

Water Institutional Arrangements of Falaj Al Malki in the Sultanate of Oman

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Abstract: Oman, which is located on the Southern East of Arabian Peninsula, classified as holding a semi arid climate with an average annual rainfall of 100 mm. Therefore, agricultural production in Oman is fully dependent in irrigation. More than one third is supplied by the ancient aflaj (sing. Falaj), which provide $680 \times 10^6 \text{ m}^3$ of water per year and irrigate of an area of 26,500 ha. There is two commonly known definition of the aflaj; the locally defined from the classic Arabic root as to divide the water among its shareholders. And the modern technical definition as trenches and tunnels, which are dug in the ground, to convey the accumulated rainfall water table to the irrigated area in the villages. This study explore some of the existing institutional arrangements found within Falaj Al Malki , at the waliyat (city) of Izki located in the Dakhillya governmental, Sultanate of Oman. This study uses mainly face-To-face interviews with local administrative falaj agents to explore and discusses the most operated mechanized of the institutional arrangements. The study concluded that there is strong relationship between Falaj Al Khatamain physical water variability and its institutional arrangements setting.

Keywords: aflaj, water rights, water physical variability, water market.

1. INTRODUCTION

Oman classified under arid and semi arid climatically zones which depend entirely on groundwater and desalination plants to fulfil its growing water demand. Historically the Omani innovated a well-known ancient irrigation system locally referred as aflaj to manage their scarce water resources under a harsh environment. In the past, the aflaj systems considered as the backbone of the village life, not only provided water for domestic and agricultural uses, but encouraged settlers to participate on day-to-day water transactional activities such as the weekly or annually traditional water market, selling of water rights and weekly or annually renting water rights. However, still some of these activities take place in Oman until present time. Hence, the main aim of this study is to document and explore some of these institutional arrangements. Falaj *Daris*, at the waliyat of Nizwa located in the Interior region, Sultanate of Oman was taken as a comprehensive detailed case study to examine to what extent have the existing surrounding hydro geological environment affected the historical development institutional arrangements of the ancient falaj systems?

the theory that water institutional arrangements might be reflected upon watercourse physical variability (Young, 1986). Generally, aflaj water flow continuously day and night, however, it varies according to main rainfall rate on the flaj zone mountainous areas. Therefore, falaj institutional arrangement required to be initiated with accordance to this phonemia. To the extent such relationship extensively reviewed in the literatures, this study focused through the use of the above-mentioned flaj to document and explore this relationship. Thus, the main objective of the study is examine if relationship between the falaj Daris water flow and its existing institutional arrangement and then to document these institutions using available watercourse literature review. Based on these two objectives, the further scope of the study are:

1. To analyze the collected time serial date of the falaj Daris water rights
2. To presented the primary data collected through interviews
3. To present the secondary recorded data obtained.

2. THEORETICAL CONSIDERATION

One of the area by which received extensive discussed within the water resources management is the mechanism used to control water flow fluctuation or sometime refereed as risk variable. For instance Demsetz's(2002) theory developed institutions based on a strong legal system which is able to reflect the fluctuation of the resource. In fact he favored the establishment of private property rights as long as the risk variable is not present. With this respect Demsetz(2002) thinks that the theory of propety rights could be made more complete. While Bromley and Chavas (1989) used such variables to discuss the consequences of resource fluctuation.

John Wilkinson was probably the first Western on demonstrated the evolution of the basic falaj organization based on the analysis, falaj malki in Izki village (Wilkinson, 1977) He showed how the villagers managed water resources during drought period by arguing that during abundance of water supply, they tend to open other channel of the primary network. He stated, "Where there is considerable variation in base flow some of the channels are opened only when water is plentiful" (p. 99). Similary, Birks (1977) illustrated the local traditional-strategic management which was taken by villagers during severe drought in wadi *Hawashniah* in 1977. This falaj had one main channel entering the village and then splitting into two supplying different parts of the village. In normal years both of these canals were open. Birks found that during drought period with low flow one canal was closed. He further pointed out that the consequence of this drought response only supplying water in one channel at a time was that the cycle of irrigation for each field was lengthened from seven to 14 days.

It is well recognised that water is considered as a prerequisite of all sorts of social as well as economic development. However, in the past water used to be referred as a free good, by which this has been replaced by new perspective that water can be treated either as social good or economic commodity (Randall, 1981, Milliman, 1959, Saleth and Dinar, 2005). First those who hold the view that water is a social good have looked into several factors including its necessity to life and perquisite of society social development (Araral, 2009, Brajer and Martin, 1990) and its association with agrarian and industrial revolution (Rose, 1990). While those who hold the view that water can be considered as an economic commodity stem from the fact that water is becoming scarce and its demand is increasing. It is not the aim this study to debate which is right or wrong, it is surface to say that the economical argument in considering water as an exchangeable commodity is the fact that price of water will reflect its true scarcity and its opportunity cost, in other words, the price that the marginal user is willing to pay (Perry, 2001, Randall, 1981).

We are fully aware that two main concepts exchangeable used as evaluative criteria to analyse any watercourse. These are:

- fairness (equity) by which to distribute water among shareholders (Easter et al, 1999, Dietz, 2003)
- efficiency to the extent of how to utilize water productively (Araral, 2009, Bjornlund, 2003).

