Improved Water Mills Impact Study

RVWRMP PHASE III RESEARCH REPORT

| 7/2019 |

GOVERNMENT OF NEPAL

EUROPEAN UNION

Ministry for Foreign Affairs of Finland

Summary

Lack of information endures on IWM's use and management patterns, and their impacts on the local lives and livelihoods. This study scrutinizes the impacts of the implementation of RVWRMP's IWMs on people's lives and behaviours. A special focus is placed on gender, IWM usage patterns, and IWM operation and maintenance arrangements. RVWRMP surveyed its IWMs, focusing on the Districts, Humla and Darchula, where IWM instalments have been the most numerous (78 IWMs out of 87 in total). The field work was conducted in May-June, 2019. This rapid impact study gives indicative figures of the IWM uses, management patterns, and impacts evident in relatively remote to very remote rural areas in Nepal.

The study indicates that IWMs have a very significant impact on time saving. Most of the beneficiaries live far from the IWM, having a long walking time to the mill. On contrary to what is often thought, the surveyed IWMs most often replaced traditional mills in other locations and not manual grinding at the household. The overall time use reduction occurs expressively through reduced walking times in the numerous cases where IWMs were installed in new locations, reducing up to more than an hour of one way walking. The reduced walking time is often neglected in the studies as it is thought that the IWMs mainly replace manual grinding work that is done at home. The other time-saving mechanism is the trice or twice faster grinding (67% of the responses) provided by the IWM technology that commonly saves around an hour per a sack of grains. For a typical beneficiary household, the time savings accumulate to several full days a year.

The main reported health impacts were related to reduced time and hard manual grinding work, whereas the main production impacts involved improved quality of the flour, and reduced wastage of grains. The survey conveys that the management is effective, and that the IWMs have remained well functional in their first year(s) of operation. The rather simple setup of the IWMs may support the sustainability of the operation. The study furthermore conveys that the IWM implementation would benefit from broader management, maintenance, and livelihoods trainings and capacity building activities that would ever increase the sustainability of the IWMs.

1. Background

Water mills are a traditional technology in use in Nepal on streams or rivers. The technology is quite basic and inefficient. The use of improved technology allows the mills to increase their efficiency. It can save the time of householders who would otherwise have to grind grain by hand, or queue for a long time at the slow traditional mills.

IWMs can grind flours of various kinds, but they can also be used for extracting oil, grinding spices, operating a saw mill, pumping water, beating chiura (butter nuts), crushing sugar cane, and even to produce electricity. IWMs are renewable energy solutions, potentially reducing CO_2 emissions and contributing to climate change mitigation (FCG et al., 2013).

Improved Water Mills (IWM) are high-in-demand especially by women. These low-cost investments may have a significant impact on women's lives. The main objective of intervention of improved water mill in RVWRMP are to reduce drudgery of specially women, and to improve the living standards of rural women and men. The IWMs may also contribute to creation of employment opportunities for rural poor people and to increases in their productivity.

An average Nepali household is a frequent user of milling services: Average rice consumption in Nepal is 128 kg/year/capita equals 640 kg for a family of 5. With a milling ratio of 70% that means in total 914 kg of paddy has to be brought to the mill. If a sack of grains weights 25 kg, there would be 36 sacks to be carried to the mill. For wheat, the figures are similar.

IWM differs from traditional mills mainly in the turbine and shaft technology, IWM having more efficient and modern mechanical parts. Figures 1-2 below present a typical water mill inside and outside, and Figure 3 presents the improved technology of an IWM.

IMPROVED WATER MILL COMPONENT IN RVWRMP III

RVWRMP targets to install 200 IWMs. The IWMs also contribute to the Project target of reaching 40'000 beneficiaries of renewable energy services, apart from micro hydropower (RVWRMP III Project Document, 2017).

RVWRMP forms a Users' Committee that builds and operates the facility, or hands over the IWM operation to an individual person. The implementation follows UC modality. An IWM materials and installation costs approximately 70'000 NPR per IWM, excluding the mill house. Users' contribution is around 30%, including local materials and unskilled labour cost. The project contributes the non-local materials and skilled labour cost.

RVWRMP provides support to install IWMs according to WUMP prioritization. Each Irrigation system is encouraged to make the provision of IWM, promoting Multiple Use water Services (MUS) (RVWRMP III Project Document, 2017).

Figure 1-3: A typical water mill from outside (Figure 1) and inside (Figure 2). The IWM differes from a traditional mill in its turbine and shaft technology (Figure 3), and in other mechanical parts, though the appearance of the house may be the same. Photo credit: Juho Haapala.

PURPOSE OF STUDY

Lack of information endures on IWM's use and management patterns, and their impacts on the local lives and livelihoods. This study scrutinizes the impacts of the implementation of RVWRMP's IWMs on people's lives and behaviours. A special focus is placed on gender, drudgery reduction, IWM usage patterns, and IWM operation and maintenance arrangements. The themes regarding the IWM covered by the survey are:

1. Common management and use patterns of IWMs.
2. Impact of IWM implementation on people's lives, gender equity and social inclusion.

