



ReWater MENA Project

2nd NLA meeting in the Northern Jordan Valley – December, 3rd 2019

Draft report



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Objectives of the workshop, agenda, and participants

Objectives of the workshop

This one-day workshop was planned at the end of the 1st year of the ReWater MENA project in Jordan. The objectives of the workshop were to:

- Get to know each other (for the participants);
- Present the irrigation water status in the Northern Jordan Valley;
- Have inputs from the participants on the opportunities and threats related to the use of treated wastewater reuse;
- Have inputs from the participants on the challenges and potential solutions related to the use of treated wastewater in agriculture;
- Start discussing about this topic with farmers.

Detailed agenda

The agenda planned a succession of various activities, both in plenary sessions and working groups. (cf. **Error! Reference source not found.**). Despite this overall planning changed along the workshop, most of the activities were done at the end of the day.

More precisely, the workshop was divided in three main sessions: first, introducing the workshop objectives and the reason of focusing on the Northern Jordan Valley; second, based on the GIZ experience in wastewater reuse, discuss the possible options when water is lacking; finally, the last session was made to gather inputs from the participants on the challenges and solutions related to the use of treated wastewater in agriculture. While the first session was mainly supposed to be done in plenary, the second was a mix with the GIZ presentation followed by group activities, and the last session was entirely dedicated to group activities.

The group activities were meant to be done under a brainstorming form, facilitated by staff from RSS and Lisode consultant in Jordan, Emad El Khalil, in order for the participants to discuss all along the workshop in Arabic.

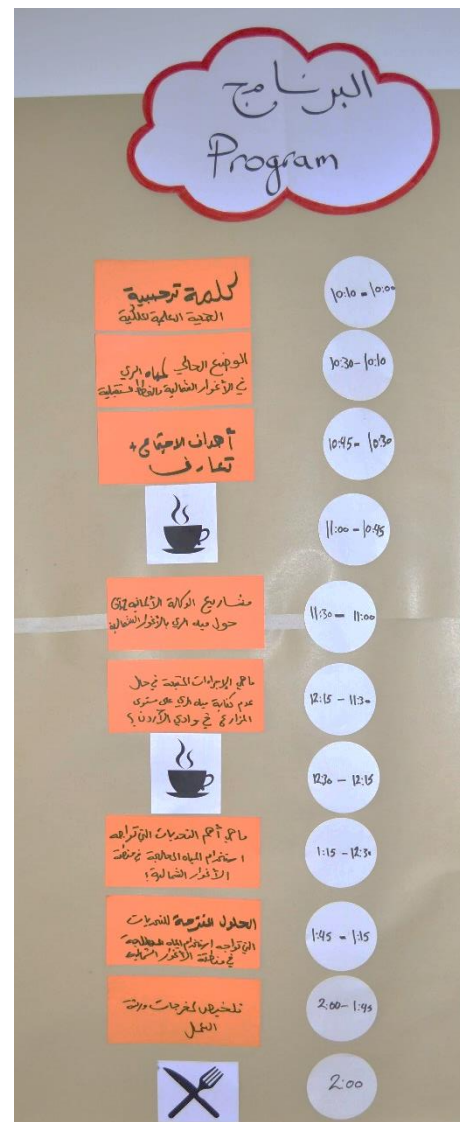


Figure 1. Agenda of the workshop, posted on the room

Participants of the workshop

The table below shows the list of participants who attended the workshop and contributed to the working group sessions. The workshop gathered a total of 44 participants, with a gender ratio close to 22% (more precisely, 82% men and 18% women). Also the workshops participants represented different stakeholders, with 30% of farmers, 40% of NGOs, 30% of government representatives.

List of participants of the workshop, see Annex A.

Report of workshop activities

Opening sessions: plenary presentations

The workshop started with opening words from Dr. Almoayied Assayed, who replaced the workshop within the ReWater MENA project and how the choice was made to have this workshop in the Northern Jordan Valley. Dr. Assayed also introduced the project team working for this event organisation and facilitation.

Then, Eng. Fadi Beshtawi, Director of the North Jordan Valley Office (JVA) followed with a short introduction and presentation on the status of irrigation water in this region of Jordan.

Those opening presentations ended with a quick presentation of the workshop objectives and activities, as well as an individual presentation of the participants. One at a time, they stated their name and their status, so that everyone gets to know “who is who” during this event.



Figure 2. Dr. Almoayed Assayed introducing the workshop with welcoming words.



Figure 3. Eng. Fadi Beshtawi, Director of the North Jordan Valley Office presenting the status of irrigation water in this region of Jordan.

Working group activities in the session 1 and 2

In the next activities, it was planned to split the group in five smaller working groups discussing the same topics at the same time, according to the agenda. In order to ensure that participants would manage to collectively work, one facilitator was appointed to each working group with specific instructions that had been given upstream. The participants were free to constitute their own groups, without interferences from the facilitators or organisation team. All the facilitators (4 Jordanians and 1 Egyptian) were chosen for their ability to speak Arabic as well as to their experience in terms of group facilitation and animation; amongst others, those conditions ensure that every participant can feel free and comfortable to express himself – which is why it was avoided to have English spoken in the working groups.

Generic proceedings of the working group activities

The different group activities were designed under the similar approach of a brainstorming methodology, than adapted to the specificities of each activity.

A brainstorming activity gives the opportunity to open up discussions and allows different viewpoints to be expressed. One of the objectives is to enable each participant to express his opinion and to ensure all viewpoints are heard. A brainstorming method is used to generate a wide range of ideas in a short space of time while involving all participants.

For this method the facilitator firstly gives the instructions to the participants: they have three colourful cards each to write down the most important ideas they have related to the question the facilitator asks (and that is displayed on the craft paper on the wall). After five to ten minutes thinking about it, the participants write one idea per card and prioritize their ideas from the most important one to the least. The facilitator then picks up the first card of every participant and then enounce the ideas one after the other, requiring the author to provide more explanations or clarifications if needed. Each card is taped on the craft paper on the wall, and similar ideas are grouped together. After different turns, the activity is done and the result is usually quite visual, with group of cards related to similar topics for example.

Anticipated and general observations of the group activities

Despite the preparation the group activities started in the session 1 with some confusion and disorder that finally managed to be tackled. One of the problems of the location came from the sound, whether the electronic sound system, or the natural sound that echoed in this large and empty room. We adapted the room set-up to this place but the room characteristics contributed to this “confused” beginning as it affected the listening quality.

Also, the facilitation team was a little bit disturbed when starting the activities as there were quite some differences between facilitators that had followed Lisode training and the ones that did not; some of them surely had a better experience in this type of activity then others; and on top of that, the number of participants was not expected to be so high, which implied the last minute briefing of some facilitators. Those issues that the team finally managed may explain some differences observed in the results of the different group activities.

In the following paragraphs, the tailored proceedings will be presented with the objectives of the activity. The results of the discussions will be then presented in a table based on the original posters created during the workshop, and also subject to an objective analysis. All the posters can be found in a readable half or full-page format in the “Annex A: NLA Attendees List

الاجتماع التشاوري الوطني الثاني

حول التحديات التي تواجه إدارة مياه الري في الأغوار الشمالية والطرق المقترحة لنتظب عليها

تاريخ ٢٠١٩ / ١٢ / ٣

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٠٧٨٧١٣٧٩٣٣		جمعية المدعية الثالثة	محمد محمد المنارة	٧

Annex B: Posters from the working group sessions”.

Session 1

This session was focusing mainly on the question of water availability for irrigation, and more precisely aimed at identifying the farmers options when they water is lacking. To have a more interactive and beneficial presentation, an active listening method was adopted.

Presentation from the GIZ

Before the GIZ presentation, each participant was given a colourful card and a marker and they were asked to write one point of the presentation that what was unclear or that was really important to them (in a positive or negative way).

Eng. Ihab Hammoudeh, form GIZ, presented a summary of GIZ previous study during 2003-2011 about the safe use of treated wastewater in the Jordan Valley. The scope was to study the use of treated wastewater in agriculture in the Middle Jordan Valley, and to investigate the risk aspects and management plan for the safe use of treated wastewater upstream and downstream of King Talal Reservoir. He focused on the statement concluded by Dr. Duncan Mara, in 2011; who summarized: "Based on field observations, data and the results of the risk analyses, it can be confidently concluded that the irrigation practices in the Jordan Valley and upstream of KTR are extremely protective of human health; and that the whole system of food production in these locations is more than fully compliant with the 2006 WHO Guidelines. In my opinion the wastewater-use practices in the Jordan Valley are amongst the very safest in the world and are comparable to those in, for example, California."

At the end of the presentation, the participants were invited to have a coffee break in the entrance, which also gave them some time to discuss about the morning activities and sessions. After that break, Emad Al Khalil (facilitator) picked up the card written by the participants and then presented them. This activity was made to start providing answers to some of the clarifications (and cards), not to answer every question; the organisation team engaged to provide more developed answers to those questions in this report. And as written in a comment on the evaluation form, this presentation seemed not so clear and easy to understand for some participants.

Besides this session generated some strong reactions among the participants as irrigation and water needs for agriculture in the region are very sensitive topics.



Figure 4. Eng. Ihab Hammoudeh answering some of the participants' questions.



Figure 5. Emad Al Khalil, facilitating the discussion around the presentation made by GIZ.

Questions to GIZ

The questions and clarifications written by the participants are presented below, with answers associated when it is possible to do so.