The aim of these two evaluative criteria is to find the most suitable water institutional arrangements (Saleth and Dinar, 2005). It is well recognised that developing a weak institutional arrangements to regulate any watercourse rights can easily create a complex management problems. For instance, Branger and Martin (1990) pointed out that any possible divergence between social and private benefit result in the failure of a market system. Bromely (1982) pointed out that the concept of Pareto optimally and economic efficiency analysis is not an adequate basis for guiding collective action. He is in favour to analyse the problem from social context. Therefore, establishing a fair system with well-defined property rights associated with community participation in decision-making is expected to be the most important priority of any institutional arrangements (Dietz, 2003). To do this some scholars have argued to incorporate knowledge relating to culture, beliefs (Rutherford, 1995, Walliman, 2006) and customs (North, 1991).

3. WATER RESOURCES MANAGEMENT IN OMAN

In the absence of alternative supplies of surface water in Oman, groundwater resources form the backbone of local farming economies. The current water supply and associated crop cultivation practices found within two main farming types, both of which use groundwater aquifer. The first and the most modernized type are practiced by digging a well which is normally owned by individual farmers. The second is through natural flows by the use of man-made tunnels and channels known as *falaj* (plural *aflaj*) systems. This classification dictates details understanding of the two types as follows: A farm with its own private owned individual well is called *mazra* literately means a farm, while farms that

receive water from a public falaj are called *amwal*. This Arabic word, *amwal*, which is literally means 'public wealth' in its plural form, indicate clearly the *falaj* system operate within a community property structure. Second, the community assets and property can be considered as a legal boundary which includes walls, channels, bridges, building and gardens. Several regions over the northern part of the country rely heavily upon a single community-owned *falaj* for irrigating their date gardens and other annual crops. This requires a high degree of social control and cooperation to maintain the system, keep it running and to manage its distributive water rights.

Wilkinson (1977)¹ provided a detailed illustrative settlement over arid region of the Arabian Peninsula using aflaj as an example, in particular Izki village. Later studies have touched upon other economic as well as technical aspects (Abdel Rahmnn and Omezzine, 1996, Al-Ghafri, 2001, Norman et al., 1997). More recent studies incorporated more of the water management social issues; Abdel Rahmnn and Omezzine (1996) and Zekri and Al-Marshudi (2008) placed the system within the context of a competitive market and tradable water right. As far as Falaj Daris is concerned (Megdiche-Kharrat et al., 2016) and (Megdiche-Kharrat et al., 2017) have provided a brief an illustrative historical and administrative account

4. METHODS

This study is a part of a comprehensive research study included the largest and most famous aflaj in the area. It is believed that these hold some indigenous knowledge with regard to study objective on the issue of water institutional arrangements. This study went through several steps:

1. Multiple visits to the study area. This has been carried out for two reasons. 1). To develop cultural understanding and norms of conduct with the Omani people whom will be interviewed for obtain information fulfilling the study objective. 2). Able to develop the research field work framework in terms sort of question needed, type of recording instrument to be used, number of important associated personal to interview and any of the official governmental bodies associated to aflaj to be included.
2. Obtained field work fund from the yearly funded Omani government project related to Oman or the dry environment countries and managed by the "Thesiger Oman Fellowship, Royal Geographical Society, UK. (see the following site for the year 2009 and the title as shown "'An analysis of institutional arrangements of the falaj irrigation systems in Oman' An exploration of the distinctive institutional settings of the Omani falaj system, developed within a closed society, and the consequential demand for water as a result of the modern technology. <http://www.rgs.org/OurWork/Grants/Research/Thesiger-Oman+Fellowships.htm>
3. Because the waliyat of Nizwa is away from the Capital (about 160 km) and several visits were required to collect the data, a communications office was required. The University of Nizwa administrative body was approached for a request of an office with modern communication facilities. It helped greatly in saving expanses which were calculated for transportation from the capital city (Muscat) over several trips. Also, created some sort of academics face-to-face feedback, as Prof. Omezzine, Abdullah, x.Dean and Prof. Powers, D. , asst. dean were asked by supervisor to provide weekly session for answering questions raised from the field activity.
4. One of the key private members as far as the field survey is concerned is the wakeel. A list of their contact numbers and names is normally available for each district's mayor (governor), locally known as '*walis*'. Several official letters were sent through the head of the College of Commerce, University of Nizwa, to each associated local *walis*, who keeps details of the *falaj wakeel*, asking for permission to interview the *wakeels* and to obtain names and contact details.
5. A complete set of questions was formulated for each wakeel covering the main topic concerning the classification of falaj property rights; in particular, how much falaj rights were devoted toward common rights, private and quasi-rights. They were also asked whether there was an auctioning water market and how often it is operated and where²

¹It is worth noting that Wilkinson's analysis placed the system within an organizational framework and he stated that "the aflaj system is an organization for distributing water amongst those who have rights to it and to divide the property to water" (pg. 94). He also stated that "the word *falaj* is a generic term for a complete irrigation system" (Pg. 74).