2. Methodology

METHODS

The method needed to be able to discover information not only about the status of the IWMs installation and usage, but also about their impacts on people's lives and behaviours. A questionnaire survey, combined with confirmative field observations, was regarded as the best method for the purpose. The questionnaire included both quantitative and qualitative questions suitable for getting a broad set of various types of information for the study purposes.

The Project had installed 87 IWMs by March, 2019, just before the start of the data collection (Table 1). Due to the small number of installed facilities, most of them installed in remote localities in Darchula and Humla, the study does not use statistical analysis but relies on observations and questionnaire responses from around 18% of the installed schemes.

Table 1: IWM implementation status (6/2019).

District	Number of IWM installed
Achham	0
Baitadi	2
Bajhang	3
Bajura	0
Dadeldhura	0
Dailekh	1
Darchula	63
Doti	0
Humla	15
Kailali	3
TOTAL	87

Data for this survey was collected in Darchula and Humla because a vast majority of the IWMs were installed in these Districts (total 78), and very few being installed elsewhere (Table 1). This division enabled comparison of a set of Darhula and Humla schemes, the first representing semi-remote hilly areas, and the second representing very remote mountainous areas. The study surveyed 15 of the 78 schemes in the study area, representing 19% of the total number. Seven IWMs were examined in Humla, and eight in Darchula.

The questionnaire was released via TSUs to RMSU/SO level for data collection: The TSUs were instructed to randomly select RVWRMP supported IWMs in the District, and let capable RMSU/SO staff collect the data. The inaugurators were instructed to print the questionnaire formats, and the respective GRWO was instructed to coordinate the data collection process in the selected RMs. The survey focused on the IWMs of RVWRMP Phase III. The mills should have been at least one year in use to get information on the management and use patterns. All questions were given both in Nepali and in English.

The study was conducted in the field through filling in questionnaires, and observing the IWMs on the spot. IWM owners/care takers were the key informants of the survey, questionnaires been targeted to them. Data collection was done manually, one IWM owner/care-taker at a time. This ensured that the respondents could be facilitated to understand the questions correctly, and so the questionnaire could properly be filled in. The inaugurators observed the IWSs and facilitated the questionnaire responding. The responses were collected on paper, and reported the results in a specially designed excel table, provided to the inaugurators. The time of data collection was 14th of May – 14th of June, 2019.

RESEARCH DESIGN TABLE

The study has been grounded on an explicitly drafted research design format, presented in Table 2:

Table 2: Design table of IWM impact survey.

Name of research	**Improved Water Mill Impact Study**			
Human resources	Research design by: Juho Haapala			
	Coordination of implementation by: Juho Haapala; Pallab Nepal			
	Coordination and implementation support by: TSUs; RMSUs			
	Data collection by: RMSUs; SOs; Juho Haapala (piloting)			
	Data analysis by: Juho Haapala			
	Reporting by: Juho Haapala			
Objective *(research need; research gap; expected type of knowledge developed)*	*Research need/gaps:* Lack of information of IWM implementation about the use and management patterns and impact to lives and livelihoods.			
	Knowledge developed, meeting the needs/closing the gap: Sample-based survey about the management, use, and impact to lives of the IWMs of RVWRMP.			
Research questions (questions the research answers)	What are the common management and use patterns of IWMs? What is the impact of IWM implementation to people's lives and livelihoods, especially emphasizing gender and social inclusion perspective?			
Research strategy (means to meet the objective and answer the research questions)	Sample-based field data collection by a simple questionnaire and interactions. Only more than 1 year old schemes considered to get a picture of the already gained experiences and established management modes.			
Data sources	x	Interviews (subjective perceptions)	x	Observations
	x	Interviews (objective knowledge)		Participating project activities
		Questionnaire (subjective perceptions)	x	Internal project data (MIS; reports)
				External data (docs, statistics etc.)
	x	Questionnaire (objective knowledge)		Specify:_____
		Informal interactions		
Data collection tools	x	Manual data collection (eg. notes)	x	Project reporting system
		Mobile online survey (eg. KoBo)		No empirical data collection
		Online questionnaire (eg. Google)		Specify:_____
	x	Email questionnaire (eg. Excel)		
Data collection unit	x	Residents/members:		Municipality/Government
		_____		Project personnel (PSU/TS/RMSU/SO)
		Households		Specify:_____
	x	Local institutions: __IWM UCs_____		
	Sample size (number and % of all):		x	sample
				Census (all units incl.)
Schedule of data collection, analysis, and reporting	Data collection: Mid-April to end of June 2019 Analysis: by mid-August 2019 (end of FY05) Reporting: In August, 2019			
Analysis and expected output description	x	Quantitative	x	Qualitative
		Quantitative statistical		Specify:_____
	Understanding of the impact of IWMs to people's lives and livelihoods, incl. GESI perspective, and use and management patterns.			
Report type and sharing	Research report as an annex to APR. Other possibilities: RVWRMP brief, PP slides for a summary. All to be available online in the Project website.			

