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POTENTIAL OF COMMUNITY BASED ORGANIZATIONS IN IRRIGATION CHANNELS TO ENHANCE CROP PRODUCTION

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ABSTRACT

This research study was carried out to identify the role of community-based organizations in irrigation channels to enhance crop yield in rural areas of district Mansehra Khyber Pakhtunkhwa Pakistan. Data were collected from 200 respondents selected randomly and analyzed through SPSS. Findings concluded that more than half (53%) of the sampled respondents perceived that CBOs played an important role in development of irrigation channels and in result the crop yield was increased in the study area. Regarding performance of CBOs, OFWM contributed more in the improvement of water courses. CBOs work was appreciated by the respondents as it positively affected the farming activities in the study area and made the irrigation system more convenient. The CBOs had some of the shortcoming such as absence of regular activities, meeting and rewards for members. There was personal biasness in the selection criteria of the membership. It was recommended that there should be regular organizational activities, duties and some kind of rewards for the member to keep their attention in the CBOs activities. The maintenance charges should be on the basis of financial status of the farmers. The need is to improve the remaining water courses for the boosting of agriculture in the study area.

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INTRODUCTION

Agricultural sector plays a vital role in the economic development of Pakistan. Its contribution to the GDP is 19.3 percent and it engages 45 percent of the labor force (Government of Pakistan, 2020). Approximately, 63 percent of the population inhabits in rural areas and they are dependent on agriculture either directly or indirectly for living. Pakistan has been facing various challenges and scarcities of agricultural inputs. However, without major investment in this sector, it would be unclear to state how the state would succeed to overcome the raising food necessities with low quantity of production. To deal with this problem of low yield, Pakistan

government requires to introduce and implement modern agricultural technology, as the installation of tube wells, fertilizers, construction of new irrigation channels and improved seeds required a good quantity of investment on the part of farmers.

The agricultural sector cannot be overemphasized, but yet, government has been trying to develop the agricultural sector in order to increase the production in terms of food and fiber to feed the population. The agricultural inputs should properly be utilized to get maximum output. As a result, there will be increase in the demand of labor in the market (Singh *et al.*, 2010). Pakistan contains one of the biggest irrigation systems in

the world to support agriculture. On the contrary, the big land lords own about 50 percent of the total arable land, which halts the agricultural reforms. Obviously, the government has to import agricultural commodities of 4 billion USD. The agriculture sector showed increase of 3.4 percent as an average of sub sectors such as Livestock 3.8%, fishing 0.8% and Forestry 0.2%. Other crops in agriculture subsector which included important crops grew by the ratio of 2.4% and 6.8%, cotton ginning of 2.4% in fiscal year 2013-14 against growth of 7.5% in 2012-13 (Rehman, 2016).

Irrigation System in Pakistan

Pakistan has important value in Asia because of its ecological and geological aspects. This land has the capability to produce various crops. It also contains arid and semi-arid areas, which need water irrigation system for agricultural purposes. In 2010, for example, 72 percent of the agricultural area was irrigated (Shideed, 2011). Pakistan's irrigation system is one of the world's biggest irrigation systems, consisting of three main basins from which water is distributed through different channels. In 2007-08, due to damages in these channels, Pakistan faced decline in the production of wheat and rice by 10 and 19 percent respectively (FAO, 2000). Agricultural sector further consists of sub sectors such as Crop production, Crop protection, Mechanization etc. Each sector has its own importance but on the other hand, irrigation is also of key importance. Pakistan agricultural productions have been declined for decades, up to noticeable extent due to damages in irrigation channels. There had been unfair distribution of water due to which high water losses occurred. Even though, some projects and policies were also launched but unluckily, they failed to achieve the targets. Irrigation does not have direct impact to the economy but it does create negative impact to the economy (Hussain, 2007). The current irrigation system is said to be insufficient either in terms of range or the lack of technology. Irrigation is the only way to improve agriculture along with the other agricultural inputs. It stabilizes water and salt contents in the soil and produce economically acceptable crops (Kljajić *et al.*, 2016). In addition, the local community-based organizations also have been trying to contribute with the government to fulfill this need of the community.