- ✓ **What is the treated wastewater suitability for fish farming?**
- ✓ The treated wastewater is not suitable for fish farming and causes usually fish kills. **Have awareness sessions been held for the people in the area regarding the use of treated wastewater?**
- ✓ Yes, several awareness sessions were held for the farmers, however all the GIZ research and field tests were done in the Middle Jordan Valley but not in the Northern one. **Are the pipes in the farms appropriate for the use of treated wastewater?**

The main distribution pipes can be used for either the fresh or treated wastewater. However, the treated wastewater has to be with very low solids content so as not clog the drip irrigation system.

- ✓ **Is there filtration for the treated water?**

The current upgrading of the wastewater treatment plants could include further filtration units so as to be suitable for the drip irrigation network.

✓ **What are the pros and cons of using the treated water?**

Using the treated wastewater can provide more irrigation water quantities for the farms, and it can reduce the quantities of fertilizers needed for the trees. On the other hand, farmers expect that the treated wastewater may affect the crop patterns from citrus trees to vegetables, which is not the case if the treated wastewater is used properly.

✓ **What is the quantity of treated water coming out from North Shouneh water treatment plant?**

✓ The current quantity of wastewater treated by North Shouneh WWTP is around 500 m³/d. **What is the treatment method used at the plant?**

✓ The treatment system in North Shouneh WWTP is natural ponds. **What is the salinity of water coming out of the plant?**

The wastewater treatment plants usually do not treat the salinity. Therefore, the salinity levels at the inlet and outlet are almost similar around 1500 mg/l , varies between Summer and Winter.

✓ **Was the concentration of boron in the treated water measured?**

✓ Boron was not tested in the GIZ study nor RSS monitoring programme. **How to reduce the pumping of drinking water to Amman?**

Pumping of drinking water to Amman can be reduced if other fresh water resources are discovered such as new fresh water aquifers or by installing desalination plants.

✓ **Are there any bacterial injuries in case of contact with the distribution team?**

The possibility of the bacterial contamination due to using the treated wastewater is very rare. Nevertheless, there are several safe practices have to be followed by farmers when dealing with the treated wastewater to avoid bacterial contamination.

Group activity 1: What are the procedures to follow in the event of insufficient irrigation water at the farm level?

Group activity 1: Objectives and detailed proceedings

In this activity the facilitator asked the participants about the procedures they follow when irrigation water is not sufficient at the farm level. The objectives were to gather participants’ inputs on that topic, especially trying to understand their individual/collective strategies to face this problem.

RSS objective to ask this question is that:

Farmers’ objection in the workshop for using the treated wastewater is expected in advance. Given that there is a shortage in irrigation water quantities currently, and this shortage will increase year after year; then farmers should be notified by this situation in order to participate in the relevant decision-making.

Group activity 1: Results of the working groups

<p>Group 1 [Agricultural practices] Follow the crop pattern under the supervision of the Ministry of Agriculture Avoid cultivating the entire area of the farm (the agricultural unit), and cultivate part of it instead [Irrigation and drainage] Grant farmers licenses for drilling wells Dig agricultural pools Build sand barriers Clean agricultural drainage (networks used for draining the excess agricultural water)</p>	<p>Group 2 [Water quantity distribution] Request additional water quantity above the daily share from the authority through pumping bigger volume of water Reduce amount of water given to irrigation Irrigation process to take place in the evening Request to have extra hours of water supply from the Jordan Valley Authority, which results in having an increased share above the planned water portion [Water management] Collect water in an agricultural pond [Technical components of an irrigation system] Use a modern irrigation system Request to change water valves [Agricultural practices] Grow crops that need less water consumption</p>
<p>Group 3 [Dialogue with concerned authorities] Discuss with the responsible authority for distributing water Request assistance from the Water Users Association and the Jordan Valley Authority Call on the Jordan Valley Authority and inquire about the water distribution explanations, seeking for the increasing the number of irrigation hours [Agricultural practices] Find crops that need less water consumption Reduce irrigated farming areas [Water quantity, water management and technical components] Use modern irrigation systems Find alternative water resources Reduce the used amount of water Check the irrigation system on the farm</p>	<p>Group 4 [Agricultura practices] Reduce the cultivated areas Grow dryness tolerant crops Cover the agricultural holes Study the crops’ needs of water, and design an irrigation program to suit the available water [Irrigation ‘terms and conditions’] Reorganize the irrigation schedule to reduce irrigation periods and the amount of irrigation water. Reduce the irrigation period for the crops Crops irrigation to be in the early morning and evening times The use of modern methods of irrigation Use drip irrigation Request additional water quantities from the Jordan</p>

<p>Group 5 High soil salinity Negative effect on fish and fruit trees The quality of TWW is not acceptable for some crops The possibility of infection and the spread of diseases and germs when in contact with TWW Reduces the trees' productivity, and reduces the fruits' taste quality A negative impact on the products marketing</p>	<p>Valley Authority [Awareness raising] Raise farmers' awareness on balanced water consumption [Water shortage and alternative water resources] Investigate the reasons of the irrigation water shortage Use treated wastewater for irrigation after being mixed Use groundwater</p>
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Note that what is in brackets like "[Water management]" was added afterwards to help the reader understand the different categories; other words were written by the participants themselves.

Group activity 1: Cross-analysis between the different groups

The first observation in the group results comes with the group 5 results, that are rather and answer to the problems related to reuse of treated wastewater than the question that was given for this activity. Launching this group was a bit difficult at the beginning and came with vague instructions and poor facilitation. Compared to the four other groups, the results are obviously out of the topic activity, though we will integrate them in the analysis done for activity 2.

Thus, the following paragraphs focus more on the results of groups 1 to 4. First of all, one topic was **unanimously identified as a potential solution, the agricultural practices** and more precisely, the possibility to have either **drought-tolerant crops**, and/or different **crop patterns**.

The question of **water availability for irrigation** was also prevailing in the four groups, with one group being a little bit less explicit about it. Therefore, the solutions were quite different, with some groups suggesting that **irrigation should be reduced**, but also **reorganised**, and that **some more water should be made available**. Two groups suggested to have **technical solutions** that can help reduce the amount water used for irrigation (e.g. modern technics, drip irrigation); two groups also suggested to look for **alternative/other resources**, one being more precise and suggesting to use both groundwater and treated wastewater. **The irrigation reorganisation** was mentioned (two groups) as part of a **request to the Jordan Valley Authority**, one group discussing the possibility of a dialogue with the concerned authorities.

Some more isolated ideas raised out the discussions, such as the need **to raise farmers' awareness** about a balanced water consumption, as well as the ideas to **have licences for farmers to drill wells**.

In a few words, this activity showed that the participants **think about how to tackle this lack of water**, though the discussion was rather around mid to long-terms solutions, **with no explicit tendency**. Some participants were more oriented towards irrigation reduction, while others rather seemed to be keener to keep their practices but have technical improvements that help reduce water, and finally others requesting more water available for irrigation.

Session 2

Group activity 2: What are the most important challenges facing the use of treated wastewater for irrigation in the Northern Jordan Valley?

Group activity 2: Objectives and proceedings

For this second activity, the facilitator asked the participants what are the most important challenges related to the use of treated wastewater for irrigation in the Northern Jordan Valley, from the participants point of view. As per the group activity 1, the objectives were to launch discussions on

that topic, in a productive and collective way, in order that participants can express themselves on the topic, and for us to understand their fears and the reasons why they do not seem so keen to reuse treated wastewater for crops irrigation.

The proceedings were exactly the same, though a last component was added after the discussion. After all the cards were displayed, the facilitators gave stickers to the participants, so they can vote for the more important ideas displayed on the wall.

Group activity 2: Results of the working groups

The table below shows the results of group discussions on the challenges associated to the reuse of treated wastewater (TWW).

<p>Group 1 [Negative impacts on trees] Causes damage to citrus trees Negative effect on trees Reduces trees productivity and quality of fruits taste [Negative impact on markets] Negative impact on products marketing Negative effect on some vegetables (productivity, product quality) [Soil degradation] Increases the soil salinity Causes soil degradation [Environmental pollution] Environmental Pollution Causes fish death</p>	<p>Group 2 [Negative impact on production] Negative impact on perennial trees because of high salinity Reduced agricultural production Elimination of livestock and fish production [Contamination and pollution] Spread of bacterial diseases coming from TWW Soil pollution [Religious concerns] Contradiction with the Islamic law principles against using TWW for agriculture [Negative impact on markets] Negative impact on marketing Consumer refusal to purchase agricultural products irrigated with TWW [Impact on technical parts] Negative impact on the irrigation network reducing its life span [Guidance to use TWW] Lack of agricultural guidance on the use of TWW</p>
<p>Group 3 [Poor TWW quality and risks] Unacceptable quality of TWW for some crops Not suitable for fish farming TWW cannot be used alone and needs to be mixed to improve quality [Contamination] Risk of infection and spread of diseases and germs when in contact with TWW [Impacts on irrigation systems] Algae appear on a water surface Affects the irrigation network life span Providing of drinking water while using the treatment</p>	<p>Group 4 [Soil degradation] Increased concentration of heavy elements in the soil High soil salinity Soil degradation [Impact on water and irrigation system] Increased salinity of irrigation water Clogged dripping holes in the drip irrigation system [Negative impact on production] Negative effect on fish and fruit trees Negative impact on production [Contaminations risks] Direct contact has a negative effect Increased pathogens affecting the trees in the soil High cost of diseases control Possibility that farmers get infected</p>
<p>Group 5 (including results of the 1st activity) [Negative impact on productions and crops] Negative effect on trees, fruit trees and fish Reduces trees productivity and fruit taste quality Negative impact on the products marketing [Poor quality of TWW] Contains heavy elements like boron, zinc and lead Quality of TWW unacceptable for some crops [Pollution and contamination] Environmental Pollution High soil salinity Risk of infection and spread of diseases and germs when in contact with TWW [Responsibility for damages on crops] The government does not endure responsibility of the agricultural damages resulting from the damage of the crops</p>	

Activity 2: Cross analysis between the different groups

The overall group results show the participants concerns associated to various impacts of the treated wastewater quality, from the impact on crops to the risk of environmental pollution as well as the public hygiene issues, and **the groups seem to be concerned by similar challenges** related to the use of treated wastewater.