3. Findings

CONTEXTUAL DATA

Figures below provide basic information of the studied IWMs for the analysis. Majority of the IWMs were one full year in operation (Figure 4). The increased implementation pace in the previous FY explains the big number of rather recent schemes. Most of the studies schemes were owned by a user group (9), or an individual (5).

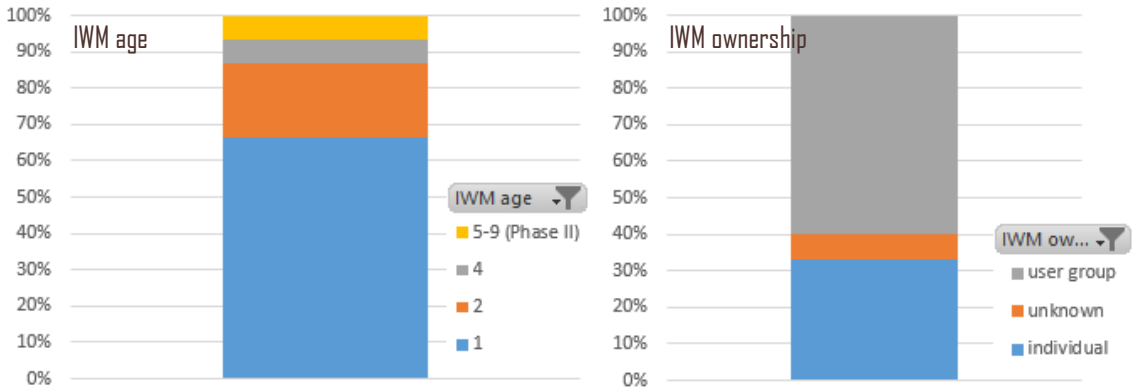

Figure 4: Age (left) and ownership (right) profiles of studied IWMs.

The owners of the individual schemes and care-takers of the common schemes were the key-informants. Their profiles are presented in figure 5. The ethnicity division approximately reflects the general division of the area, indicating a proportional benefit distribution in that regard. However, the management and operation of the IWMs is clearly very male-powered, reflecting the cultural realities in the area.

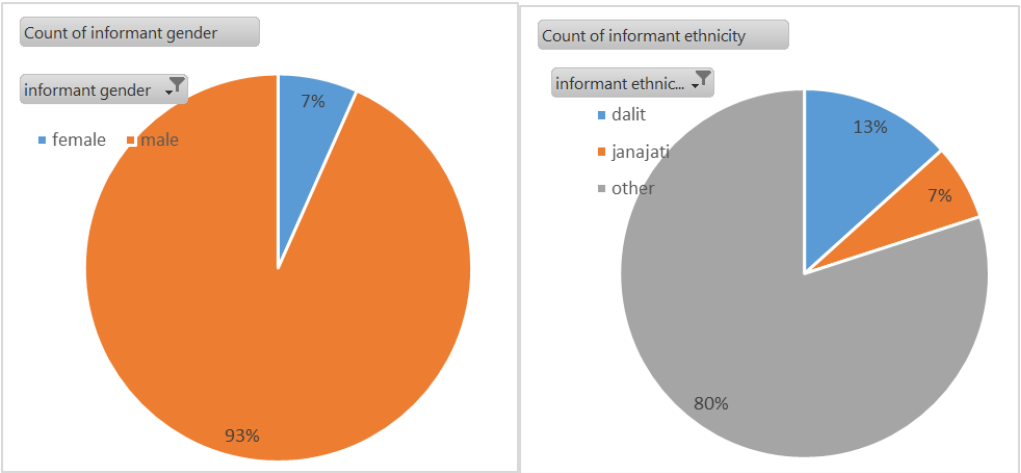

Figure 5: Gender (left) and ethnicity (right) information of the key-informants.

IWM USE PATTERNS AND IMPACTS

The questionnaire draw a picture of the IWM usage patterns, presented in Figure 6. In the studies schemes, around half of the IWMs are used by 1-100 households, and the other half has 100-200 users in total. Two thirds of the households use the IWM at least once a week, and the remaining third at least monthly, according to the key-informant estimates.

