.121	0.787^{NS}	0.123	0.083	0.487^{NS}
7.	Land Holding	-0.017	0.093	-0.184^{NS}	-0.033	0.090	-0.368^{NS}	-0.023	0.067	-0.341^{NS}
8.	Source of Irrigation	0.142	0.177	1.342^{NS}	0.149	0.169	1.409^{NS}	0.144	0.142	1.940^{NS}
C.	**Communication Pattern**									
9.	Mass Media Exposure	-0.096	0.109	-0.900^{NS}	0.202	0.104	1.936^{NS}	0.127	.078	1.712^{NS}
10.	Extension Agency Contact	0.041	0.094	0.437^{NS}	0.089	0.124	0.720^{NS}	0.096	0.080	1.296^{NS}
11.	Information Seeking Behaviour	0.290	0.096	2.841**	0.286	0.083	2.796**	0.153	0.058	2.628**
12.	Information Sharing Behaviour	0.226	0.099	2.450*	0.245	0.104	2.369*	0.186	0.068	2.526*
	R^2 = 0.65				R^2 =0.68			R^2 = 0.70		

R^2= Coefficient of multiple determinations
NS = Non significant
** = Significant at 0.01 level of probability
*= Significant at 0.05 level of probability

Regression Analysis between Socio-personal, Socio-economic and Communication Pattern Characteristics with Adoption of PKVY by the Respondents: The data presented in Table 5 depicts the regression relationship of dependent variable *i.e.* adoption on twelve antecedent variables concerning to the respondents. In case of beneficiary respondents, the magnitude of coefficient of determination (R^2) was found as 0.65. The value of (R^2) shows that 65 per cent variations in the dependent variable *i.e.* extent of adoption was because of twelve antecedent variables taken for the present investigation, remaining thirty five per cent variations in the adoption was because of the other elements outside the periphery of the investigation. Hence, the dependency relationship of adoption on each selected characteristics was studied with the help of 't' value. The data presented in Table 5 in case of beneficiary respondents reveals that education (3.191**) and information seeking behaviour (2.841**) were significantly associated with the adoption at one per cent level of significance whereas, information sharing behaviour (2.176*) was significantly associated with the adoption at five per cent level of significance. Other factors like age, caste, social participation, major occupation, annual income, land holding, source of irrigation, mass media exposure and extension agency contact have not shown any significant involvement to the multiple regression analysis. Further, for non-beneficiary farmers the value of coefficient of determination (R^2) was calculated as 0.68 which means sixty eight per cent variations in the dependent variable *i.e.* adoption was because of the twelve independent variables taken for the present investigation, remaining thirty two per cent variations in the extent of adoption was because of the other factors outside the periphery of the investigation. The data in Table 5 indicates that there was significant relationship found between the education (2.889**) and information seeking behaviour (2.841**) of non-beneficiary respondents with adoption at one per cent level of significance. While, information sharing behaviour (2.450*) was significantly associated with the adoption at five per cent level of significance. The other characteristics such as age, caste, social participation, major occupation, annual income, land holding, source of irrigation, mass media exposure and extension agency contact were non-significantly associated with adoption of non-beneficiary respondents which elucidates that there was no association found with adoption of the non-

beneficiary respondents with these selected variables. A critical examination of Table 5 for overall respondents shows the magnitude of coefficient of determination (R^2) as 0.70. The value of (R^2) shows that seventy per cent variations in the dependent variable due to the twelve antecedent variables chosen for the present study. Table 5 thus depicts that in case of adoption of overall respondents, it had positive and significant association with education (3.117**) and information seeking behaviour (2.628**) at one per cent level of significance. While, information sharing behaviour (2.526*) had positive and significant association at five per cent level of significance. The factors like age, caste, social participation, major occupation, annual income, land holding, source of irrigation, mass media exposure and extension agency contact have not shown any significant involvement to the multiple regression analysis and were non-significantly associated with adoption of overall respondents. The findings are in line with the findings of Singh & Sharma (2019) and Bhattacharjee et al. (2020) who reported that age, caste, occupation, annual income and mass media exposure had non-significant association with adoption of organic farming practices. Whereas, education was found highly significant and had positive relationship with adoption of organic farming practices.

4. CONCLUSION

On the basis of major findings of the study, it is concluded that the extent of adoption of PKVY among majority of the farmers was medium and they had the highest extent of adoption on the aspect of "nutrient management" and least extent of adoption on "technical knowledge". There was significant association found between education, information seeking behaviour, information sharing behaviour and knowledge of respondents about PKVY. The characteristics such as age, caste, social participation, major occupation, annual income, land holding, source of irrigation, mass media exposure and extension agency contact have not shown any significant contribution in the multiple regression analysis and were non-significantly associated with the adoption of overall respondents. Since majority of the farmers in the study area had medium level of extent of adoption of PKVY, so for converting it to high level of extent of adoption of farmers', incentives and credit facilities may be provided to the farmers for initial 2-3 years for the sake of loss farmers bears while converting from

conventional farming to organic farming. Provision of free insurance may also be made essential under PKVY for organic crops at the time of registration to attract more number of framers towards organic farming. It was observed by the investigator while conducting interview with the non-beneficiary farmers that farmers were not adopting PKVY because of high incidences of insect-pest at their farm due to no chemical is used. For this, government should provide organic insecticide, fungicide etc. to the registered farmers under PKVY free of cost. To sustain the farmers with organic farming under PKVY, regular monitoring of organic farms should also be done by the government officials at regular intervals to ensure that farmers are following the guidelines of PKVY in the field.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing and editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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