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Author	J.I. Wessels
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SUMMARY

The main objective of this study is to better understand the process of collective maintenance of ancient water tunnels called qanats in Syria. It aims to evaluate the social, cultural, political and environmental factors that have driven abandonment and decay of qanats in Syria. Considered are processes of collective action to maintain *qanats* at two case study sites in Syria; Shallalah Saghirah and Qarah. Qanats are subterranean tunnels that tap the groundwater and lead the water artificially to human settlement and agricultural lands using gravity flow conditions. The technique is similar to mining and originates from Old Persia. In its nature a qanat is a sustainable technique of extracting groundwater. It only relies on gravity as a power to lead the water to the desired location and it cannot exhaust an underground aquifer. Therefore qanats are interesting from a point of sustainable development. But qanats require a certain social organisation and collective action to be maintained.

Qanats in Syria are rapidly drying up and being abandoned. A problem analysis identified various causes such as climate, introduction of newer technological tools to extract groundwater, which leads to over-exploitation of the aquifer and a non-emergence of collective action at community level to maintain qanats. Changing socio-political factors and landreform causes the lack of collective action. Further endogenous and exogenous causes such as internal community politics and other socio-economic and cultural factors are identified. Contextualisation of the collective action is necessary to better understand the local level processes of collective maintenance of qanats.

A national survey identified a total of 44 sites in Syria containing 101 flowing qanats. Syria is divided in three regions of flowing qanats; North West, South West and Middle Syria. The other regions have qanats but there were no reports of active use at the time of investigation. Flowing qanats can be used as indicator for the presence of collective action at community level. A strong relationship between communal ownership and collective action is analysed. However, it is also found that private and community ownership of qanats is not necessarily correlated to community leadership for collective maintenance. In many cases, the state is regarded as the main entitity to initiate and lead collective action on qanats.

The unwillingness to invest in maintenance is strongly related to the lack of collective action. A dry qanat or silted-up with calcareous deposits does not trigger collective action of the users community. There seems to be a “dismissal of human agency” in the local perception on the causes of the drying of qanats. In those communities where there is no willingness

to pay, people rely heavily on state authorities and leave the maintenance to fate.

The first renovation case study considered in this thesis took place in 2000 and concerned the cleaning of the qanat in a village called Shallalah Saghirah. 25 households who are all bloodrelated live in the small village of Shallalah Saghirah. It lies between the 200-mm and 250-mm rainfall isohyets and has a semi-arid climate. The village area comprises a watershed that lies between 300-600 m above sea level. Supplied with water only by an ancient *qanat,* the users community has a history of hard struggle to survive in this harsh environment. During this pilot renovation the researcher was involved on a daily basis both through participant observation and living with the community for quite some time. The initiative of the renovation was based on a community request.

The local history of settlement and politics shows that several events can be identified that influenced the social cohesion in the village either positively or negatively. Among the positive events are the various leadership periods where the village had a mukhtaar mediating between disputing parties, establishment of the rights system, the building of an irrigation reservoir and several exchange marriages to adhere the lineages. Among the negative events were several deaths of key extended family members, the introduction of brides from the higher echelons of the Hariri clan, migration to urban areas, "unlawful" selling of land amongst cousins, a conflict in the larger extended family in another village that resulted in a bloodfeud in the 1970s and other conflicts among resident family members.

Main actors of the renovation have been identified and various stages of orientation-to-action have been analysed using Uphoff's (1996) action grid. Irrigated agriculture from the qanat will not provide enough economic benefits for the villagers to be self-sufficient. The qanat provides drinking water and domestic water; the irrigation water is used for fig trees, home garden allotments and additional barley for lambs. The renovation has shown the intimate power dimensions, multiplicity and heterogeneity of a seemingly coherent and close-knit community.