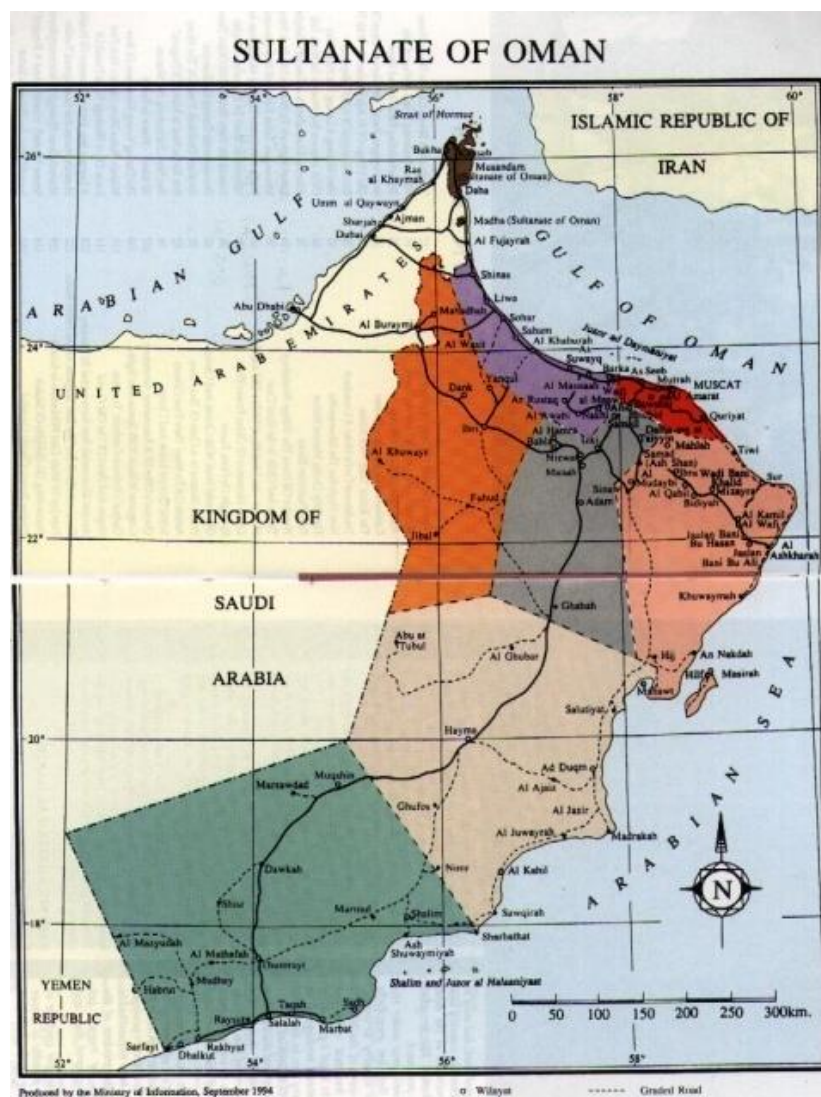
²Four interviews were conducted; two with the two wakeels Mr. Khamis Al Daishi, who responsible about one third of the private water right owners and Mr. Fahid Al Tobi who responsible with the other third and the governmental part-time employer who responsible about the bayt-mal water rights

6. After completion of the responses to all the questions, detailed records were obtained concerning a list of the property rights for all stakeholders, auctioning water prices and other related data. Some of the respondents were not ready at the proposed time of the first visit and in some cases data held by other members within the administrative falaj structure was obtained instead. Thus, names and contact address for other members of the local administrative committee were obtained. Due to difficulties in following up the list of property rights or understanding some of the auctioning terms used in relation to the water market, further visits were conducted to obtain clarification of these issues. Later on a great deal of material required similar clarification either from the wakeel himself or from other members, and in some cases interviews were completed via telephone calls.

The secondary data which for this study included official data on *falaj* flow, water auctioning prices and climatic data on rainfall and temperature. These were obtained from either the traditional recording books held by the *wakeels* or auctioneers

5. STUDY AREA

Falaj al Malki considered to be among the five Omani aflaj inscribed in the World Heritage List since July 2006. It was selected for several reasons. First, it believed to hold ancient indigenous knowledge with regard to the water institutional arrangements. Second, it is popular in its water flow reaching a level of 2000 litres per second. According to the last inventory of aflaj, the total irrigated area of falaj *al-malki* was a total area of 11,323,72m², which is approximately 72% of the total demand area of 15,727,39m² (MRMWR, 2000).