In more details, the group results show that **treated wastewater quality** is an important challenge to everyone and more specifically the **problems of water and soil salination**. Most of the groups also discussed the **negative impact of treated wastewater on crop production**, whether it affects trees productivity, fruit taste quality, or fish farming. According to them, this type of water resources would be responsible for a loss of production, apparently both in terms of quantity and quality.

Which explains that two groups discussed **the impact on food markets** in both ways, whether because consumer do not feel comfortable in buying products that have been irrigated with treated wastewater, or because the quality of products sold decreases.

Besides the groups appeared quite concerned by the **pollution and contamination** challenge of treated wastewater. In the group discussions, almost **all levels of contamination have been discussed**, from water quality, to crops and soil contamination by diseases and germs, to the farmers' exposure to sanitary issues, and until the markets and potentially the consumers.

To those social and environmental considerations, three groups out of four added the **technical issues** that must be highlighted when using treated wastewater. Indeed, two groups explained that using treated wastewater was responsible for **a decreased life span of the irrigation system**. And a third group added the **challenge of algae development** in this type of resources, as it also has technical consequences such as the **clogging of drip holes**.

Only mentioned once, the two following topics yet need to be highlighted as they can explain some reactions and unacceptance of the reuse concept. First, some participants of a group explicitly wrote that **reusing treated wastewater was not accepted by the Islamic law principles**, which cannot be put aside. Then, the **lack of guidance on how to use this type of water resources** was expressed by some participants, maybe willing to know more about it. Finally, a group of participants discussed the **responsibility issue in case the use of treated wastewater causes damages on crops**, saying that the government is not responsible for that.

Finally, despite a vote system was suggested, the groups ran out of time and did not have all the chance to vote. For more details on the ideas and challenges that some participants vote for, please refer to the picture of the posters that are added on the Annex A: NLA Attendees List

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تاريخ ٢٠١٩ / ١٢ / ٣

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Annex B: Posters from the working group sessions.





Figure 6. Groups working during the activity 2.

Group activity 3: What are the main solutions to use treated wastewater for irrigation in the Northern Jordan Valley?

Group activity 3: Objectives and proceedings

In the last activity, the facilitator based the question to be answered on the results of the voting done at the end of activity 2 so that the participants think about potential solutions that could tackle the most important challenges raised before. Once again, the objectives were to raise the discussion between the participants, to have some participants' inputs on that topic, especially trying to understand what they may have been thinking about to be able to reuse treated wastewater.

Group activity 3: Results of the working groups

The table below shows the results of group discussions on the potential solutions that could solve the most important challenges associated to the reuse of treated wastewater.

<p>Group 1 [Agricultural practices] Follow the agricultural pattern to provide water for citrus and vegetables [Water quantity] Increase the water pumping hours for farms from King Abdullah Canal [Water quality] The TWW contains a group of chemical elements that provide agricultural fertilizers for crops</p>	<p>Group 2 [Lessons learnt and experience sharing] Exchange experiences with countries using treated wastewater [Scientific perspective: pilot areas with monitoring] Apply scientific studies on the safe use of TWW; quantities to use and their impact on the agricultural crops, and the establishment of a testing area Create a monitoring body to study the safe limit of using wastewater [Education] Educate farmers and consumers about the importance of using treated wastewater [Water quantity] Build new dams for collecting water Create agricultural ponds inside the farm to collect water Install filtering system at the level of stations and farms [Religious concerns] Issuance of a religious directive (fatwa) to allow the use of TWW</p>
<p>Group 3 [Water quality] Mixing TWW with water from King Abdullah Canal [Water quantity] Pump from the Mujib dam water to the northern region and use it for agriculture</p>	<p>Group 4 [Monitoring quality and efficiency, improve quality of TWW] Increase the efficiency of treatment plants, use the latest technology to treat water from the plants, and enhance the quality of TWW Regular monitoring of the quality of TWW from the plants Improve the TWW quality Regularly test samples from the soil and the agricultural crops Increase the mixing ratio between treated and surface water [More projects] Obtain funds from international organizations to finance the projects increasing TWW efficiency Desalination of salt water or seawater and use it in agriculture [Education] Raising farmers' awareness on dealing with the TWW</p>
<p>Group 5 [Water quantity available] Allow well drilling Build new dams Focus on water harvesting Desalination of the saline water Transferring Irbid rainwater to Wadi Al-Arab Dam [Improve water networks efficiency] Reduce losses in the drinking water networks [New projects for more water] Activate the use of the Sharhabeel Bin Hasna Dam water Execute Al-Bahrain project</p>	

Group activity 3: Cross analysis between the different groups

The most unanimous topic of solutions is obviously about the increase of water quantity available for irrigation. All the groups discussed about it, in different terms and conditions but they can be sum up in the following way: some solutions mentioned concerns the farm level or local level, it can be the authorization to dig wells, the installation of filtering systems, the creation of agricultural ponds; other solutions are at a larger scale with dam projects (existing or new ones), water transfers on large distances, increasing the volume pumped in dams; or it can even concern new projects that could go in this direction. One group made interesting suggestion as they were not directly made to increase water quantity, and rather suggested to improve the efficiency of infrastructures and networks. In this area of solutions, some groups suggested the possibility of water desalination.

Two groups of participants also suggested the idea of implementing a 'pilot', a 'testing area' where efficiency and parameters on water, crops and soil quality could be regularly monitored in order to study the safe limit of using treated wastewater in a Jordanian context. One of those groups also suggested to have a look in other countries and regions where treated wastewater is used in order to compare and exchange experiences when possible.

Also, the mixing ratio between surface water and treated wastewater was suggestion as a solution (to be better used) as it can contribute to the improvement of water quality. In addition to that, another idea was suggested by some participants, that using treated wastewater is also a way to have water and a 'cocktail' of natural fertilizers that could be beneficial for the farmers.

Besides, one group came back on the fact that religious concerns should be included in the reflexion of solutions, as well as some educational work that should be done for farmers and consumers.



Figure 7. Some group working on the activity 3.

Evaluation of the workshop

At the end of the workshop, the participants were asked to fill in an anonymous evaluation form prepared by Lisode, containing the 8 following items:

1. The objectives of the day were clear and transparent.
2. The day was useful.
3. I understand what the challenges are in terms of water reuse in the Jordan Valley.
4. I know how I can contribute to the project.
5. The participants well represented the different stakeholders and points of view. If no, which stakeholder should be consulted?
6. The work method (tools, animation) was effective.
7. The facilitators were impartial with regard to the content of the discussions.
8. I had the opportunity to express and give my opinion.

For each of these questions, participants had the possibility to say if they “rather disagree”, “rather agree” or “don’t know”. We gathered 31 evaluation forms by the end of the workshop; the results are presented in the Figure 8 below.

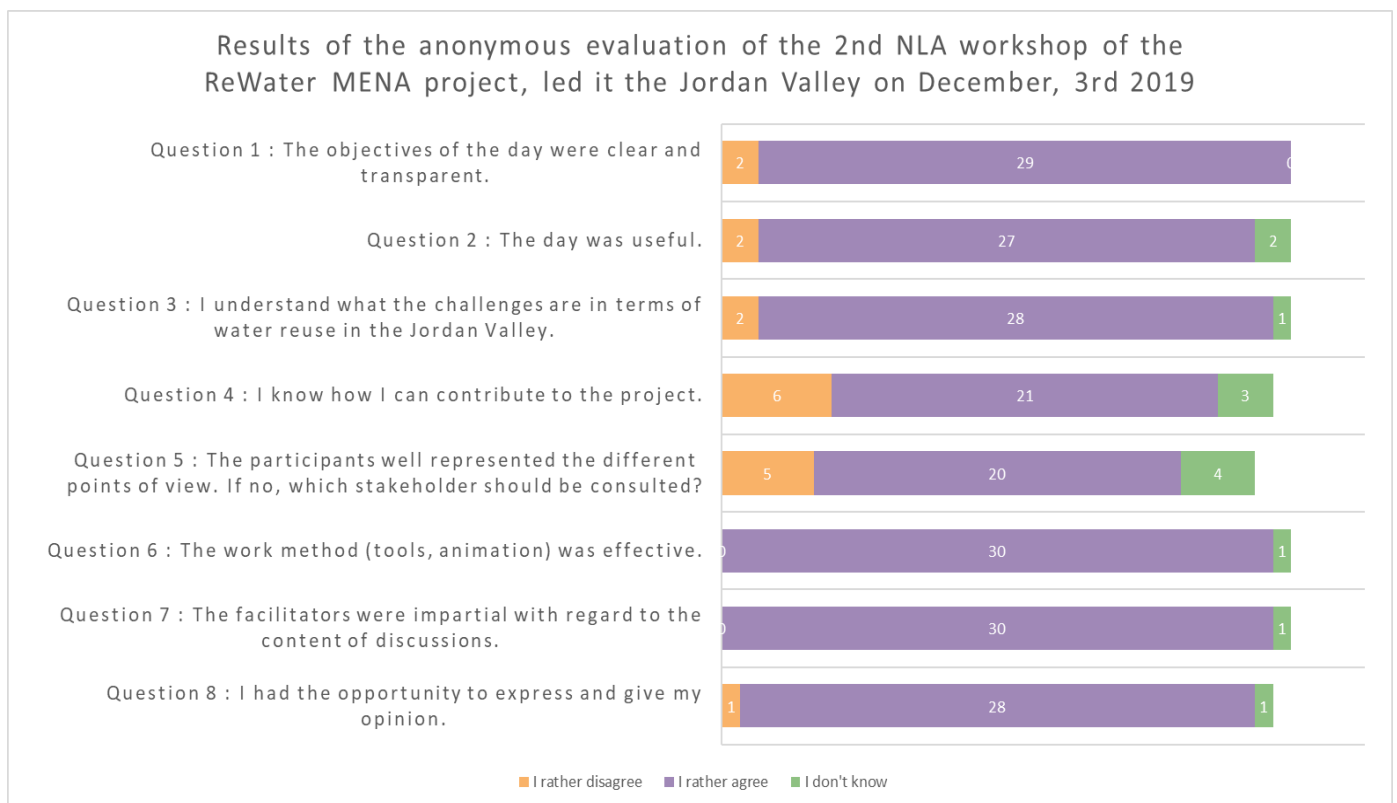


Figure 8: Quantitative results of the anonymous evaluation of the 2nd NLA meeting in the Jordan Valley.

