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Dear Reviewer,

We appreciated the time that you have taken in our manuscript and the constructive comments.

In this revised version of the manuscript, we have tried to do our best to address your comments. We have included many paragraphs in many parts of the manuscript to improve our contribution. A slight change has been made in the title to be more engaged with the body. We also tried to change titles and sub-titles to reflect our intentions and visions. More specifically, we have rewritten some sections and added more information to enhance the quality.

We hope this version will be considered positively for publication.

Thank you again for your consideration.

Sincerely,

Masoud Saatsaz

Corresponding Author

Reviewer #1: comments

I appreciate the authors for their efforts to shed light on such an important subject, but their work has plenty of room for improvement.

- 1- The paper's subject is unclear. The title suggests that the authors will argue the specific way(s) in which technology and culture interacted in shaping water management in ancient Iran. Nevertheless, this topic is not touched on in the paper. The Abstract suggests two other topics: a) a brief history of water management in Iran; b) how geo-climatic functions control water regimes, settlement patterns, and [undefined] socio-economic issues. A brief history of water management in Iran fits most closely the content of the paper.*

Answer:

First of all, we would like to thank you so much for your high quality of editing.

You are right. This work can be considered as a historical investigation. As we mentioned before to Prof. Ertsen, Dr Saatsaz has published an article titled "A historical investigation on water resources management in Iran" in 2019. This article is quite different from that of 2019. For this reason, we tried to select a different title for this manuscript.

That research was related to water resources management throughout different traditional, transitional, and modern periods. In that article, water management, technology, and culture in ancient Iran were not discussed much. As he was writing that article, he realized there are many other essential issues on water resources governance, hydraulic engineering, management practices, and cultural issues in ancient Iran to consider. As far as we know, no article thoroughly explained the whole topics mentioned above. Several scholars have studied the development and management of water resources in ancient Iran. One of the limitations of most previous studies is focusing on either water-related technological systems or socioeconomic aspects of water. One of the main characteristics of

this study is the description of a set of technical, management, and cultural topics, from pre-civilization times to the end of the Islamic Golden Age (1219 AD), and making the link among them, if possible. This task was not easy; it was done by reading more than three hundred articles, books, documents, and maps over three years. This task was not easy; it was done by reading more than three hundred articles, books, documents, maps over a period of about three years.

In this version, we have changed the article's title and sort its terms "Technology, Management, and Culture" according to their engagement in the manuscript. As follows:

Old title: Water Resources Management, Technology and Culture in Ancient Iran

New title: Technology, Management, and Culture of Water in Ancient Iran

- 2- *I was not able to find an original argument in the paper. A very general introduction with ambitious statements is followed by detailed facts about individual hydraulic structures across the country. Those facts, if well integrated, could be used in a survey-style textbook chapter on hydraulic structures in ancient Iran. The research questions stated in the introduction (48-52) can be considered an outline of a term paper, but they fall short of proposing or addressing a worthwhile problem in water history studies.*

Answer:

Concerning the items above, some sections have been totally revised in the items above. Some discussions have been added, and some new subjects have been included in the manuscript to improve logical flow and transitions between the sections. Also, we have outlined all heading or subheading titles to separate distinct parts of the manuscript.

Regarding the proposal for publishing this work as a chapter book, we believe this work in the format of an article in this valuable journal can be more accessible for Iranian researchers. Most Iranian scholars cannot buy an original international book due to their economic situation and lack of access to international banks. However, this explanation is not a scientific reason and does not justify reducing our efforts to improve the research.

- 3- *The facts about specific hydraulic infrastructures and specific archaeological sites are too detailed without being integrated into a general theoretical discussion. Literature review without integration has resulted in some contradicting statements, for example, regarding the state of water management in the Islamic period. A statement about the innovations in hydraulic technology in the early Islamic period is followed by a paragraph on the demise of water management in the same period. For the same reason, some sections like "Historical Evolution of Life in Iran" do not relate to the paper's topic.*

Answer:

As mention in the previous answer, we tried to tackle these concerns through stated above ways. For example, concerning the item related to the section "Historical Evolution of Life in Iran," we have changed the title and rewritten the entire paragraph to confirm that the first Pre-Iranians lived alongside rivers do in the present.