Community-Based Organizations, CBOs

Community-Based Organizations are non-profit agencies formed by the communities that work as central section of the community and stay busy in fulfilling the needs of

the community. They are unpaid helper, board of directors who govern the CBOs. Some of them receive funding by donations, fees, grants and fundraising but yet, the government performs as their backup supporter. CBOs need to stay open and connected with other groups to facilitate the task and decrease the operation costs. This simply means that CBOs initiate at gross root stage and linked with national level through district and regional heads (Hussain *et al.*, 2008). CBOs are usually unspecified to form communal people. Besides, a sub group has the responsibility to decide for using the funds (Clements, 1995). CBOs play a vital role in the development of the community by performing the required activities in order to improve the living standard of the community. They peacefully and effectively resolve the conflicts concerned with farming community members. On the other hand, CBOs failed to solve some problems other than farming, due to lack of cooperation from the community members. This includes the development of agriculture by improving the watercourses in the study area, which significantly decreased water loss and increased the yield. In the study area, large number of watercourses were improved by OFWM (On Farm Water Management, SRSP (Sarhad Rural Support Program) and other NGOs on the demand of the local inhabitants. Various CBOs such as SUNGI, SRSP, Humkadam and Save the Children are working for the improvement and maintenance of irrigation channels (Adisa, 2013).

History of Community Based Organizations (CBOs) in Pakistan

In Pakistan, the community-based organization is very old. It consists of elders' gathering called "Jirga or Punchayat". They work for decision making and running organized public campaigns (Khan and Anjum, 2016). These organizations in Pakistan, have been working for the social and economic development of the state. They show their contribution in the field of disaster, crisis and other aspects of social development. They give out as a vigorous partner of the Government and International agencies. They also contribute in health sector and education sector. These organizations also work for the understanding of population and provide their legal rights. These organizations are either small sized or medium and they work for social welfare. According to Asian Development Bank, there are less than 90 successful NGOs in Pakistan, while there are, somehow,

more than 900 weak CBOs. These organizations consider the government as their supporter and mentor. After all, they need development in their linkages, reporting of their work and proper distribution method (Shah and Ilhaq, 2008).

Justification of the study

Community Based Organizations have played an important role in irrigation channels to enhance crop yield in district Mansehra. Keeping in view the functions of various Community Based Organizations working to improve the irrigation channels to identify and explain the problems of farmers, peasants, tenants and other connected people with agriculture. Keeping in view the below objectives the present study will give a support for more research on a number of features connected to Agriculture based CBOs. The most specific objectives of the study are to identify and examine the functions of various CBOs working in developing the irrigation channels in the study area. 2) To study the effect of irrigation channels by comparing crop yield and income of beneficiaries and non-beneficiaries in study area. 3) To suggest recommendations on the basis of study findings for further improvement in crop yield and income of farmer in study area.

MATERIAL AND METHODS

This section deals with the collection and sampling of the study area, data collection and analysis of data. The details of the materials used to achieve the final conclusion are explained as under. District Mansehra was the universe of study. According to the district records, there are about 130 CBOs working in the district. However, for this study two villages i.e. Chattar and Battal were purposively selected for the data collection as they have improved irrigation channels and four well establish CBOs are working in this study area. These include i.e. HUMKADAM, SUNGI, SRSP and Save the Children. Normally a large sample size gives better results but due shortage of time, economic and human resources constraint, the size of sample remains moderate for the study. A total sample size of 200 respondents were selected from Chattar and Battal out of this sample respondents 120 beneficiaries' respondents and 80 non-beneficiaries were selected through proportional allocation sampling technique from the selected villages in order to compare crop yield and income of beneficiaries and non-beneficiaries.

Keeping objectives of the study primary data were collected directly from the sample respondents through face-to-face interviews and for this purpose a pre-tested interview schedule was used for data collection and for data analysis SPSS and MS Excel were used. Descriptive statistics were used for data analysis to describe socio-economic characteristics of the respondents and independent sample t-test were used to compare crop yield and income of the beneficiaries and non-beneficiaries sample respondents. Statistical independent sample t-test (Chaudhary and Kamal, 2012) was used as under.

$$\frac{\bar{x}_1 - \bar{x}_2}{S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where \bar{X}_1 = mean value of beneficiary farmer
 \bar{X}_2 = mean value of non- beneficiary farmer
 n_1 = sample size of beneficiary farmer
 n_2 = sample size of non-beneficiary farmer
 S_p = pooled variance

$$S_p = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}}$$

RESULTS AND DISCUSSION

Age of the Respondents

Age is one of the main factors, which contributes a lot toward any economic activity when accompanied by better health condition. Table1, reveals that majority 43.5% of respondents between the age group of 31-40 years, while 33.5% respondents were in the age group of 41-50 years, 18.5% of the respondents were between the age group of 20-30 and 4.5% of the respondents were in the age group above 50 years.