The overall quantitative results are **quite positive** with 18 “I rather disagree”, 13 “I don’t know” and 4 empty answers out of a total number of 244 answers, which represents 14,3 % of the total answers.

Two participants insisted on the **need to continue with this type of meeting with stakeholders**, a third one highlighted **the need to do so for the benefit of farmers**.

Though it has to be balanced with the feedbacks provided in the forms (half the participants wrote more detailed comments in their evaluation forms) that are less enthusiastic and raise expectations for the next steps. Amongst them, three participants **explicitly wrote their refusal / unacceptance in using treated wastewater for irrigation**; a fourth participant advised to **consult the stakeholders before starting the project**.

Around a third of the participants either disagreed or did not know about questions 4 and 5 related to their contribution to the project and to the representativity of stakeholders. Also, 3 participants did not answer to those questions.

Some participants (around 10% of them) were not so comfortable with the questions 2 and 3, meaning that they did not fortunately find the day so useful and that some of them did not fully understand the challenges of wastewater reuse in the Jordan Valley.

However, most of the participants found the objectives of the day very clear and transparent (question 1) and **had the opportunity to express and give their opinion** (question 8). For this last question, only one participant disagreed.

Finally, we can say that almost everyone found the work method effective (question 6) and the facilitators impartial (question 7). Only one participant filled the category "I don't know" for both questions.

Besides the written comments bring other interesting feedbacks that should be taken into account for further activities. Some participants really insisted on the dissemination of the workshop results at different levels: at the decision-making level, in the relevant ministries or concerned authorities; at the Royal Water Committee level; and at the participants levels so they have a written record of the meeting. Those requests mean that it will be **important to have this report circulating at national level, and also communicated to the farmers' level**.

Amongst the comments, the remaining were actually more oriented towards some very practical suggestions and / or requests such as digging agricultural groundwater wells or providing financial support to farmers to create agricultural ponds and install water filters.

Conclusions:

Reusing the treated wastewater in irrigation in the Northern Jordan Valley is a very sensitive topic due to farmers concerns and fears. Their objection is based on expectations including, but not limited to: damage to citrus trees, reduction of trees productivity, impact the quality of fruits taste, impact on food markets, increase the soil salinity and degradation, creation of bacterial diseases, public hygiene issues, environmental pollution, fish death, livestock elimination, algal growth, minimizing the irrigation network life span, elimination of workers direct drinking, clogging of dripping networks, elevated content of heavy metals & Boron, in addition to religious constrains. It seems that farmers concerns of reusing the treated wastewater is exaggerated, while they are not fully aware by its advantages. Although the workshop topic was challenging, and burden the workshop management, it ends up with a comprehensive understanding of the current and future irrigation challenges in the Jordan Valley, and enable the farmers to recommend solutions to the decision-makers including the wastewater reuse.

Recommendations:

- It's clear from the workshop first impression that farmers are not welcoming the reuse for the treated wastewater for irrigation in the Northern Valley. On the other hand, they have to be aware about the challenges facing the irrigation management sector, and participate in the decision-making for this critical issue.
- The workshop attendees concluded the following recommendations:
 - Other fresh water resources alternatives have to be studied such as investigating new fresh water aquifers, granting permits for excavating new groundwater wells, constructing new rain harvesting dams, and/or installing desalination plants.
 - The Ministry of Agriculture has to activate its role in managing and controlling the crop patterns, and focusing on drought-tolerant crops, and/or different crops with high productivity and less water consumption.
 - The WWTP should provide a high quality of treated wastewater suitable for the drip irrigation networks in terms of suspended solids content.
 - When using the treated wastewater, farmers have to be trained excessively about:
 - The safe practices of using such water in order to avoid any contamination or bacterial injuries.
 - The best practices for saving the irrigation water (use of modern methods of irrigation, the drip irrigation, irrigation timing in the early morning and evening times, raise farmers' awareness on balanced water consumption, ...etc.
 - JVA management for irrigation has to be modified and improved (changing water valves, modify the irrigation system, maintaining the irrigation network frequently ...etc.
 - Exchange experiences with the Middle Jordan Valley where many farmers succeeded in cultivating citrus trees irrigated by the treated wastewater.
 - To obtain farmers trust and confidence, relevant authorities have to:
 - Use the best mixing ratio with fresh water
 - Apply safe practices of using treated wastewater for irrigation
 - Control fertilizers doses;
 - Apply comprehensive and regular monitoring body, to ensure compliance with Jordanian Standards.
 - Issue a religious directive (fatwa) for the use of TWW.
 - Raise farmers' awareness on dealing with the TWW
 - Improve the efficiency of infrastructures and networks.

Farmers requested that it is important to have this report circulating at national level, and also to be communicated to the farmers' level.

Annex A: NLA Attendees List



الجمعية العلمية الملكية
Royal Scientific Society



الاجتماع التشاوري الوطني الثاني

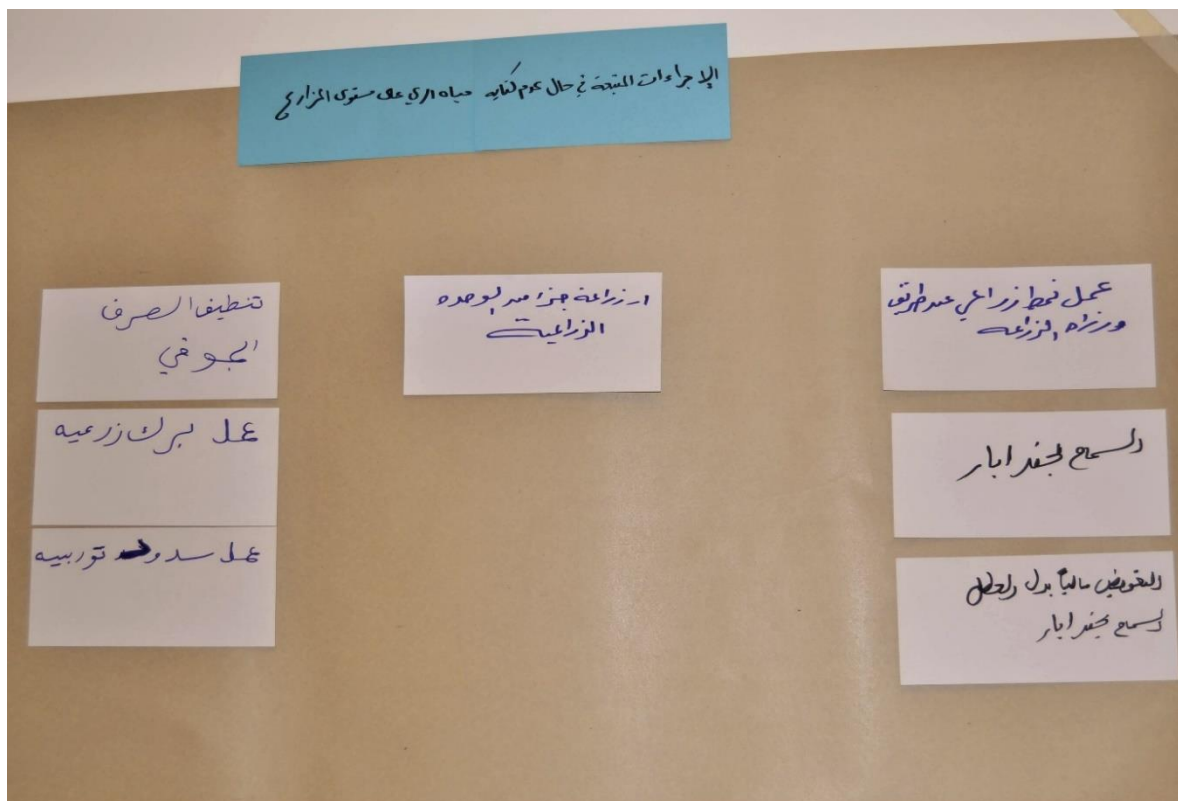
حول التحديات التي تواجه إدارة مياه الري في الأغوار الشمالية والطرق المقترحة لانتخاب عليها