- 4- *Several critical arguments in the paper are wrong, outdated, or unsupported. To name a few:*

There is no evidence that difficulties of access to water management for a large urban population in southwestern Iran were the catalyst of systematic water management. It is unclear what do the authors mean by systematic water management. In any case, early riverine societies seem to have developed canal irrigation independently and simultaneously.

Answer:

In this manuscript, we have mentioned:

"systematic development appeared in west and southwest Iran closely related to Mesopotamia."

In the above sentence, "systematic" means an action that affected the entire society on a relatively large scale.' Through a systematic development in this area, the first proto-cities of the Middle East, such as "Susa," began to flourish around the Uruk period (4000 to 3100 BC), a prehistoric period of Mesopotamia. Undoubtedly, if there was no systematic development, these cities did not merge or vanished after a time. However, other non-systematic small scale actions were not at a level that their effects can be accurately quantified.

5- *There is no evidence that the irrigation systems of southwestern Iran were the adoption of a Mesopotamian water management system. The entire discussion on "Mesopotamian water management" is inaccurate. Canal irrigation was not an inherently Mesopotamian development. Nor was Fertile Crescent's agriculture and economy under Mesopotamian control.*

Answer:

Many reasons show Mesopotamia influenced the irrigation systems of southwestern Iran. The main reason can be finding one of the earliest water-related regulations issued by King Hammurabi, one last of the Mesopotamian Empires ((who established the Old Babylonian state). Another reason is that the nearest and most vital historical region to the south of Iran was Mesopotamia.

6- *Even though qanat irrigation is a much later technology than canal irrigation, and even though qanat tends to be found in arid regions without permanent rivers, one cannot simply state that qanats were developed because the "Mesopotamian water-based technology" could not meet the needs of arid regions. This statement presumes a causal relationship between two separate phenomena with their complicated development history.*

Answer:

We changed this sentence to be more logical as follows:

Old version:

By the 4th Millennium BC, while water access became more difficult as population growth, economic activity, and urbanization progress, water resources' systematic development appeared in west and southwest Iran under the Mesopotamian civilization. However, despite all benefits, Mesopotamian water-based technology and administration could not meet all water demands in Iran's arid regions.

New version:

By the 4th Millennium BC, while water access became more difficult as population growth, economic activity, and urbanization progress, systematic development appeared in west and southwest Iran closely related to Mesopotamia. However, existing technologies and administration and administration could not meet entire water demands in all Iran's arid regions.

Undoubtedly, by increasing population and the need for more food, qanats were welcomed in Central Iran. After developing qanats, whole season cropping associated with growing various fruits and crops expanded throughout Iran. Other qanat benefits and the role of the Achaemenid administration in water governance have been mentioned in many parts of the manuscript.

7- *The origin and early history of qanat's development are still unknown. It is hard to pinpoint its development to a specific location even though Iran seems to be a good candidate. Moreover, there is absolutely no data to support that Achaemenids used qanats to intensify agriculture across their empire, other than the Western desert in Egypt. In fact, the most well-dated evidence from the Achaemenid period from Fars is for canal irrigation.*

Answer:

In this manuscript we tried to show that the success of the Achaemenids in water resources development was due to these factors:

1- Proper administration

- 2- Water infrastructure such as dams, qanats, canal networks
- 3- Public corporation

All these factors were interrelated, but each had its own role. Hence, many paragraphs have been provided to make a bridge between these factors and support the claims about their importance.