Education level of the Respondents

Table 2 illustrates the literacy rate and level of education where the majority 70% of respondents were illiterate and 30% respondents were literate. The table further states that majority 41% of literate respondents had primary level of education, 12% were middle, 29% were matric and 18% were above matric level education. The result concludes that as the study was conducted in rural areas where there are poor education facilities, so most of the respondents were found as illiterate in the study area, few were literate with low level of education.

Table 1. Distribution of sample respondents by age group.

Village name	Age Group (in years)									
	20-30		31-40		41-50		Above 50		All	
	No.	%	No.	%	No.	%	No.	%	No.	%
Chattar	18	14.75	58	47.54	42	34.42	4	3.27	122	100
Battal	19	24.35	29	37.17	25	32.05	5	6.41	78	100
Total	37	18.5	87	43.5	67	33.5	9	4.5	200	100

Table 2 Distribution of sample respondents according to literacy status and education level.

Villages	Literacy Status			Education Levels				Total
	Literate	Illiterates	Total	Primary	Middle	Matric	> Matric	
	No/%	No/%	No/%	No/%	No/%	No/%	No/%	
Chattar	35 (28.68)	87 (71.31)	122 (100)	10 (28.57)	4 (11.42)	14 (40)	7 (20)	35 (100)
Battal	25 (32.05)	53 (67.94)	78 (100)	7 (28)	3 (12)	10 (40)	5 (20)	25 (100)
Total	60 (30)	140 (70)	200 (100)	17 (28.33)	7 (11.66)	24 (40)	12 (20)	60 (100)

Figures in () Show Percentages

Family Types

Table 3, reveals that two types of families exist in the study area. The greater part 58% of the sample respondents were living in the joint family system while 42% were living in nuclear family system. The result conclude that majority respondents were belong from joint family it is because most of respondents live in rural areas and the rural areas people gives more preference to joint family system as compare to nuclear family.

Tenancy Status

Table 4, reveals that three types of tenancy status were found in the research study areas where as the majority 52% of the respondents were tenant, 34% of the sample respondents were owner and 14% of the respondents were owner-cum-tenant. Most of the rural people are poor and they don't have their own land. Their farming produce is of subsistence level and they cannot produce for commercial purposes, because of which the tenant remains tenant for several decades.

Table 3. Distribution of sample respondents by family type.

Village name	Family type					
	Joint		Nuclear		All	
	No.	%	No.	%	No.	%
Chattar	72	59.01	50	40.98	122	100
Battal	44	56.41	34	43.58	78	100
Total	116	58	84	42	200	100

Table 4. Distribution of sample respondents according to tenancy status.

Village name	Tenancy Status							
	Owner		Tenant		Owner-cum-tenant		All	
	No.	%	No.	%	No.	%	No	%
Chattar	35	28.68	67	54.91	20	16.39	122	100
Battal	33	42.43	37	47.43	8	10.25	78	100
Total	68	34	104	52	28	14	200	100

Perceptions of the Respondents Regarding CBOs Activities

Table 5 shows that majority 53% of the sample respondents said that CBOs activities were very good, 34% respondent's perception is good and the rest 13% respondents pointed out that their performance was poor. The result clearly describe that a majority of the respondents considered the CBO activity was very good in the research study area.

Meeting Pattern of CBOs

Table 6, illustrate that the meeting pattern of CBOs where is the majority 64% of the respondents' view that meeting pattern of CBOs were occasional and the remaining 36% reported that the meeting pattern was regular. The result concluded that there are no specific rules for meeting and the members can meet for some purpose everywhere informally. The president can call the meeting, when the community members report any problem. The members of CBOs can also meet and discuss the problems on the occasion of festivals and ceremonies etc. the result of this research study is like to Azeem (2005) about the meeting pattern of CBOs.