تاريخ ٢٠١٩ / ١٢ / ٣

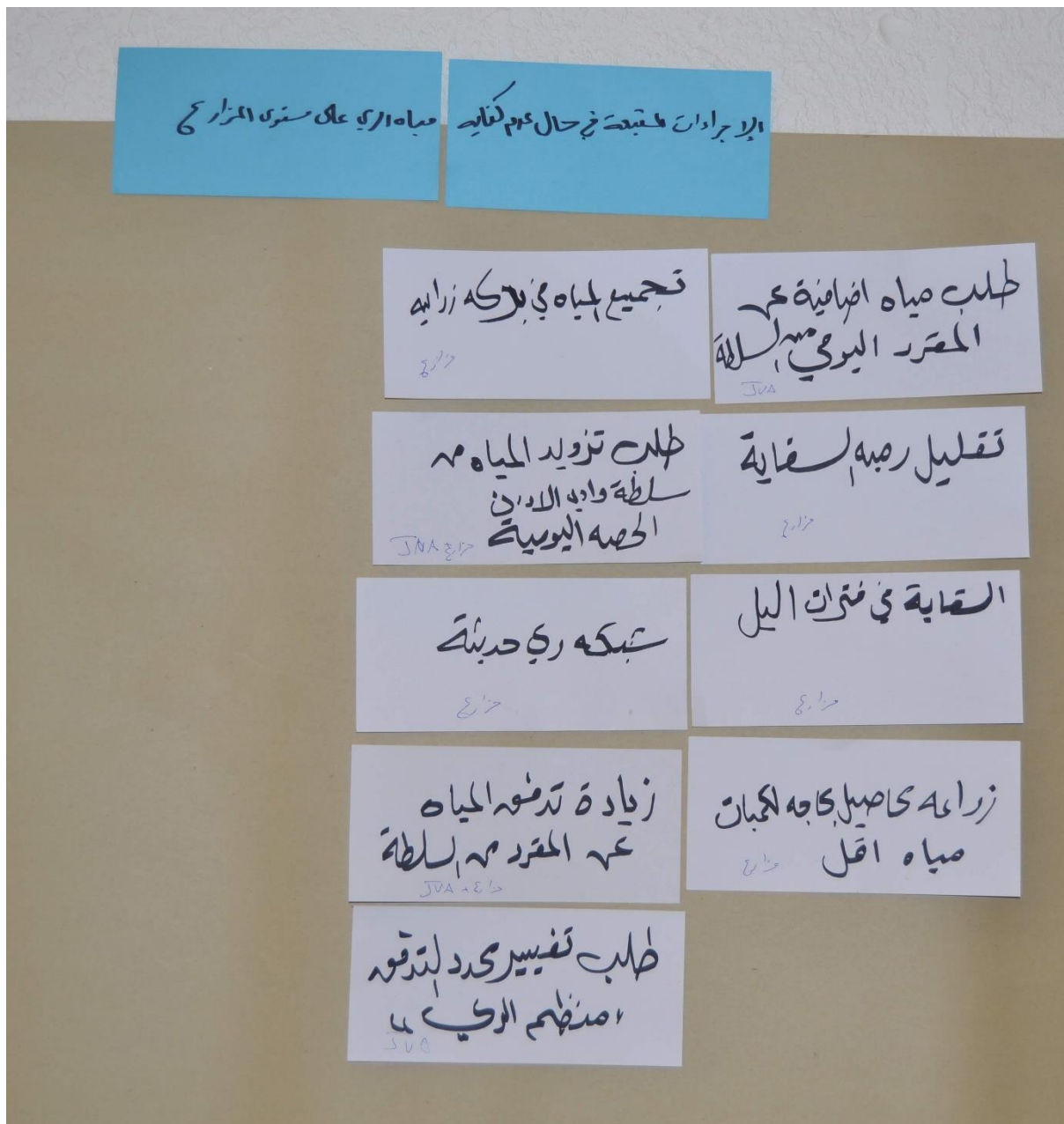
رقم الهاتف	البريد الإلكتروني	المؤسسة	الاسم	الترتيب
+201011206104 0785600919	m.tamir@jordan.gov.jo	IWMI مركز البحوث	محمد حسن توفيق م. علي إبراهيم	١ ٢
	audrey.barbe@lisaode.com	LISAODE	Audrey Barbe	٤
	jean-emmanuel.rougier@lisaode.com	LISAODE	Jean-Emmanuel Rougier	٥
٠٧٨٦٧٥١٨٧٠		جمعية الهندسة المائية	محمد دنان أحمد خلفه الوائلي	٤
٠٧٨٦٦٤٤٩٢٣		جمعية الهندسة المائية	ميريام عمران أحمد الوائلي	٥
٠٧٨٧١٣٧٩٢٣		جمعية الهندسة المائية	محمد محمد المنارية	٦

Annex B: Posters from the working group sessions

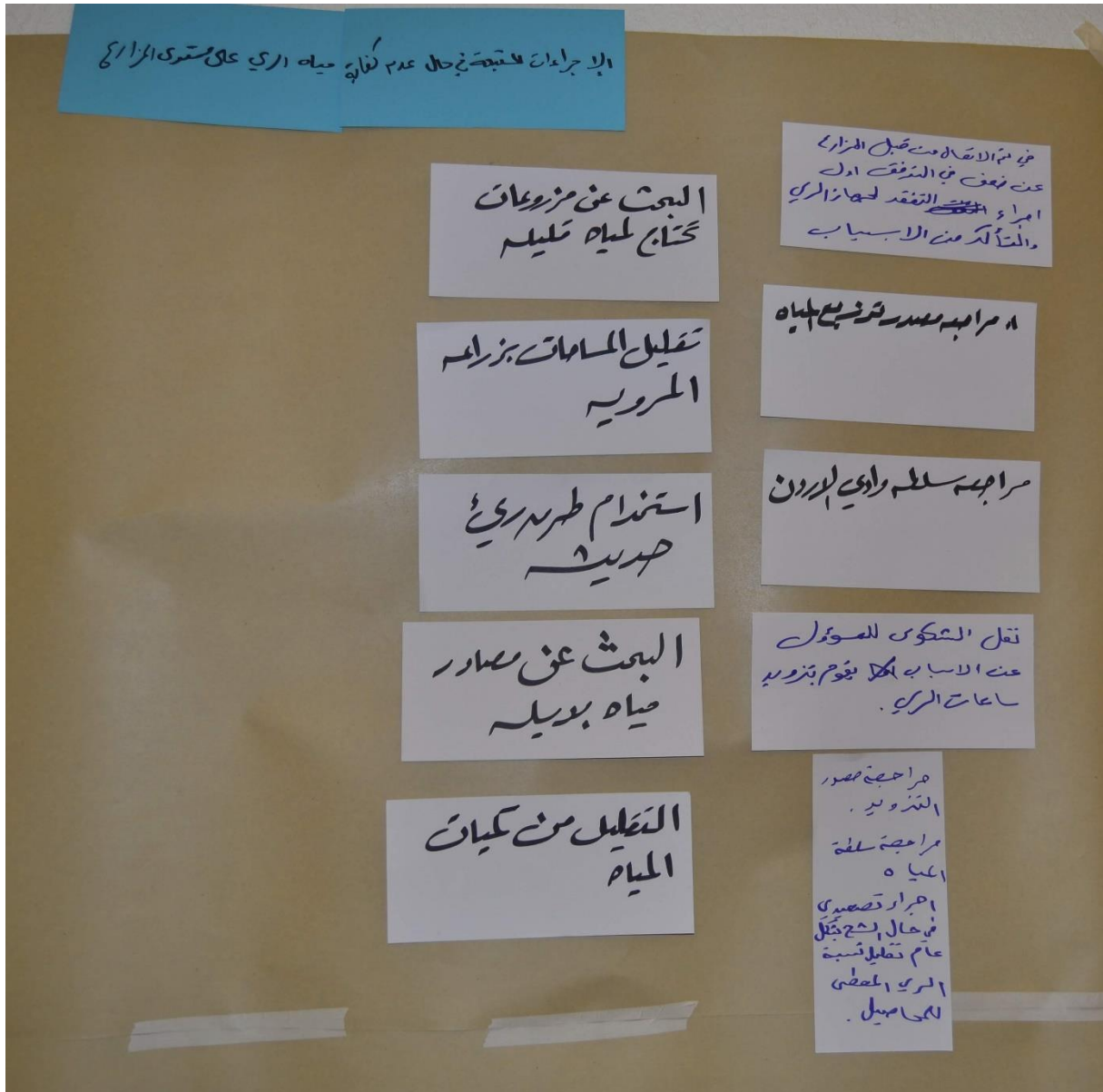
Activity 1: Pictures of the group posters