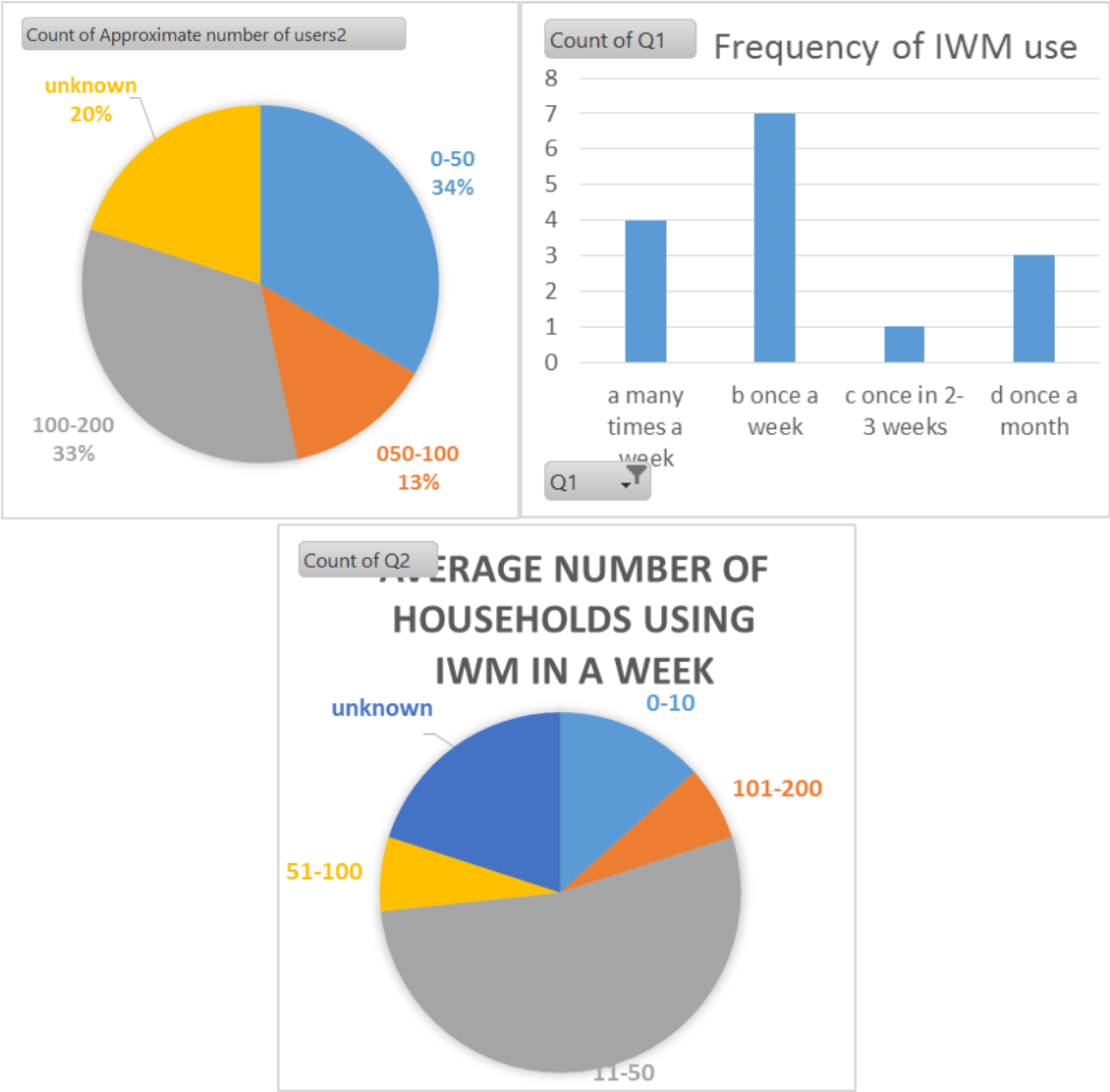

Figure 6: Profiles of total estimated number of users of an IWMs (up left); distribution of frequency of IWM use (up right); and the distribution of the number of IWM users in a typical week (low middle).

The field observations and the questionnaire data revealed that majority of the IWMs are located far away from a typical user – up to three hours of walk in Humla. Most of the respondents claimed more than one-hour long one-way walks to the grinding stations before the intervention, most typical answer being between one and two hours.

The questionnaire presented that assembling IWMs had significant effect on the proximity of the grinding service (Figure 7). Most of the beneficiaries used a traditional water mill in another location. The new location of the IWM reduced the distance, helping the beneficiaries to reach the grinding station and carry the heavy sacks a shorter distance. Some of the assembled IWMs replaced the old mills, not changing the distance (6 responses). However, nine IWMs had reduced the walking time significantly, up to more than one hour one-way reduction.