CBO Meeting Attendance

Table 7, show the members' attendance of CBOs in the meetings. According to the table majority 52% of the sample respondents said that attendance in CBOs

meeting was satisfactory, 24% of the sample respondents reported that it was poor while the rest 24% respondents' view about the attendance in CBOs meeting was good. The result concludes that there are no strict rules and also no payment for attending the meetings that's why the attendance in the meetings is satisfactory. It would have been better if there were certain rule which bound the member to attend the meeting.

CBOs Participation in Operation and Maintenance (O&M) of Watercourse

Table 8 shows the perception of the respondents regarding the CBOs participation, Operation and Maintenance (O and M) of watercourses in the study area. According to the below table majority 49.5% of the respondent's perception about the operation and maintenance work was done occasionally, whereas 42.5% of the respondents viewed that maintenance was done on regular bases. The remaining 8% concluded that there was no participation of CBOs in the O&M of water course. Hence, these were the respondents who were understanding that the water course with in their farm should also be look after by the CBOs. There is a need to educate these farmers. The operation and maintenance of watercourses done occasionally because the condition of the watercourse is good enough and chances of damaging and tempering is low.

Table 5. Perceptions of respondents regarding CBOs performance.

Village name	CBO Performance							
	V. Good (3)		Good (2)		Poor (1)		All	
	No.	%	No.	%	No.	%	No	%
Chattar	67	54.91	35	28.68	20	16.39	122	100
Battal	39	47.43	33	42.30	6	7.69	78	100
Total	106	53	68	34	26	13	200	100

Table 6. Respondents perception about the meeting pattern of CBOs.

Village name	Perception of respondents					
	Occasional		Regular		All	
	No.	%	No.	%	No.	%
Chattar	77	63.11	45	36.88	122	100
Battal	51	65.38	27	34.61	78	100
Total	128	64	72	36	200	100

Table 7. Respondents perception about the attendance of members in the meetings.

Village name	Perception of respondents							
	Poor		Satisfactory		Good		All	
	No.	%	No.	%	No.	%	No	%
Chattar	36	28.68	63	51.63	23	18.85	122	100
Battal	12	15.38	41	52.56	25	32.05	78	100
Total	48	24	104	52	48	24	200	100

Table 8. Distribution of respondents on the basis of their views about the CBOs participation in O&M of watercourse.

Village name	Perception of respondents							
	Regularly		Occasional		Never		All	
	No.	%	No.	%	No.	%	No	%
Chattar	56	45.9	59	48.3	7	5.7	122	100
Battal	29	37.1	40	51.2	9	11.5	78	100
Total	85	42.5	99	49.5	16	8	200	100

Charges of Operation and Maintenance (O & M)

The CBOs charges the water users for the operating and maintenance of the water courses. This amount depends on the size of land holding. As such big landlords have to pay more as compare to the small land holders. The same is the case for the tenant. However, the tenants having small holding are not charged. The amount of the charges varies from Rs. 1500 to Rs. 6000 per season. This table 9 shows the perception of the respondents

regarding the charges of CBO for the operation and maintenance of water courses in the study area. The data describe that majority 50% of the respondents were of the view that the collecting charges was moderate followed by 42.5% who reported that it was high and the minimum 7.5% said that it was low. It can be concluded that the respondents, on their way, do not have any serious problem in this regard.

Table 9. Perception of the Respondents regarding charges of Watercourse O&M.

Village name	Perception of respondents							
	High		Moderate		Low		All	
	No.	%	No.	%	No.	%	No	%
Chattar	56	45.9	63	51.6	3	2.4	122	100
Battal	29	37.1	37	47.4	12	15.3	78	100
Total	85	42.5	100	50	15	7.5	200	100

CBOs work effects on agriculture

Table 11 reveals the perception of the respondents about the CBOs activities about agricultural development. According to the below table that majority 80% of the sample respondent's perception that CBOs work has positively affected and rest of 20% reported that there is no effect of CBOs activities in the study area. Result conclude that CBOs promote agriculture activities through watercourse improvement in the study area. The improved watercourses save the wastages of water and also helpful in avoiding of soil erosion and water logging. The tampering cases were also reduced due to

cementing of watercourse. Due to the above reasons the majority of the respondents consider that CBOs has positively affected the agricultural development.