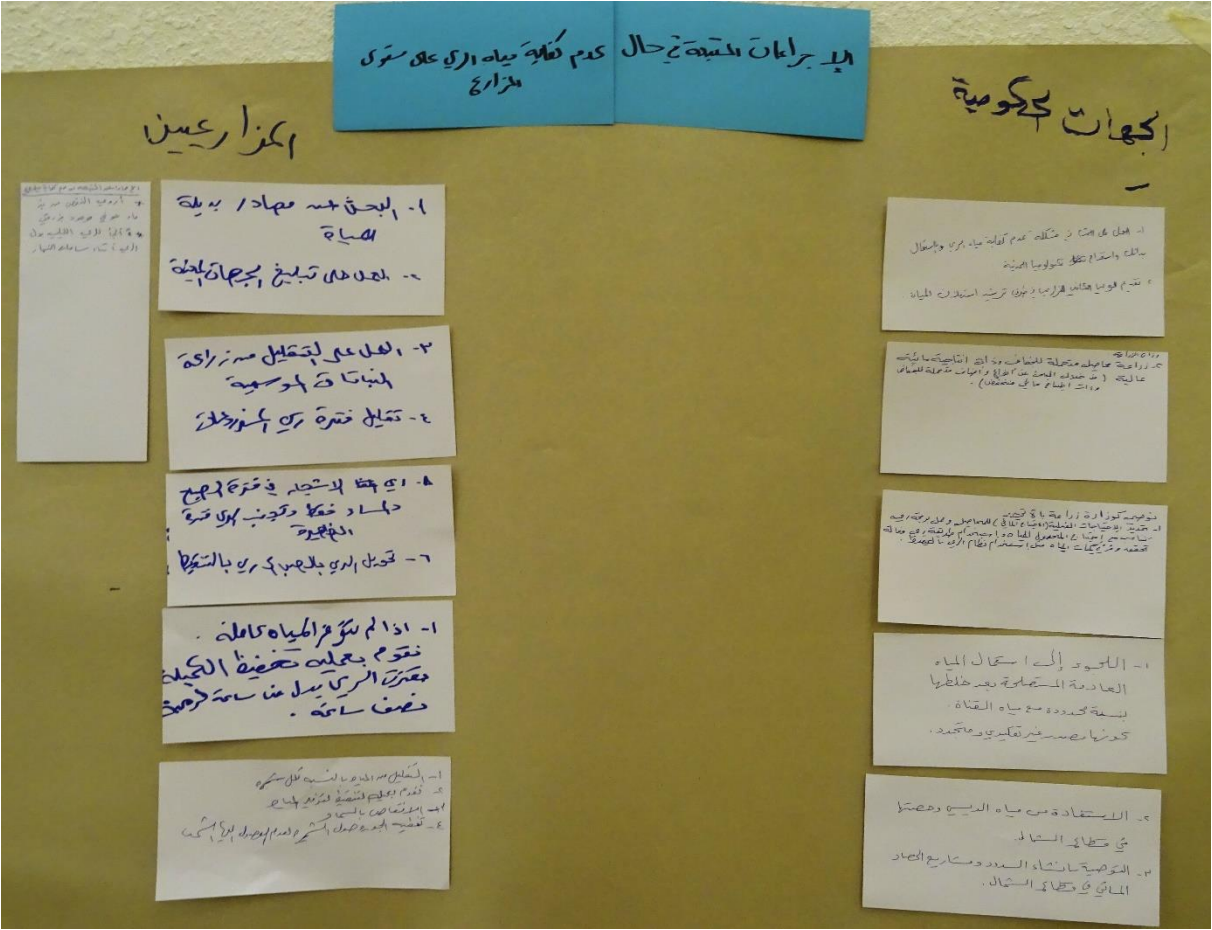
Activity 1, Group 1



Activity 1, Group 2



Activity 1, Group 3



Activity 1, Group 4

الإيمان لا يتبعه في حال عدم كفاية مياه الري على مستوى المزارع

في حال نقص المياه وعدم كفاية
متطلبات الزراعة . أفضل ان يتم
تقليل المساحة المروية وعدم انقحام
مياه معالجة لري المزرعة

الجدد اني مسؤولي جميع
مستخدمي المياه كل مشكلة
نقص المياه لحل المشكلة
مع سلطات وادارة الاردن

في حال عدم توفر المياه . يتم
طلب مساحات اضافية منه سلطة
وادي الاردن لتتوفر لنا , لنقص

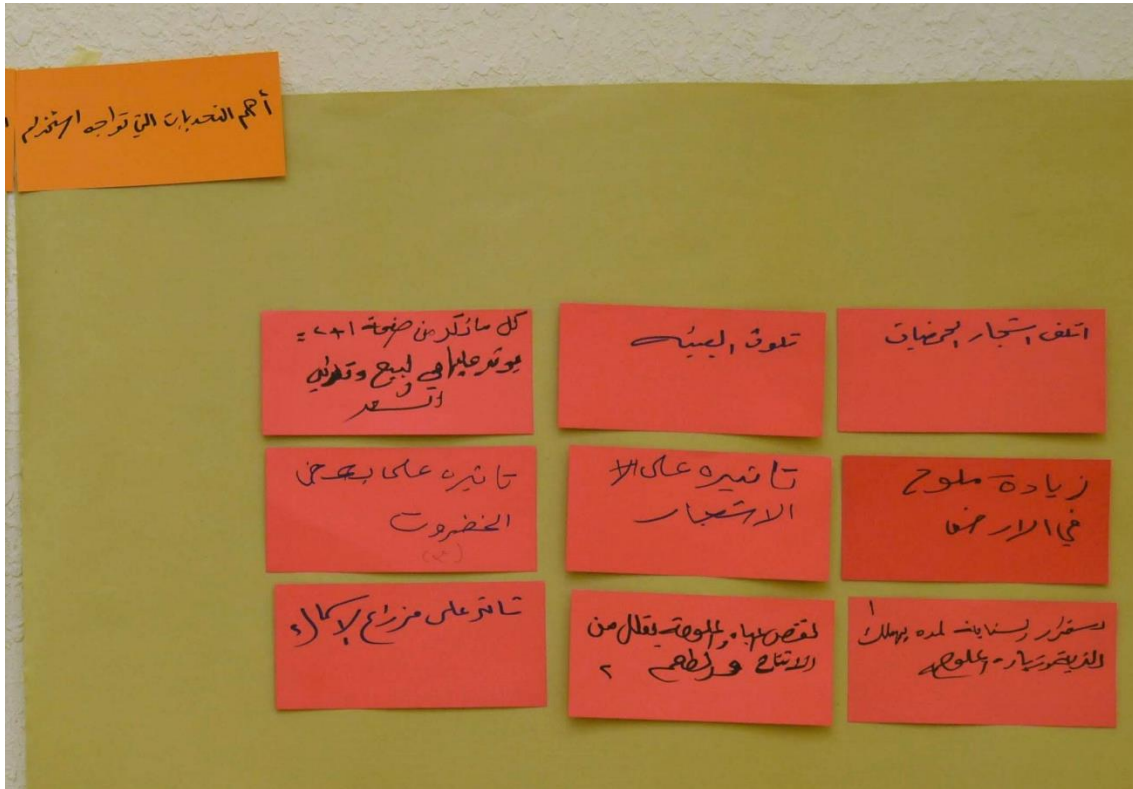
في حال نقص المياه يتم هدرولة
الري بطريقة معينة لتقليل من مزارع
الري وكليات المياه المستخدمة

ماهي الا حيل المصنعه على
الخصيات عند الري بمياه معالجة
لفترة زمنية طويله .