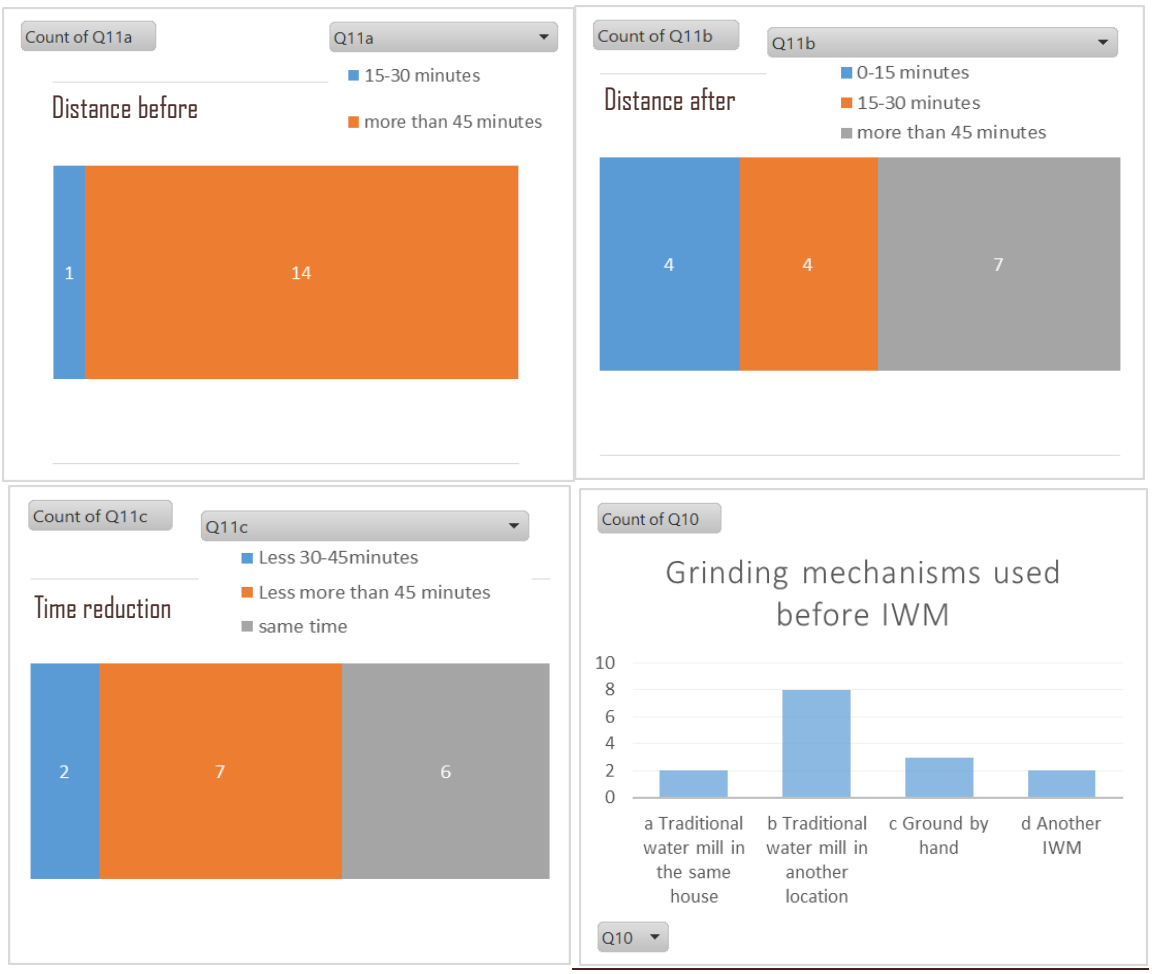

Figure 7: Distance to IWM in time before (upper left) and now (upper right); and time saved through intervention (lower left). Grinding mechanism used before the IWM (lower right).

Three respondents had ground manually before the intervention (Figure 7 lower right corner). The time used for manual grinding was approximately tenfold in comparison to IWMs, and the hardship of the manual work greater in a similar fashion. Figure 8 presents the survey data on the time benefits of the improved grinding technology.