Hydrologically, the renovation was successful. Economic cost-benefit analysis also shows the renovation as an effective investment. However, both the positive economic analysis and the successful technical and hydrological outcome do not outweigh the negative social analysis. Lack of social cohesion and leadership are main constraints to the sustainability of qanat maintenance in Shallalah Saghirah. Context and local socio-political history play a major role in the emergence of collective action for maintenance of qanats. A seemingly homogenous, small-scale and closeknit community appeared to be in fact very heterogeneous and socially complex. Simple recipes and design principles

for devolution programmes are therefore at risk of wrongfully assuming social cohesion of communities and denying the non-economical and endogenous dimensions of collective action at the micro-scale levels. Technical and economical successes alone do not mean participation is socially sustainable.

The second case study that is considered took place in Qarah. Qarah has an average annual rainfall between 200-250 mm but not less than 200 mm for two out of four years. The elevation of the area is relatively high, the average altitude is above 1300 meters. Qarah's natural vegetation is sparse and consists of shrubs and other drought tolerant plants. The town has a population size of approximately 19,000 permanent households of which 900 extended households are said to have irrigation rights in the various qanat systems that are present in and around the town.

The renovation followed after a video feedback session at community level. The community requested the researcher to provide technical advice and information on funding contacts. In this renovation, the researcher was mainly involved in preparing an interim evaluation. The initiation, proposal development and ultimate responsibility was with the community representatives with little or no input by third parties.

Considering the positive attitudes towards investment and the long history of social organisation around the qanat systems in Qarah, the prospects for collective action in Qarah were considered favourable despite the high migration rate. In general, the qanats of Qarah are still fairly well maintained and the farmers' communities take care of their plots in the irrigated gardens. However there is a high tendency and risk that the younger generation will move indefinitely towards urban areas especially Damascus. Furthermore the development of deep boreholes at the edge of the gardens next to the summerhouses is potentially worrying for the qanats as well as the government's groundwater abstraction for piped water supply to the town of Qarah.

The renovation in Qarah was carried out in the years 2003 and 2004. An analysis is provided of the various power relationships between the monastic community and the other main actors during the renovation. Social relationships at user community level were analysed in relation to their behaviour and attitude towards qanat renovation. In the analysis of the renovation, Uphoff's orientation-to-action grid was not used because of the less intimate relationship between the researcher and respondents compared to the renovation in Shallalah Saghirah.

The renovation of Qarah can be summarised as a successful qanat renovation both technologically and socially. The enabling environment was favourable for collective action and a total of seven main actors have been identified. Contrary to previous government subsidised qanat renovations in the Qalamun region, the renovation in Qarah was carried

out following the traditional techniques where possible using the local expertise of the qanat users and experts.

In the field, however it is observed that despite the projected benefits in an ideal world, spontaneous collective action only started with an energetic initiator, the use of video feedback and other participatory tools and involvement of a third party, namely the international funders as external agency. Following cultural theory, the lack of spontaneous collective action is due to a certain fatalism and an attitude of laisser-faire of the user community.

Various biophysical and sociocultural elements of qanats as complex human ecosystems are explored and described in comparing the two case studies. The human ecosystem at regional level shows that borehole users and qanat users compete for the same resource and a cause for drying up of qanats can be found in over-exploitation by borehole users. But many farmers attribute the drying up of qanats to "fate" or changes in climate and rainfall. It is more likely that transformation in the socio-cultural elements and the introduction of pumped well technology are main causes for the drying up and abandonment of qanats.

The human ecosystem approach has been very useful to visualize various biophysical and socio-cultural elements and relations of the qanat system. However in an attempt to bring focus in a systematic structure, it tends to fall into the trap of forming "design principles" just like the recipes for devolution programmes in New Institutionalism. The approach also failed to analyse adequately the internal processes that took place during the renovation case studies in Shallalah Saghirah and Qarah. The human ecosystems approach cannot account for the temporal analysis of specific local social histories. A process approach is more useful for this.

The two case studies of qanat renovation in Shallalah Saghirah and Qarah show how important context is in the study of collective action. One of the main factors identified for successful collective action for qanat renovation is the presence of powerful leaders, connectors and initiators at community level. Local history, perception, and power are important aspects of collective action for qanat maintenance. We saw in both cases that these factors are main influences on the process of community-based interventions. We did not find an unambiguous relationship between heterogeneity and qanat maintenance.