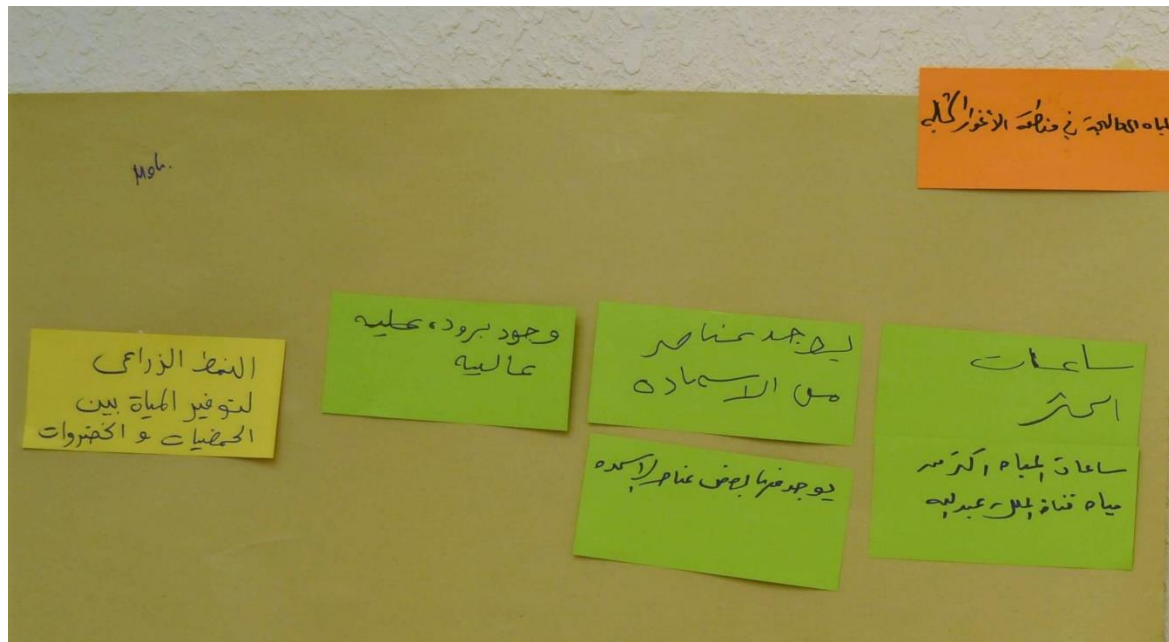
Activity 1, Group 5

Activity 2 and 3: Pictures of the group posters

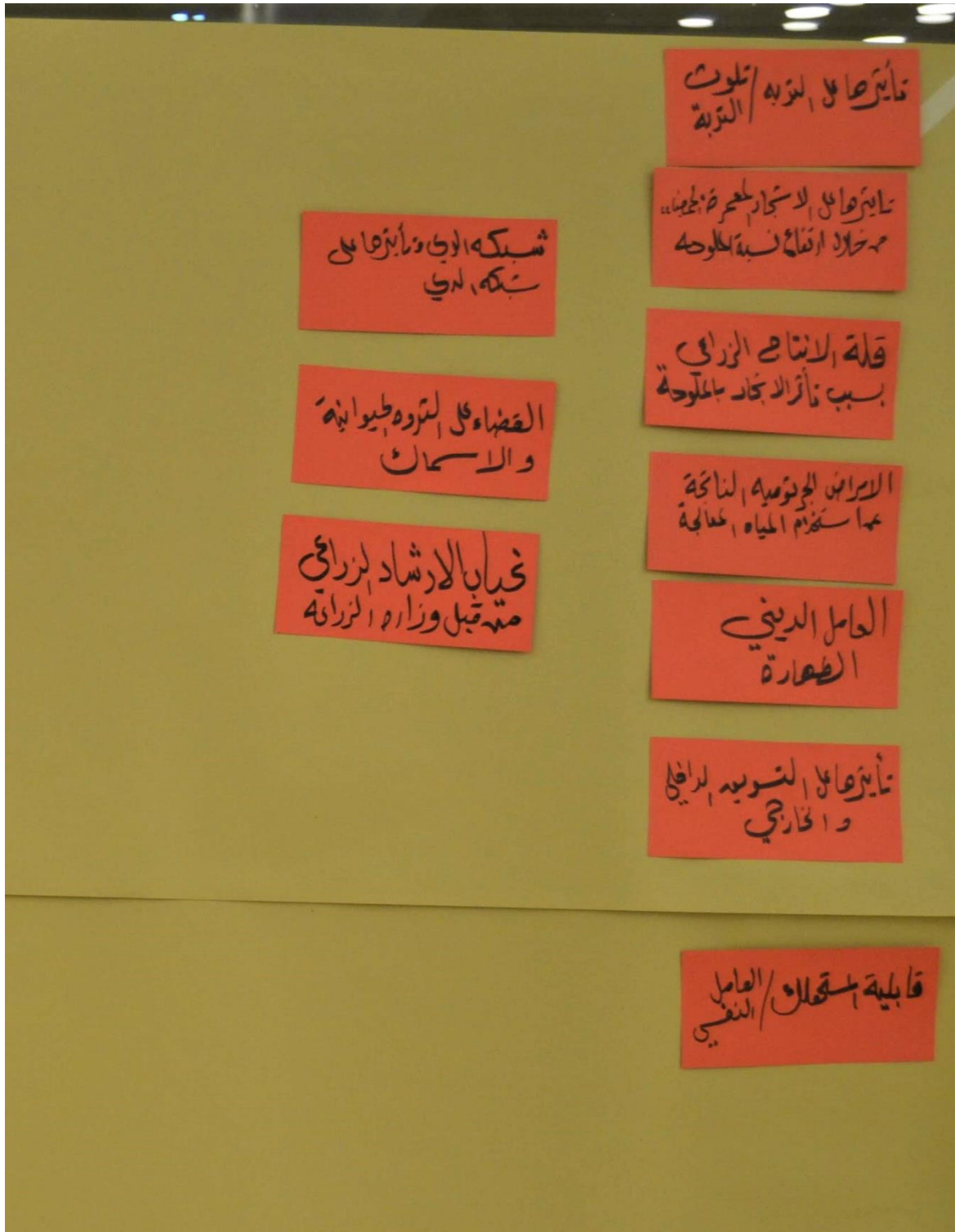
Please note that cards in red corresponds to the Activity 2, and cards in green to the Activity 3



