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Interactive comment on "Performance Characteristics of a Small Hammer Head Pump" *by* Krishpersad Manohar et al.

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Reviewer comments: "In this sense, I suggest the authors to highlight as much as possible the actual contribution of their article to this specific field of knowledge. Maybe that contribution is more focused on the easiness of construction and installation, perhaps to its size or maybe to the ratio size / efficiency. On the other hand, a main part not explicitly addressed in the introduction is the research gap and the consequent research objective. Therefore it is difficult to link the concluding remarks to the general work."

Authors response: "The major hindrance in using this established technology in third world countries is the exorbitant cost of the commercially available units. For a UK

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built pump the cost is US$ 1800 [10] and cheaper china made pumps range between US$500 to US$1300 [11]. One of the objectives of the Prude University project in Haiti was to develop a cheaper alternative, however, the cost was US$100 [9]. Therefore, there is the need to develop a low cost alternative that can be easily built from readily construction materials and requires minimal technical skills."

Reviewer comments: " Not all the farmlands in the world meet the condition of being far from an electricity source yet close to a water source. Maybe a word like "usually" or "mostly" could fit, as long as evidence is provided for such an affirmation."

Authors response: "In developing and under-developed countries, farmland are usually located close to a reliable water source to ensure viability [6, 7]."

Reviewer comments: "It is better to explain why the relevance of being far from electricity sources, i.e. why is it a challenge/problem for farming. Besides, please think of what happens with diesel-based pumps, which do not rely on electricity."

Authors response: "However, in many instances these locations are far from any reliable source of electricity and the cost can be prohibitive [6, 8]."

Reviewers comments: " Is there evidence for stating "The water source is usually situated below the level of the farmlands"? Or perhaps it is better to say something more general, such as "there are cases where the water source..."."

Authors response: "In cases where the water source is situated below the level of the farmlands, getting the water to where it is needed can be challenging [7]. "

Reviewers comments: There is the need of an introductory / transition sentence before "A water pump operating on the water hammer effect...". I suggest to introduce the reader why it is a challenge being far from electricity, and what can be done using hydropower. Then the explanation of the hydraulic ram pump will fit better in the storyline."

Authors response: "In cases where the water source is situated below the level of the

farmlands, getting the water to where it is needed can be challenging [7]. Under these circumstances, a water pump operating on the water hammer effect and requires no external power source can serve as an effective means of pumping water to a higher altitude, once a reliable source is available."

Reviewers comments: " The historic introduction, particularly if it does not go beyond the work done by Pierre Mongolfier, must be briefly summarized. Its constructive details are not relevant for the scope of the paper."

Authors response: "Given the long history of the hydraulic ram pump, the design and manufacture has improved considerably with time and efficiency of operation increased. For commercial ram pumps the typical energy efficiency is about 60%, but can reach up to 80% [12].This is different from the volumetric efficiency, which relates the volume of water delivered to total water taken from the source. The amount of water delivered will be reduced by the ratio of the output head to the supply head. For example, if the source is 2 meters above the ram pump and the water is lifted to 10 meters above, only 20% of the supplied water will be available and the other 80% being spilled via the waste valve [13]."

Reviewers comments: " In principle, no machine can be considered "perfect". Furthermore, what are the criteria to be considered as such? I recommend to use expressions like “highly reliable”, or any other that reflects its degree of development. In adittion, hydrams, compared to other similar technologies, are subject to constant wearing due to the aggressiveness of the water hammer effect, which is in turn their main drawback."

Authors response: "The automatic hydraulic ram has been used for centuries to lift water to heights over 100 meters and is considered an effective machine for pumping water once certain conditions are satisfied."

Reviewers comments: " It mentions "water was wasted", whereas the Fig. 1 refers to "exhausted water". It is important to keep consistency in the nomenclature, and making sure it matches with the usual terminology in the literature (e.g. “A Manual On

The Hydraulic Ram For Pumping Water" by S.B. Watt, or "Hydraulic Ram Pumps: A guide to ram pump water supply systems" by Jeffrey et al.)"

Authors response: "This editorial change will be made to ensure consistency in the manuscript."

Reviewers comments: ": About "once any form of flow can be created", it will be good to provide an insight on how this flow can be created after the different water sources, i.e. what kind of extra infrastructure it might need: dam, weir, drop, etc."

Authors response: "This source could be a spring, streams, river, ponds, dam, lakes and even some wells, once the conditions exist for these water sources to create a hydraulic flow head, either by forming a dam or a naturally existing head."

Reviewers comments: "The ram pump installed at a lower location than the water source is not an ideal scenario but a mandatory one. Otherwise the pump will not operate whatsoever."

Authors response: "The ram pump must be installed at a location lower than the water source which is used to create the flow giving the fluid (water) some velocity."

Reviewers Comments: This paragraph describes the generic structure of a Hydram. I suggest to put that in the introduction, so in this section the specific parts and assembly methods of your prototype are directly described.

L. 61: Figs 1 and 2 could be put side to side, so the reader can make a quick correspondence between the scheme and the actual prototype.

L. 73-76: I recommend to match the parts of the experimental set-up, as described in this paragraph, with those of the Fig. 3, to make sure all of them can be identified in both graphic and text. A good way of achieving it could be by assigning letters or numbers to each part.

L. 93: I wonder if it would be more convenient to combine both tables 1 and 2 in a

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single one, due to their similar structure. In that case, each cell must be divided in two parts, for the pumped flow and wasted flow, respectively. Moreover, this can give the chance to include a third part: the pumped/wasted ratio; it can be eventually related to the pumping efficiency.

L. 100 and next ones: The discussion part must be enriched by comparing your study with other ones, perhaps using similar prototypes in sizes and conditions. Of course, the respective literature and references must be taken into account while doing so.

L. 134: The first conclusion might be too obvious, after so many years of continuous and ubiquitous use of the hydrams, to be considered as such after the present study.

Technical corrections: Keywords: "Pump characteristic" is not a so accurate keyword for this study, since it does not suggest any possible topic. L. 26: Farmlands are (missing plural). L. 37: The name of the son of Joseph Michel de Montgolfier, who improved his father's model, is Pierre (or Pierre François). L. 37: "Montgolfier designed the sniffer valve that reintroduce..." It must be "reintroduced". L. 40: "The pump construction was simple and consisted of a pump camber...". Do you refer to "chamber" perhaps?

Authors response: All the editorial and technical corrections will be done in the final manuscript.

Please also note the supplement to this comment:
https://www.drink-water-eng-sci-discuss.net/dwes-2019-7/dwes-2019-7-AC3-supplement.pdf

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