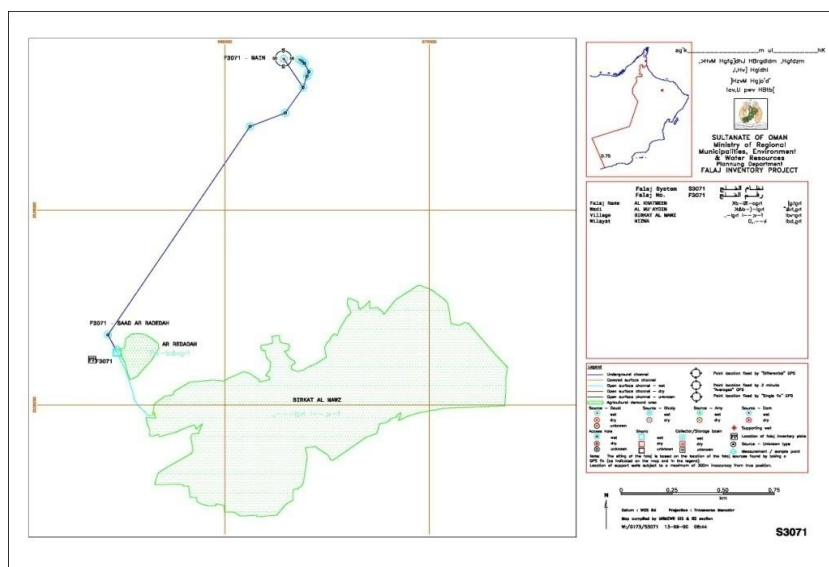


6. RESULTS

Oman has almost two distinct topographic areas; the mountainous zone areas, by which reaching altitude of 200-300 m, and the coastal plain areas descending to the sea level (Megdiche-Kharrat et al., 2017). It is the mountainous zone area where by most of the aflaj systems are found, specifically in the northern part of the country. It is well recognised that there are two important elements very much associated with the context of the systems; these are:

- The significant of the natural setting characterized by mountains and oases, of which have reflected upon the water supply.
- The development of legal and social organizational setting which based on belief and customary rules.

These have assisted greatly on the formation of what known as "settlements" or villages around legal known boundary. Hence Falaj Al-Malki was constructed in accordance with topography of the area by which has divided the *waliyah* of *Izki* into two main sections;



Source : (http://whc.unesco.org/en/list/1207/multiple=1&unique_number=1384)

Figure. 1: Falaj Al-Malki lay out map; mother well to irrigated areas

Location and History of Falaj Al-Khatmain:

Falaj *Al-Malki*, located near the ancient city of *Izki* at coordinate of N22 43 60 E57 46 00.00 (http://whc.unesco.org/en/list/1207/multiple=1&unique_number=1384), is one of very ancient aflaj.

Falaj administrative structure:

The *wakeel*, *Mohammed b. Said Al-Azri* was first contacted by phone and informed of a detailed study which included the falaj that he is administrating. He responded positively, and asked the author to meet at the main entrance of the city (see Fig. 3). During this interview overview insight concerning falaj Al-Malki water distribution (*baddah* and *raddah* local term see below) and water rights structure have been provided. It is worth noting that several interviews were conducted with him for two main reasons:

- The complexity of water management found within *Al_malki falaj* because this falaj is regarded as the largest in the region and thus possesses a large number of property rights which are distributed among different shareholders (this shall be discussed in details below).
- It is true that this *wakil* has received little or no education but he has great knowledge concerning water management that probably no one else in the area can provide. It is normal in Oman for this elderly generation, together with the vast majority, to be illiterate since formal education only started in 1970 with just a few schools. This ought to be viewed positively because most of the information was provided dealing with matters of custom which is passed by oral tradition from one generation to another.



Figure. 2: detailed interview with wakil *Mohammed b. Said Al-Azri*

After interviewing the first *wakil*; *Mohammed b. Said Al-Azri* he introduced us to the only *Areef Saiyd B. Nasser Al-Mahrooqi* who provided more details of irrigated areas and better explanatory terms for the *baddah* and *raddah* (see below). Finally, annual auctioned manager were introduced. Below is a detailed illustrative account of the revealed field survey conducted with these administrative falaj Al-Malki agents. It is worth noting although the *wakil* Mr. *Mohammed b. Said Al-Azri* was illiterate and held no written documentation for any related *falaj* matters, most of the time he tried to introduce us to a key administrative person within the community and sometimes took us to field sites for demonstrative purposes. Sometimes another visit conducted to him in order to clarify certain matters.

Falaj Al Malki: water circulation mechanism:

According to the *wakil* Mr. Mohammed b. Said Al-Azri who orally stated two important institutional arrangements by which *Al-Malki falaj* water is distributed to all shareholders. 1). *Al malki falaj* water must be distributed over a period according to the local custom of ‘nine *raddat*’, which means that the water must be delivered to users in turn over a total period of nine days. 2) This falaj holds 760 *athers* that can be delivered over the course of a one day.

Raddah is a local customary term which means ‘number of turns’ (plural *raddat*). It is considered as the main component of the distribution and allocation system known by custom as *number of raddat using plural term*, which means ‘rotation over a defined period’, normally a week or more. In the literature it has been indicated repeatedly that *dawrah* forms the principle of the distribution of water in aflaj (Wilkinson, 1977, Al-Ghafri, 2001).