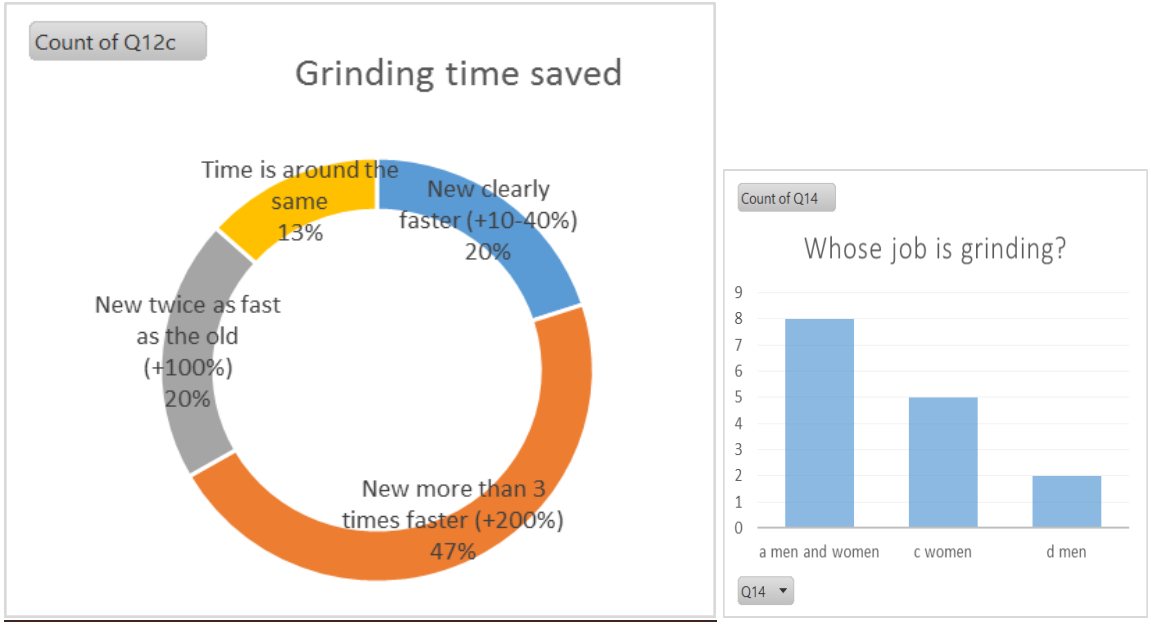

Figure 8: Grinding time saved by IWM (left) and grinding responsibility distribution in households (right).

The figure shows significant time savings by the use of the improved technology. The time savings were estimated by asking the respondents to estimate the time used for grinding an amount of wheat in minutes in the previous technology and the improved mill technology. The deduction of the difference was done by the inaugurators. Almost half of the IWM installations had resulted in tripling the grinding speed, one fifth of the IWMs had doubled it, and another fifth had improved the speed significantly. Only one ninth of the IWMs had reportedly the same speed as the previous station.

In practice, the increased speed saves easily an hour per a sack of grains (the normal amount of grains that is ground at a time), accumulating to a few full days of saved time per household a year, given that most of the households use the IWM weekly (see data in Figure 4).

According to the respondents, both men and women do the grinding work though it is more often women's responsibility than men's (Figure 8 right side). The questionnaire respondents did not tick children or elderly people as the responsible persons for doing the grinding. Furthermore, none of the respondents tick an option that anyone's access to the service would be ever denied, though menstruating women and disadvanced ethnicities were on the list. If such discrimination occurs, the survey could not find a method to find it out.

The survey focused also on the visible impacts of the IWM in terms of the quality of the products, and influence on people's health (Figure 9). Most of the respondents reported better quality of the ground products, and lesser amount of wastage. Decreased carrying of

heavy sack and the decrease in the heavy manual grinding duty were seen the most apparent health effects.

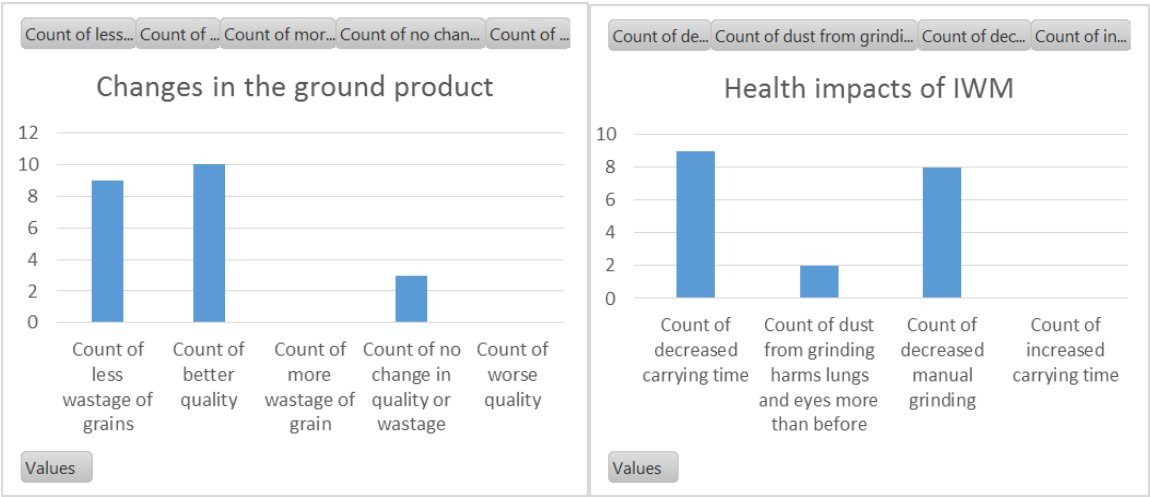

Figure 9: Changes in the quality and processing of the grinding product (left) and health impacts of IWM (right).

MANAGEMENT AND MAINTENANCE

The survey found out that around half of the IWM care-takers were trained on livelihoods approaches, and similarly around half on operation and maintenance (O&M). Many of the respondents proposed for an opportunity to be trained. Figure 10 presents the care-taker profiles. All respondents from Humla reported being trained on O&M, whereas few from Darchula. With livelihoods, the responses divided more equally. 60% of the respondents regarded IWM as a business, including all IWMs in Humla, and a large majority planned to continue being the care-taker with no reservations. However, most of the business-orinted IWMs were located in Humla, and only few in Darchula: In Darchula the mid-set leaned more towards voluntary work.