- 8- *There is no evidence to support recession in irrigation or agriculture in the Seleucid or Parthian period. The most well-documented evidence comes from Khuzistan which shows a steady development of canal systems from Achaemenid to the Sasanian period.*

Answer:

Thanks for your comment. We have made substantial changes in this section as follows:

Old version:

6. Water Resources Management in the Seleucids Era and Parthian Era

Following the conquest of Iran by Alexander the Great in 330 BC, the Iranian satrapsⁱ were governed by various Greek Satraps forming the Hellenistic Seleucid Empire and then the Parthian Empireⁱⁱ (Curtis 2007). After the conquest of Iran by Alexander, qanats seem to have been abandoned or destroyed (Ashrafi and Safdarian 2015). Moreover, since the Parthian government was remarkably decentralized, the Parthians were not concerned about the loss of qanats and other hydraulic structures. According to Semsar Yazdi (2006), some qanat systems and irrigational systems were abandoned or damaged. Polybius, a Greek historian of the Hellenistic periodⁱⁱⁱ, recorded that Arsaces III, one of the Parthian kings, tried to destroy some qanats and interrupt water flow to make it difficult for the Seleucids to advance towards the Parthian capital^{iv} (Beaumont 1971).

6. Water in the Seleucids Era and Parthian Era

Following the conquest of Iran by Alexander the Great in 330 BC, the Iranian satraps^v were governed by various Greek Satraps forming the Hellenistic Seleucid Empire and then the Parthian Empire^{vi} (Curtis 2007). In this era, Iran was nominally a united country; it was composed of some semi-independent and sometimes scattered states. The central government did not interfere in the internal affairs of the states except in cases related to security and peace. Besides, the Parthian emperors did not promote a single religion. Hence, there were no single and fixed judicial principles. These factors reduced consensus, unity, and cooperation among Iranians. In the early Parthian period, the Parthians could not manage water-related structures like the Achaemenids could. Qanats and other water-related facilities seem to have been abandoned or destroyed due to internal strife^{vii} and wars with Rome (Ashrafi and Safdarian 2015). According to Wenke (1981), agricultural development in the first two centuries AD was concentrated in certain well-watered regions. Subsequently, the agricultural activities decreased in water-scarce regions due to poor water resource management, causing environmental degradation, a decline in rural family income, a rise in rural unemployment, and growth in rural-urban migration. Along with the migration, the number of urban centers increased; urbanization changed society and the economy. At this time, trade and manufacture activities reached their peaks^{viii}. Later, the Sassanids made these factors more complete and purposeful by expanding agriculture and creating a suitable administrative organization.

- 9- *The conclusion is a very general discussion of modern water management issues in Iran rather than a summary of the body of the evidence.*

Answer:

We have made substantial changes in several parts of the conclusion to address the reviewer's comment.

ⁱ Satraps were the governors of the provinces of the Achaemenid Empire.

ⁱⁱ It was under the control of the Seleucids, but Parthia's Seleucid governor proclaimed his independence. More information is available at Brosius, M. (2006). *The Persians*. Routledge (Taylor and Francis). Abingdon, U.K.

ⁱⁱⁱ The Hellenistic period was a time frame from Alexander the Great's death in 323 BC to the emergence of the Roman Empire in 31 BC. For more information, about this period see Hemingway, C., & Hemingway, S. (2007). *Art of the Hellenistic Age and the Hellenistic Tradition*. The Metropolitan Museum of Art. New York, USA.

^{iv} "Hecatompylos", also known as "Qumis", was the capital of the Parthians (in present-day Semnan Province)

^v Satraps were the governors of the provinces of the Achaemenid Empire.

^{vi} It was under the control of the Seleucids, but Parthia's Seleucid governor proclaimed his independence. More information is available at Brosius, M. (2006). *The Persians*. Routledge (Taylor and Francis). Abingdon, U.K.

^{vii} Polybius, a Greek historian of the Hellenistic period, recorded that Arsaces III, one of the Parthian kings, tried to destroy some qanats and interrupt water flow to make it difficult for Seleucids to advance towards the Parthian capital (Beaumont 1971).

^{viii} Improved transportation, well-developed coinage systems, and opening the Silk Road played significant roles in trade development in this period.