A third visit was made to the *wakil* Mr. Mohammed b. Said Al-Azri for further clarification and deeper understanding. This time he took us to a very important member of the community who plays a major role in deciding how water is distributed in falaj Al-Malki. Mr. Saiyd B. Nasser Al-Mahrooqi is the only *Areef* for this falaj. He orally stated that unlike other neighbouring falaj (*Daris* in the town of Nizwa and *Al-Khatmeen* in the district of Burkat Al-Mouz), this falaj holds no *Bayt-al-Mal* water rights and less *Waqf*. Since most of the rights are private (*Aseelah* this shall be explained below) belonging to individual farmers, the role of the *Areef* is critical as he holds the knowledge of all water shares. In addition, he is responsible for attaching the annual auctioned falaj common rights to the potential bidders existing as private rights, as shall be discussed in more details below. It appeared from the first visit and discussion with the *wakil* that this falaj’s water distribution is a complex process and is difficult to come with a complete picture of its water right structure and institutional arrangement by which it operated. However, the several visits and meeting different administrative agents provided better clarification. In addition, going on a field tour with local people provided a better means of simplifying things. Below is a summary of the revealed information concerning how Al-malki falaj water is distributed among different shareholders under two main heading?

1. Custom names and fair distribution:

According to the *wakil* and the *Areef* there are nine custom names used as guidance in distributing water among stockholders. These names³ are attached to the Al-Malki nine *raddat* water circulations. How these are operated and what are their functions?

Table. 1:

Al-Nazar irrigated area			Al-Yemen irrigated area		
	irrigated local names	athar		irrigated local names	athar
Day1	Futih qadah	48	Day1	Futih qadah	48
Day2	Bani Hussayn	48	Day2	Bani Hussayn	48
Day3	Al Khaburah	48	Day3	Al Khaburah	48
Day4	start of shillal	48	Day4	start of shillal	48
Day5	Mid of shillal	48	Day5	Mid of shillal	48
Day6	remain of the shillal	48	Day6	remain of the shillal	48
Day7	Al-habtah	48	Day7	Al-habtah	48
Day8	half of radah	48	Day8	half of radah	48
sub total		384			384
		768			
Day9	falaj renting right	48	Day9	falaj renting right	48
Grand total		864			

Since the *Al-malki falaj* water continuously flows day and night, locally the time period of the complete day (24 hours) represents a distributive *raddah* (turn). Then this *raddah* is normally assigned to a particular irrigated area which is locally known by particular local name as shown in Table 1. These names are eight in principles because the ninth *raddah*

³We think these names operate in the form what is known as cluster, a group of shareholders which are attached within one name in order to ease the process of distribution.

set aside for the falaj renting common right. In addition, these names are well known by most members of the community and falaj administrative agents and they have three main function

- Used by all water share members (the private's rights holder) and the waqf rights in order to represent them in a form of group cluster. For instance, they say today's turn or *raddah* '*futuh qadah*' (shown on Table 1 as day1) and hence a group of identified private shareholders must received their water only when it turn to this known irrigated name. According to the *Areef* even some of the endowment rights are attached to it. Finally, the remaining all member evenly distributed in sequence over the other remaining names listed in Table 1.
- Allow fair distribution among shareholder in terms of day time and night period. Suppose falaj water flow on Day1 for name '*futuh qadah*' was on Sunday during night then after nine days the flow will be re-scheduled to this name again but this time during day time. Locally, they use two different time measurement units; they say 'day time *baddah*' and 'night time *baddah*' which in principle each hold 12 hours.
- Within the above-mentioned *baddah* division, there are other equal division with accordance to the movement of the hours whether during day time or night into equal quantum of time. In principle this is equal to one and a half hours. Added together, these eight periods must equal a full 12-hour period. An attempt is made to simplify these in a form of chart (see figure 3)