Wheat Yield Comparison of Irrigated land and Non-Irrigated Land

Table 12 indicate the yield of irrigated land and non-irrigated land. The below table reveals that increase in the yield of irrigated land as compare to non-irrigated land. Overall, 190 (kg/Acre) differences are recorded in Chattar while 170 (kg/Acre) differences are recorded in Battal in wheat yield. As in the study area farmer get

benefit from irrigation channel and solve the problem of water deficiency and as a result their yield increase as compare to those farmers where there are no irrigation channels, and they face the problems of water accessibility on time and hence yield decline.

Effect on income from Wheat Crop

Table 13 illustrate that information about the income of wheat crop of irrigated and non-irrigated land of the farmer. The income of wheat irrigated land farmer is recorded an average of 33900 (Rs/Acre) while the non-irrigated farmer is recorded in an average of 28500 (Rs/Acre) as a difference of 5400(Rs/Acre). The t-value

shows the significant income difference between the irrigated farmer and non-irrigated farmer in the study area.

The income of the farmer depends on the yield of the farmer. Such a difference is recorded in the study area due to the water availability on time. The result concludes that beneficiaries get benefits from water and hence their yield and income is more than non-beneficiaries. Khan (2011), has also reported similar results in has study where the beneficiary household had obtained higher income per acre from wheat crop than non-beneficiaries' households.

Table 11. Respondents views about the CBOs work effects the agriculture activities positively.

Village name	Perception of respondents					
	Effective		Not effective		All	
	No.	%	No.	%	No.	%
Chattar	99	81.14	23	18.85	122	100
Battal	61	78.20	17	13.93	78	100
Total	160	80	40	20	200	100

Table 12. Wheat yield under irrigated and non-irrigated areas.

Village name	Wheat yield (kg/Acre)			t- value
	Beneficiary	Non beneficiary	Differences	
Chattar	1150	960	190	0.007
Battal	1110	940	170	0.03
Average	1130	950	180	0.018

Table 13. Wheat income under irrigated and non-irrigated of the study

Village name	Income from Wheat (Rs/Acre)		t- value
	Beneficiary	Non beneficiary	
Chattar	34500	28800	0.003
Battal	33300	28200	0.023
Average	33900	28500	0.013

Maize Yield Comparison of Irrigated land and Non-Irrigated land

Table 14, indicate the maize yield of irrigated and non-irrigated land. The data reveal that the increase in the yield of irrigated land as compare to non-irrigated land. According to the below table 120 (kg/Acre) differences recorded in maize yield at Chattar while 125 (kg/Acre) differences are recorded at Battal. Water is one of the basic requirements for crops. The yield of maize crop mostly depends upon the access of water and yield of

different crops can be increase by regular and well-timed accessibility of water. As in the study area farmer get benefit from irrigation channel and solve the problem of water deficiency and as a result their yield increase as compare to those farmers where there are no irrigation channels and they face the problems of water accessibility on time and hence yield decline. The finding were also similar with Masaud (2011) for maize yield.

Effect on income of Maize Crop

Table15, indicate that information about the income of maize crop of irrigated and non-irrigated land. The income of maize irrigated land farmer is recorded an average of 18355(Rs/Acre) and of non-irrigated land farmer is recorded in an average of 17160(Rs/Acre) as a difference of 1195 (Rs /Acre). The t-value shows the

significant income comparison between the beneficiaries' farmer and non-beneficiaries farmer in the research study area. The income of the farmer depends on the yield of the farmer. Such a difference is recorded in the study area due to the water availability on time. Beneficiaries get benefits from water and hence their yield and income are more than non-beneficiaries.

Table14. Maize yield of selected irrigated and non-irrigated areas.

Village name	Maize yield (kg/Acre)			t- value
	Beneficiary	Non beneficiary	Differences	
Chattar	910	790	120	0.009
Battal	895	770	125	0.026
Average	902.5	780	122.5	0.017

Table 15. Maize income under irrigated and non-irrigated selected research areas.

