RAICHUR 2050

Results and Findings Report

August 2026

WELL LABS
WATER · ENVIRONMENT · LAND · LIVELIHOODS

THUMBI LABS

Contents

Introduction

Raichur 2050 is a participatory, game-based tool designed to gather preferences on developmental pathways from different farmer groups in Raichur. Its primary objective is to capture the kinds of future pathways communities envision across specific parameters such as preferred land use, crop choices, water infrastructure, non-farm livelihood preferences, etc. Further, the tool gathers insights on the trade-offs different farmer groups negotiate - like financial growth, water sustainability, water logging in soil, distribution of water resources etc. The tool enables participants to create a shared artefact representing their desired future, while also fostering dialogue through choices and negotiations around their collective needs and priorities.

1. Gameplay

The game uses 20 tiles that represent the Raichur. The tiles are divided into 3 types of regions — canal command, dryland and highland. Further, the canal command region is split into head, mid and tail end areas. It's a round-based game, with participants divided into land team, and water team.
The game starts with a context setting of the current land use and water systems of Raichur its impact on income indicators and environmental indicators of water and water logging in soil. The game is turn-based, and participants are divided into 6 teams. 5 teams are responsible for land use change— head-end, mid-end, tail-end, dryland and highland. 1 team is responsible for water infrastructure for all regions.
Round 1 starts with the land team making choices for their regions, followed by looking at the consequences of their choices on income, water levels and distribution and water logging in soil. Next, the water team makes decisions on what type of infrastructure should be provided for the region. Once the water team has made their choices, the impact is calculated and shown across indicators.
At the end of Round 2, a drought situation is introduced — reducing the rainfall by half and canal water by 40%. The implications of the drought shock are seen across the indicators. In Round 3, players make choices during the shock scenario, giving insights into the choices and preferences players make during such situations.

The last round is a discussion on canal water distribution across regions. Participants engage in dialogue around the current distribution, what are alternative options for distribution, what is fair and why? The groups vote on which water system to go ahead with. The implications of the new water system are then shown across indicators of income, water and water logging in soil.

2. Game sessions

Between July 22nd and 24th three sessions of Raichur 2050 were conducted with the farmers some of whom some are members of Water User Cooperative Society (WUCS) belonging to different regions in Raichur, primarily representing head-end, mid-end and tail-end regions of Narayana Right Bank Canal Command area, and dryland and highland areas nearby where the canal is not currently available.

Session 1: 22nd July 2026
9 farmers from Kakkaladoddi, Myakaladoddi, B R Gunda, Ganadhal, Ooty and Jalahalli villages.

Session 2: 23rd July 2026
14 farmers from Mukkanal, Gajaladinni, Parapur and Mundragi villages

Session 3: 24th July 2026
10 farmers from Mukkanal, Mykaldoddi, B R Gunda, Ganadhal, Maduvaygaddi, Parapur and Ganajilli villages.

Tools Design Elements

Raichur 2050 employs a game-based methodology to elicit people's preferences for different pathways and trade-offs. Below are the key elements of the tool design:

1. Tool logistics

No. of participants	10-15
Game duration	~2.5-3 hours. • Context setting: ~15 minutes • Game briefing: ~ 30minutes • Game play: ~ 75 minutes • Debrief: ~ 30 minutes
No. of facilitators	3-4 • Primary facilitator: Conducting the game • Secondary facilitator: Helping during gameplay with assets, calculations etc. • Note-takers: Noting discussions and observations during gameplay • Additional facilitators: To help with context setting

Table 1: Tool logistics

2. Session structure

Session part	Description
Context setting	• Give an overview to the participants on objective of the session and why they are here. • Divide people into head-end, mid-end, tail-end, lowland and highland regions. • Have a conversation on the current state of Raichur- type of land, predominant livelihoods etc., and get participants accustomed to the map and regions.

Game briefing	• Talk about the game structure and rules of the game • Explain the current land-use and its consequences on income, water sources — rainwater, canal, groundwater and its distribution, and water logging in soil • Explain the game choices for land team and water team
Game play	Conduct the game in 2 phases for each round: 1. **Conduct the game in 2 phases for each round:** • Round 1 Phase 1 (Land team): Participants choose between different land use choices • Round 1 Phase 1 consequence (Land team): Participants see the implications of their choices on income, canal water, ground water, and water logging in soil • Round 1 Phase 2 (water team): Participants choose between different water infrastructure • Round 1 Phase 2 consequence (water team): Participants see the implications of their choices on income, canal water, ground water, and water logging in soil 2. **Round 2 continues in the same manner** 3. **Shock round:** • At the end of Round 2, a drought is introduced. This reduces the rainwater to half - from 20 tokens to 10, and canal water by 40% - from 20 to 12 tokens • Implications: Participants see the implications of the shock on income, canal water, ground water, and water logging in soil • Round 3 starts with the shock conditions • Round 3: Phase 1 (Land team): Participants choose between different land use choices • Round 3 Phase 1 consequence (Land team): Participants see the implications of their choices on income, canal water, ground water, and water logging in soil • Round 3 Phase 2 (water team): Participants choose between different water infrastructure