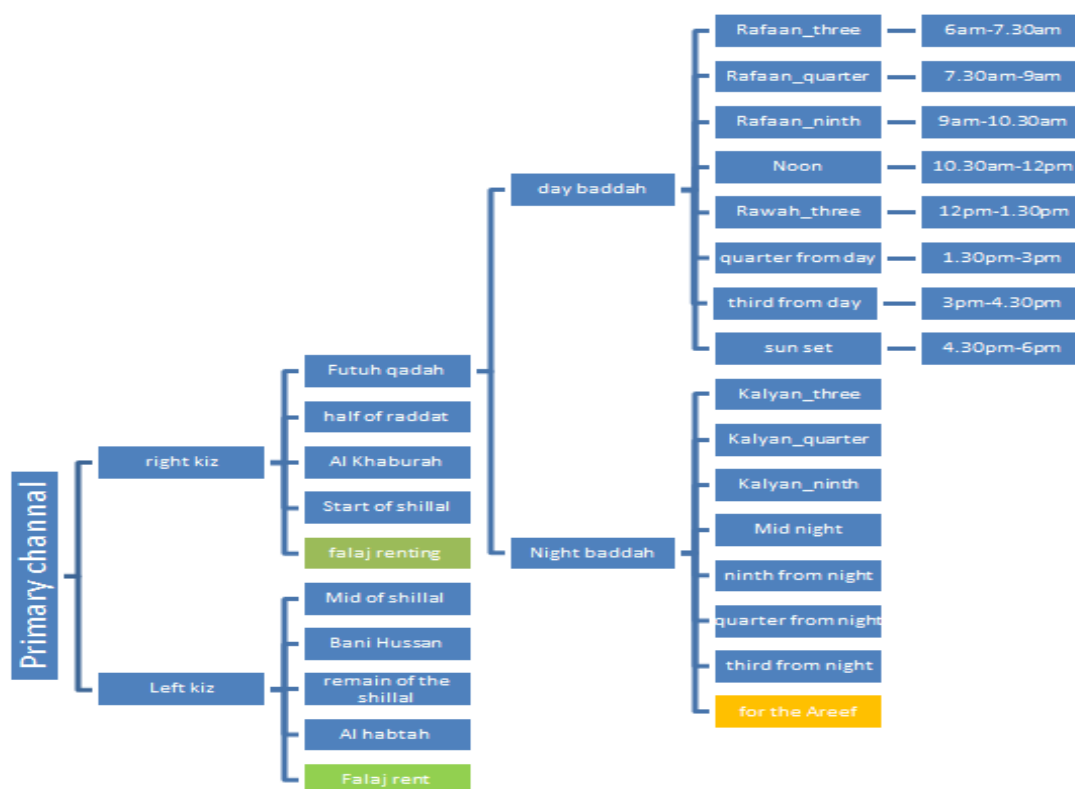


Figure. 3:

A simple process of comparison and calculation was used to understand and associate all of the collected information, in an attempt to produce a complete picture for this falaj. First, it was assumed that a nine-day *raddah* circulation must be equivalent to 18 *baddah* when simply multiplied by two to account for the fact that each day is also divided into 12-hour halves (day and night), that calculates upward to a total of 432 *athers*. However, as stated above the information received indicated that there are 760 *athers* in the system, so some water rights are not being included. Thus, another visit was conducted to the *Wakil* to clarify these matters. Since he was illiterate and held no written documentation for any related falaj matters, most of the time he tried to introduce us to a key administrative person within the community and sometimes took us to field sites for demonstrative purposes. Several important institutional arrangements concerning drought became apparent:

2. Drought mechanism institution:

During our second visit the *wakil* requested us to follow him to view very important institutional arrangements which, this time, reflected on the physical structure of the channels. Figure 4 clearly demonstrates that the primary canal of *falaj Al-Malki* is split into two. The water supply flows from the mother well into one main canal and once it reaches the main entrance of the town of Izki splits into two canals supplying different parts of the town. According to the *wakil* one is to irrigate the *Al-Nazar* area, sometimes referred to as the right channel, and the other to irrigate the *Al-Yemen* area, sometimes referred to as the left channel.

The *wakil* Mr. Mohammed b. Said Al-Azri orally stated an important institutional arrangements or a strategic way to solve the problem of drought. He stated this by indicated two main scenarios 1) during scarcity of water flow, the *Al-Malki falaj* main canal which is conveying water from the mother well to the main irrigated areas must receive administrative intervention by blocking one of the splitted canal divisions on turn. This intervention allows the flow of water to irrigate *Al-Nazar* area and the *Al-Yemen* area on turn. Furthermore, this intervention alters the normal nine-day raddat to almost double to an 18-day cycle. 2). during abundance of water no intervention is required and thus the water flow naturally between the two indicated main areas; *Al-Nazar* and *Al-Yemen* and therefore the nine *raddat* circulation remain for each canan without combination.

To appreciate the implication of this division, it is important to analyse it from the perspective of equitable water distribution. This shall be illustrated and explained with accordance to the given local information. But first we thought is appropriate to illustrate this implication concerning the opening and closing of the two divided channels because, as the local view, played a major role in securing equitable water distribution among shareholders. The revealed survey result show two different institutional arrangements apply for two different situations:

2.1. During abundance of water supply:

When the flow of water supply is high, the strategy is to allow the water to flow naturally without any intervention into two different canals in order to irrigate the two mentioned areas (see figure 4⁴). This has, according to the *wakil*, particular institutional arrangement implication as follows: the nine raddat distributional scheduling applies to each canal. That is each canal is distributes water among shareholders over a nine raddat circulation. This might help explain the difference between the 432 and the 760 athers discussed above. During abundant supply the nine raddat can be doubled compared to periods of drought to 18 raddat (which is equivalent to 36 baddah) and calculated again over the two half-day cycles to sum up to 864 athers. This is still not clarify the 760 athers given by the *Wakeel*), but still further clarification was needed to complete the picture. This shall be explained under the *falaj* common rights discussed below.



Fig. 4: High water flow with no intevension to the canal

⁴Note this photo was obtained from the Ministry of Regional Municipality and Water Resource Published in the year 2000. The reason for this because during our visit the water flows of this falaj was very low as this can be seen from figure 4 which the authors were obtained.

3. during scarcity of water (drought):

In contrast to the above illustrative abundance of water flow, when water flow becomes very low the following institutional arrangement intervention applies: one canal at a time must be blocked using a wooden small piece (see figure 5) in order to allow the water to irrigated one of the mentioned area at a time. This reflects different institutional arrangements as follows: 1) since the amount of water available is less, more time is needed to complete the nine raddat distributional scheduling. This meant that the raddat is now extended and widened to 18 days. 2). Farmers are required to plan for growing fewer crops. 3) Farmers require rent more water from the falaj common rights (as this will be discussed below). Although the water is now very low, access is the right of all shareholders not being affected by the drought. In fact, the effect has been controlled through the implementation of the institutional arrangements for the channel division.