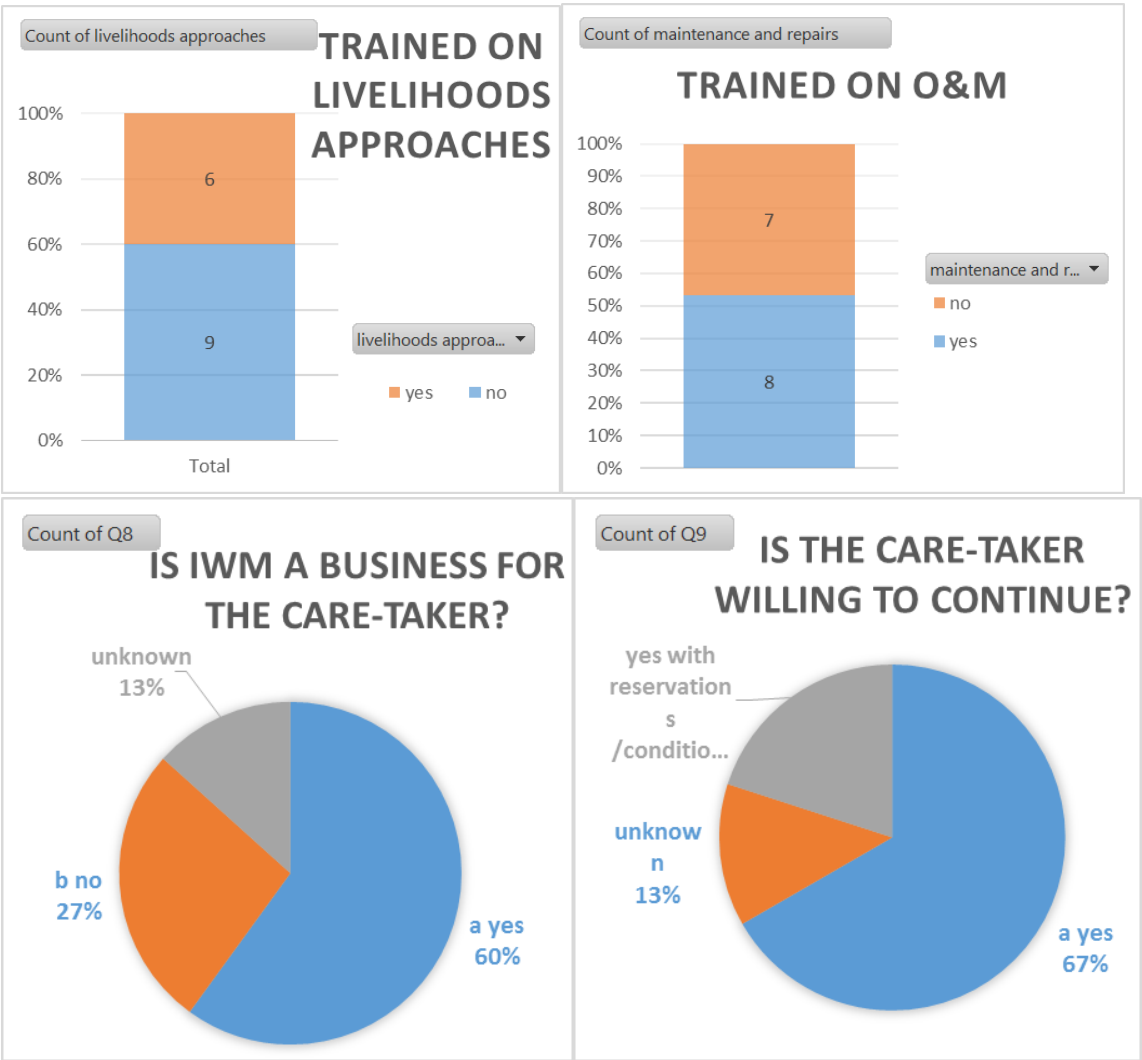

Figure 10: Owner/care-taker profiles.

The questionnaire asked about the person who does the maintenance and pays for it. Some minor maintenance had been done without problems. 8 key-informants responded that they have done minor repairs and maintenance by themselves, and one responded that the users as a collective have done it, and paid for it.

The owners and care-takers had minor and rather simple and concrete ideas for improving the IWM. Some of them were simple technical improvements, including a better roof and room, reducing the sprinkling of water from the millhouse, installing a long shaft to enable power production, improving the canal, and proposed support for replacing the grinding stone by the project. Few suggestions were related to management, e.g. setting grinding tariff, and receiving more training (not specified what type). All the suggestions were under the users own range to conduct.