Village name	Maize income (Rs/Acre)		t- value
	Beneficiary	Non beneficiary	
Chattar	20020	17380	0.017
Battal	16690	16940	0.04
Average	18355	17160	0.028

CONCLUSIONS AND RECOMMENDATIONS

Study concludes that the CBOs had an important role in enhancement of crops yield through water courses improvement in the study areas. Beneficiaries viewed CBOs performance and activities differently. Most of the members attended the meetings of CBOs because of flexibility in schedule. On Farm Water Management (OFWM) contributed more in the improvement of water courses. The CBOs take charges from Rs. 1500- Rs.6000 per season for the operating and maintenance of water channels with respect to their land holding size. Most of the respondents consider this amount as high. Majority of the respondent's percept that CBOs work positively affected the farming activities in the study area and made the irrigation more convenient. The wastage of the water reduced and flow of water in the channels were increased due to improved water courses. More land irrigated after cemented the water channels and the crop productivity has significantly increased because of more availability of water. Which results rise in the income of the farmers in the study area. Despite these shortcomings most of the respondents consider the CBOs activities as necessary for the better future of the community. It was recommended that there should be regular organizational activities, duties and some kind of

rewards for the member to keep their attention in the CBOs activities. The maintenance charges should be on the basis of financial status of the farmers and improve the remaining water courses for the boosting of agriculture in the study area.

REFERENCES

- Adisa, B. 2013. An Assessment of Participation of Rural in Community Based Development Activities (CBDs) in Osun State, Nigeria. *Journal of Sustainable Development in Africa*, 15.
- Azeem, F. 2005. The role of Community Based organization in the promotion of Education in District Mansehra, University of Agriculture Peshawar.
- Clements, A. 1995. Employment growth and housing shortage: A case study of Wongan Hills. , Curtin University of Technology
- FAO. 2000. Making the best use of water for agriculture Food and Agriculture Organization of the United Nations. Rome.
- Government of Pakistan. 2020. Economic Survey of Pakistan Ministry of Economic Affairs. Islamabad, Pakistan.
- Hussain, A. H., N. U. R. K. Khattak and A. Q. K. Khan. 2008.

- Role of Community Based Organizations in Rural Development: A Case Study of Selected CBOs in District Swat. *Sarhad Journal of Agriculture*, 24: 749-53.
- Hussain, I. 2007. Direct and indirect benefits and potential disbenefits of irrigation: evidence and lessons. *Irrigation and Drainage: The journal of the International Commission on Irrigation and Drainage*, 56: 179-94.
- Khan, M. 2011. Water availability and productivity in the Command Area of improved/unimproved water courses (Peshawar), University of Agriculture Peshawar.
- Khan, S. and G. A. Anjum. 2016. Role of Citizen Community Boards in Promoting Participatory Development in Muzaffargarh District, Pakistan. *Pakistan Journal of Engineering and Applied Sciences*.
- Kljajić, N., V. Paraušić and A. Rodić. 2016. Tehno-economic feasibility use of portable solar irrigation systems; Proceedings of the 152nd EAAE Seminar Emerging Technologies and the Development of Agriculture. Serbian Association of Agricultural Economists In: Institute of Agricultural Economics, Faculty of Economics, Belgrade
- Masaud, K. 2011. Comparison of water availability and productivity in service area of improved and unimproved parts of water course in upper swat canal, University of Agriculture Peshawar
- Rehman, A. 2016. Agricultural and economic development in Pakistan and its comparison with China, India, Japan, Russia and Bangladesh. *Andamios. Revista de Investigación Social*, 12: 180-88.
- Shah, S. A. and H. Ilhaq. 2008. Information System for NGO Libraries in Pakistan: A Proposed Model for Organizing the Grey Literature. *Changing Roles of NGOs in the Creation, Storage, and Dissemination of Information in Developing Countries*, 123: 127.
- Shideed, K. H. 2011. Informing policy development for sustainable and productive food production systems in dry areas. International center for agricultural research in the dry areas (ICARDA), Aleppo, Syria.
- Singh, R., D. Kundu and K. Bandyopadhyay. 2010. Enhancing agricultural productivity through enhanced water use efficiency. *Journal of Agricultural Physics*, 10: 1-15.

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