Figure. 5: Low water flow with invention to the canal (wooden piece)

Falaj common right:

1. The weekly auctioned:

This is the most common auctioned right and possesses two particular features. First, it is closely linked to the water distributional raddat circulation (see Table1). Here a whole day is assigned for falaj income generation and is mainly used for its day-to-day maintenance. Second, *Mr. Mohammed b. Said Al-Azri* showed an important institutional arrangement by which the weekly auctioning process must be regulated. He stated although during scarcity of water supply raddat circulation must be extended to 18 day, the Al-Malki falaj common renting right must not be modified during drought period. It must remain of holding two separated whole day for each irrigated areas; one *Al-Nazar* and the other for the *Al-Yemen*. In fact, he strongly emphasis the fact these rights must be increased its irrigated period from hold a one hour and a half during the abundant water supply to three hours (almost doubled) during the drought period.

To appreciate the implication of this institution toward the water market auctioning prices and how potential water bidder reacts, time series data concerning actual auctioning process were collected and analysed. This obtained from a person locally known as *khatab* (recorder), he is locally known by the term '*dafter*', literally meaning recording books, always present during the auctioning process the recorder *Mr. Salim b. Nasser Al-Azri* was introduced.

His main function is to recorder an important information associated with the bidding process; include the irrigated time local names (first of night, mid of night etc), names of the bidders, and auction prices. We asked the *khatab* to view these books and, if possible, to photocopy some of its pages for the purpose of the study. He agreed on the condition that the contents remain confidential and that they were returned quickly. Before analysing this data, it is important first to understand the above-mentioned items and what they mean.

The field survey reveals that Al-Malki falaj water distribution is based on two main institutional arrangements: 1) the separate arrangements for managing drought and abundance using the primary channel division; and 2) The use of local names attached with the system of nine *raddat* circulation.

In every nine days, participants from the community gather to take part in very active water auctioning bidding process⁵. The auctioning items in this process are local names which are traced back to the main irrigated measuring unit 'day baddah' and night baddah' by which then divided into eight different names. Now these names which are divided into an equal quraqum time irrigated period, each hold one hour and half represent an item by which are auctioned. It was observed during the author's attendance of the auctioning process the following:

- There are many local potential bidders interested in renting one or more of the irrigated names
- The main benefit of buying these names is to add extra water to their existing right or supply water to their farms which hold no right.
- This will be applicable for the week after the auction.
- The auctioneer asks all of the participants, including the administrative agents, to start the auction by giving an opening price.
- In each round interested bidders respond to a fixed-incremental increase in the value of the irrigated names until no increase is received and remain only one bidder who shall take this irrigated name
- *dfter*, who present, will record this irrigated name and by whom is bought and the final auctioned price
- Then they will take the next irrigated name to represent a next auctioning item and so on.

Further investigations of these auctioning items along to their auctioned prices were obtained from the *khatab* (recorder) in the form of a time serial. Two different years were selected for the purpose to analyses the refecton of the institutional arrangement applied during drought vs. abundant of water supply. Table 2 summaries the auction items with their bided prices for the year 2005 and 2008.

Table 2: Actual bided auction prices for the year 2005 and 2008

	Price RO	
	05/07/2008	03/07/2005
Day Baddah		
Rafan_three	16.5	4
Rafan_quarter	16	4
Rafan_ninth	16	3.7
mid of the day (noon)	16.2	4.8
Rawah_three	17	5
from day quarter	17.7	5
from day three'	19	5.1
sun set	20	6
Night Baddah		
Kalyan_three	20	6
Kalyan_quarter	21	5.3
Kalyan_ninth	23	5.1
mid night	20	6.3
from the night ninth	18.8	6.7
from the night quarter	12.6	8.3
from the night three	16	8

⁵The wakil was contacted to grant permission for the authors to observe this auctioning process. A research team comprised of the supervisor and his wife, one faculty member from College of Commerce, University of Nizwa have attended (photos were taken but for the reason of ethic were asked not to publish but are available to view in request.

The two columns of data shown in Tables 2 and 3 indicate actual bidding prices for the years 2005 and 2008. These were selected from the time-serial data obtained from recorders for the purpose of analysing the two institutional arrangement scenario concerning falaj common right.

- Scenario one: during abundant of water flow, the common falaj right hold quantum portion of one hour and half. This can be seen in 3 for the year 2005. In fact, Al-Malki falaj water flow recorded was high at 59.7 litres per second (Aflaj Dept., 2009).
- Scenario two: during scarcity of water flow then *falaj Al-Malki* doubled of the quantum portion to three hours. This can be seen in Table 3 for the year 2008. In fact, Al-Malki falaj water flow recorded was low at 24.8 litres per second (Aflaj Dept., 2009).

According to 3 these two scenarios highly influence auction prices, as during 2008 prices were almost doubled than those obtained in 2005. First, this must be explained within the context of the rules applied during drought and abundant water supply of the two scenarios; during abundant of water flow the amount of the water available for renting naturally left at the initial setting of one hour and a half and the flow in the two channel is also left without intervention. Second, one can associate demand supply theory. As water supply became scarce in the 2008, dramatic reduce almost of the half that was in 2005, there were very high bidding prices. This situation probably attracted many potential bidders because of their high incentive to irrigate their farms.