Most of the care-takers hold the by-products of the grinding, husk and bran, as a service charge (Figure 11). This can then be sold or used as animal feed and fuel but also as a fertilizer. In two schemes, there were no service charge, and similarly in two schemes the charge was determined according to the amount ground.

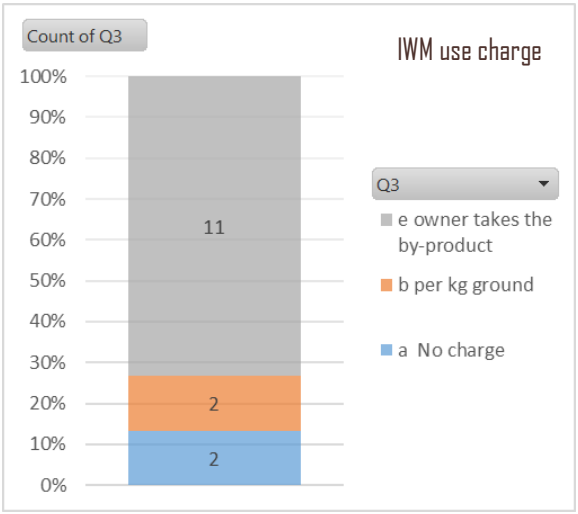

Figure 11: Service charge profile of IWM operation.

The observations in the field supported the rather positive views on the functionality and maintenance needs of the IWMs, conveyed by the questionnaire data. Most of the IWMs were fully functional, and had no needs for significant repairs or maintenance (Figure 12).

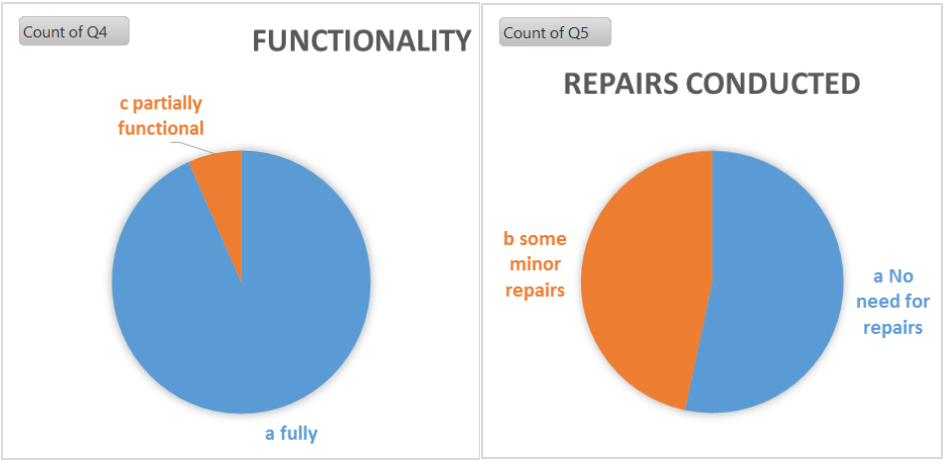

Figure 12: Functionality status (left) and repairs conducted (right).

The rather simple technical and institutional setup of the IWMs may support the sustainability of the operation. The figure above indicate that the IWM implementation would benefit from broader management, maintenance, and livelihoods trainings and capacity building activities that would ever increase the sustainability of the IWMs.

4. Comparison with other IWM studies

The findings of the study replicate much of the previous findings of the so-called Winrock-RAP3 study for 26 IWMs in Doti (2015). According to the study, milling times for wheat and maize halved (20-40 minutes time saved per week per family), and flour quality was found better (study referred in Particip & Niras, 2019). This study similarly indicated significant decrease in milling times, regularly from twice, to often up to three times faster grinding than before. This equals a corresponding level of time savings to the RAP study, or even slightly bigger, though the time varies a lot from case to case depending on the frequency of IWM use, and the effectiveness of the particular mill compared to the previous grinding method.

Furthermore, this study found that the IWMs installed to new locations were many, and they had significant decreasing effect on the walking distance to the grinding facility. This may even double the time saved, as the influence was in the conducted study most often close to an hour of saved time.

The study found that the distance to a grinding facility can be tremendous in remote areas. The MTE report (Particip & Niras, 2019) mentions that the distance between IWMs and the village can be far, i.e. up to 30 minutes, and the path might not always be safe. The reality is much tougher: In Humla, normal walking time exceeded an hour for a typical user, and in some localities the time was three hours one way. The time in the more remote areas expectedly exceeded the time in the relatively less remote localities, also visible in the comparison between Darchula and Humla.

Another issue the MTE (Particip & Niras, 2019) conveyed in general terms was the repair of the turbine (often needed from 5 years onwards) that is done in well-equipped workshops, but such services are at best only available in few places of the Far West. The surveyed IWMs were less than five years old, and no such problems were reported by the key-informants in this study.

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