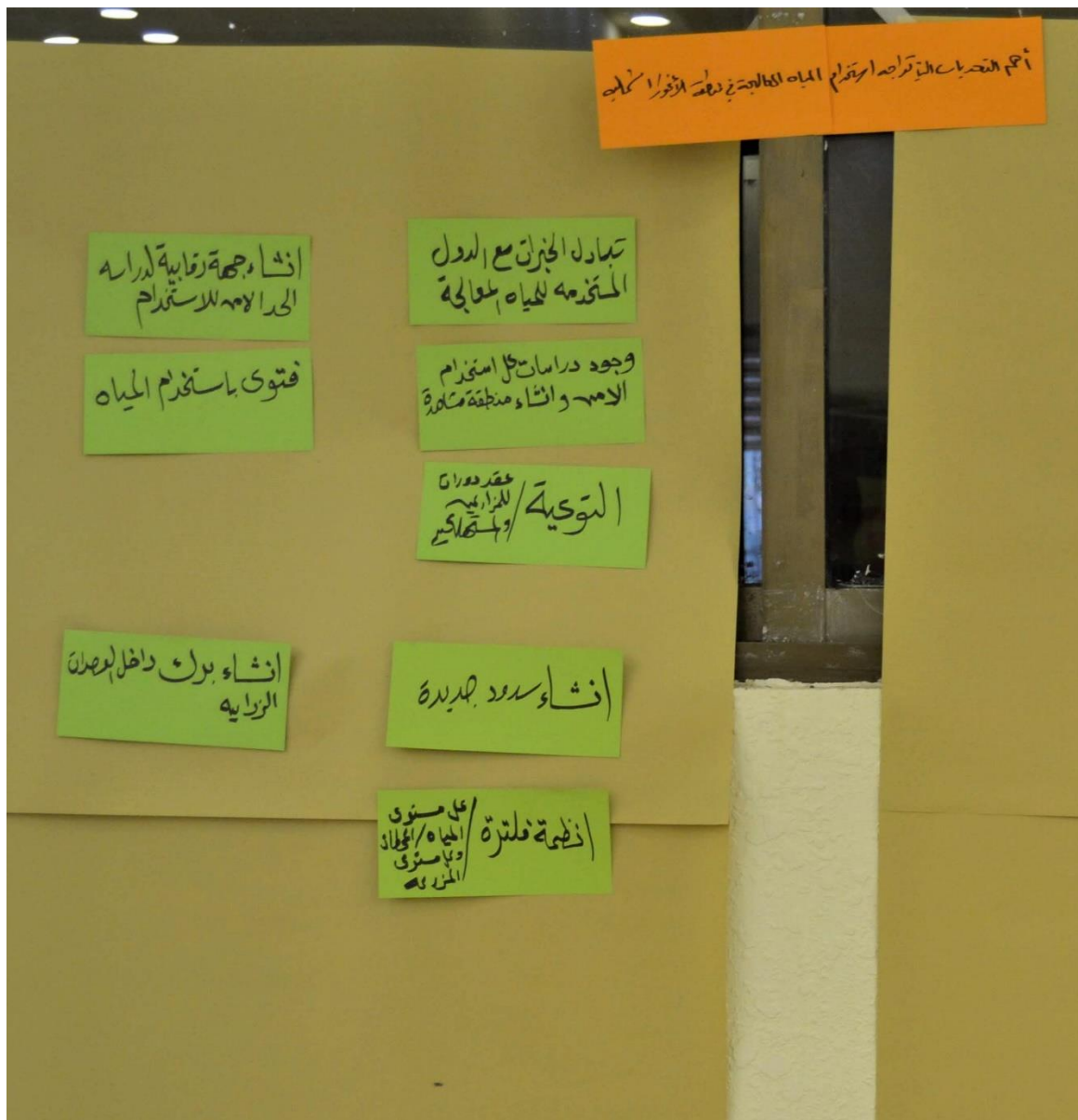
Activity 2, Group 1



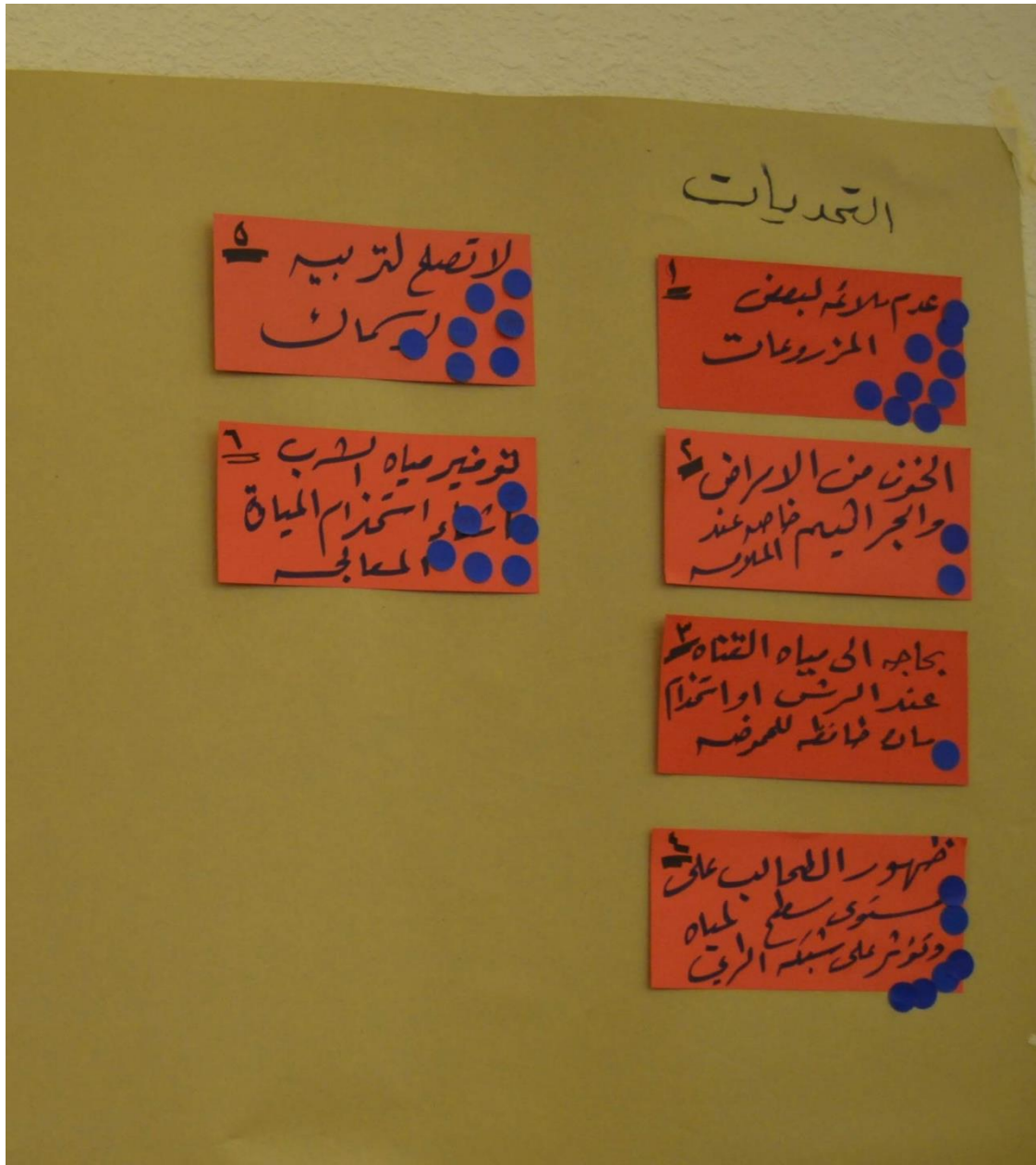
Activity 3, Group 1



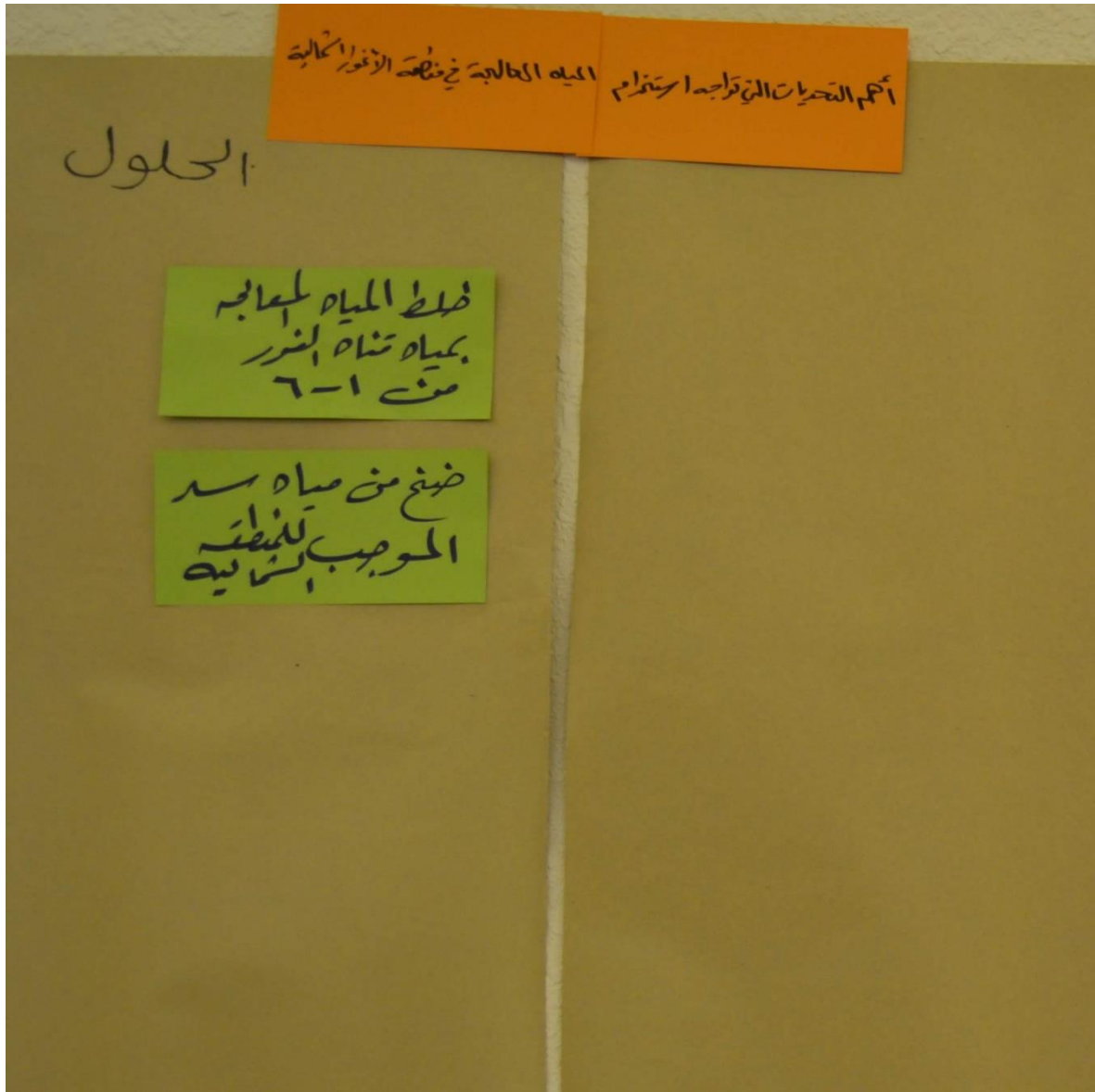
Activity 2, Group 2



Activity 3, Group 2



Activity 2, Group 3



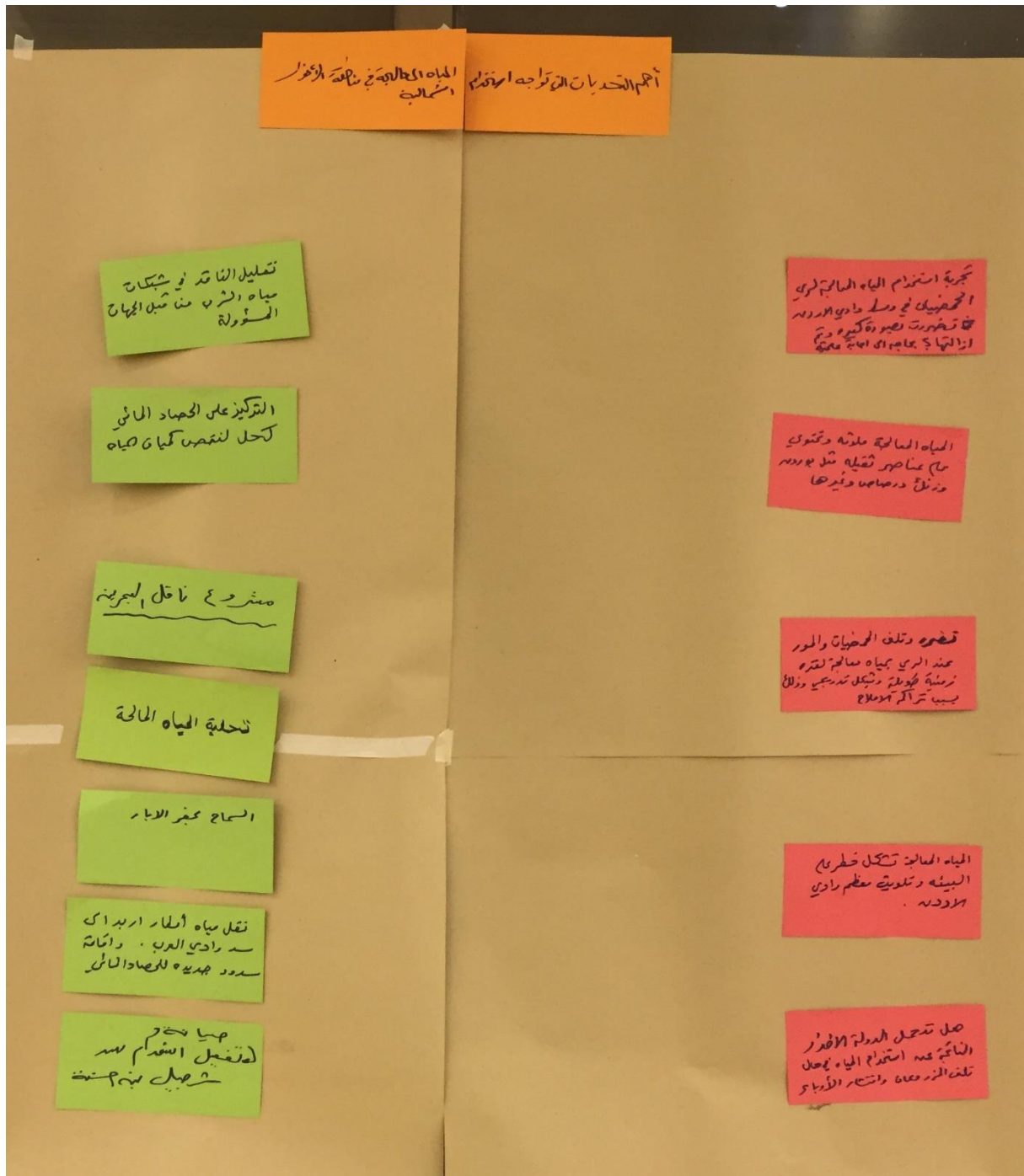
Activity 3, Group 3



Activity 2, Group 4



Activity 3, Group 4



Activity 2 and 3, Group 5