2. Annual rented falaj rights:

Beside the weekly common falaj rights, there are certain water rights referred to as '*muzyadah*', meaning the bit left over. That is the right to use water for a period of time in this case one year. The wakil introduced another important member administrative agent; Mr. '*Yasser b. Saleh Al-Tobi*' and he currently manage the annual rented falaj rights. According Mr. '*Yasser Al-Tobi*' in every year in the month of *Muharram* (the first month of the year in the Islamic calendar) 51.5 *athers* are auctioned to potential buyers from the town of *Izki* and the revenue from the auction of these *athers* is used for maintenance of the major delivery system. Then Mr. *Al Tobi* was asked to provide a time series of prices paid on the auction for annual rights. At first it was difficult to obtain but when it was explained that the data was needed to provide a complete description of the falj system and its historical setting, he agreed. A list of the annually auctioned *muzyadah* was obtained for the period 1992 to 2008. According to this list the auctioned price was RO 5,232 in 1992 while it was RO 2,945 in 2008. The differences in the auction prices are caused by the difference in flow rates. According the records of the Ministry monitoring water flows for this falaj the flow during 1992 was 780 litres per second which attracted buyers pay high prices while in 2008 it was only 250 litres per second which made buyers less willing to pay.

Table. 3:

Years	Price/ather R.O	Average flow litre/s
1992	5232	0.078
1993	4322	0.032
1994	6035	0.022
1995	5089	0.033
1996	2230	0.029
1997	1424	0.220
1998	957	0.267
1999	2541	0.123
2000	2687	0.025
2001	a.n	0.016
2002	a.n	0.009
2003	2084	0.009
2004	1839	0.008
2005	1545	0.055
2006	972	0.044
2007	1181	0.039
2008	2945	0.025

7. SUMMARY

A final visit was made to the *wakil Nasser Al Azri* for further clarification and deeper understanding. This time he took us to a very important member of the community who plays a major role in deciding how water is distribute in falaj Al-Malki. Mr. *Saiyd B. Nasser Al-Mahrooqi* is the only *Areef* for this falaj. He orally stated that unlike other neighbouring falaj (Daris in the town of *Nizwa* and *Al-Khatmeen* in the district of *Burkat Al-Mouz*), this falaj holds no *Bayt-al-Mal* water rights and less *Waqf*. He went to say 'most of the rights are private (locally used the word *Aseelah*, which mean original) belonging to individual farmers.

Locally there is an important exchangeable term very often used to refer a private right: *Aseela* (which means genuine). They try to relate all these private rights to the historical and the original sources. During interviews with members of the community the term *Assela* is more appropriate to use than the other term *mulk* (means ownership) He attributed this to the fact those water rights which lie within the boundary of the community and must be historical documentation preserved. However the survey reveals that the documentation of these rights are rarely exist but it was found are highly protected and passed from generation to generation through custom.

8. DISCUSSION AND CONCLUSION

The fast body of literature concerning the possibility to assert private ownership to a watercourse, discussed in section two, can be linked with the revealed survey result. Probably the revealed results for the falaj daris institutional arrangements have reflected upon this link from two main prospective. First, the difficulty to use a measuring unit over a watercourse in order to transact water rights (Dales, 1968) . Second, the present of risk variable, which is associated with fluctuations in water supply, and how to overcome this? These can be discussed from the two main finding; the raddat measuring unit and the existing of the customary legal system.

The first perspective of the use of raddaht can be viewed as the prevelling and forming the based on the institution for private ownership. This has overcome the problem of a watercourse being fleeting resource, mobile and so large that it makes it difficult to use a measurable unit. Probably the use of time, ather (reflect the shade of a stading person and how water flow over in accordance to the movement of the sun) rather than the use of volume (*qiyas*).

The second perspectives can be further discussed using the revealed result on the customary arrangement to overcome the watercourse supply fluctuation. We are in favour with the developed stages by Rose (1991)⁶ on how water can be transferred through three main stages as it become scarcer. We belief is the significance of stage two where the resource becomes less plentiful, and where property rights begin, and where customary arrangements (implemented) by a group start to begin. Furthermore, it is important to view the present of the legal system over the development of institutional arrangements. The Arabic word “urf”, which means custom, has particular implication within the Muslim community. Kamal (1991) indicated that within the Islamic legal system there is room for two sources of opinion and speculative analogy. This shows that the Islamic laws, which are based on judicial opinion or on speculative analogy, have often been based on prevailing customs. For example, Kamali (1991) demonstrated the use for the concept of ‘custom’ within changing circumstances that might occur in society, where it was stated that “it is permissible to depart from the custom on which they were founded if it changes in the course of time” (pg. 285). This is exactly how the private water rights and other rights operated over the flow of the Daris water fluctuation as this investigated over the revealed results.

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⁶Stage one is where any given resource is un-owned, unmanaged, and open to all. Stage two is where the resource is less plentiful and is appropriated by a group. Stage three begins when the resource is scarce enough to be subject to full-blown individualized property rights.

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