	• Round 3 Phase 2 consequence (water team): Participants see the implications of their choices on income, canal water, ground water, and water logging in soil 4. Round 4 WUCs Discussion • Participants have a discussion on the current distribution of water amongst different regions and come up with alternative systems of distribution. Participants vote on which distribution system should be taken up. • Round 4: WUCs Decision Consequence: Participants see the implications of the water system redistribution on income, canal water, ground water, and water logging in soil
Debrief	Talk about different aspects of the choices participants make during the game: • Their preference for the current Raichur or the aspirational Raichur they built, and why? • Individual choices of something they would like to change, and why?

Table 2: Session structure

3. Gameplay choices

Phase	Options within each phase
Land team	• Natural systems (forest, lakes, grasslands etc) • Barren Land • Paddy • Cotton • Mixed Cropping: Peanuts, Millets • Small livestock: Chickens, Goats, Sheep • Large livestock: Cows, Buffaloes • Small Scale Agricultural Industries • Large Service Industries
Water Team	• Extend canal to dryland • Lift irrigation to highland • Add borewells • Add Field Irrigation Channels (FIC)

Table 3: Gameplay choices

4. Data assumption on land, water availability and demand

The land was divided in 20 units, with 2, 3, 3, 6, 6 units distributed between head-end, middle, tail-end, dryland and highland areas respectively based on current land distribution. The starting state is based on LULC data, and that from the agricultural department. Based on available data on water in the NRBC area and surrounding rainfed areas within the catchment of Krishna river in Raichur, it was estimated that 737 MCM water of rainfall water and 737 MCM water of canal water was available, and around 400 MCM of usable ground water was available. In the game this was converted to 20 units of rainfall and canal water and 11 units of groundwater. The water demand for each crop was proportionately determined.

Insights from Sessions

1. Overall Trends

Section 1: Land use choices

The average land use across three sessions across each round is shown below.

Overall	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	17%	37%	27%	0%	0%	0%	0%	10%	10%
R1-Land	9%	28%	23%	17%	6%	2%	2%	9%	4%
R2-Land	4%	19%	13%	19%	7%	18%	9%	7%	4%
R3-Land	0%	14%	9%	27%	9%	22%	9%	6%	3%

Table 4: Average land-use across the three sessions.

Section 2: Water Distribution choices

Across the three sessions, participants had slightly higher preference towards Canal expansion over FIC in round 1, while the preference between canal expansion, lift irrigation and FIC was similar in round 2, and in the third-round post the drought; borewell was of focus. In all three sessions, the borewell was either in the dryland or highland areas.

	Round 1	Round 2	Round 3
Canal Expansion	58%	50%	0%
FIC	42%	50%	33%
Borewell	0%	0%	67%

Table 5: Average water-teams' choices across three sessions

The consequences of both land use change and water choices led to greater diversification of canal water use, with the highest allocation towards small agricultural industries. Despite action, the excess was around 23% pre-drought, but post-drought was zero.

Canal	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total units
Initial	38%	30%	5%	0%	0%	0%	0%	28%	20
R1-Land	16%	20%	8%	0%	2%	2%	2%	52%	20
R1-Water	18%	33%	8%	0%	5%	2%	3%	32%	20
R2-Land	8%	23%	2%	0%	10%	9%	10%	38%	20
R2-Water	8%	31%	5%	0%	12%	11%	10%	23%	20
R3-Drought	13%	28%	4%	9%	17%	20%	10%	0%	12
R3-Land	0%	21%	3%	14%	19%	28%	14%	0%	12
R3-Water	0%	21%	3%	14%	19%	28%	14%	0%	12

Table 6: Average canal water allocation across sessions for each round.

The ground water use across sessions moved away from cotton towards small agricultural industries and large service industries. The groundwater level reduced by 3 units as compared to the start.

Borewell	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
Initial	0%	100%	0%	0%	0%	0%	0%	6.0
R1-Land	0%	90%	10%	0%	0%	0%	0%	6.2
R1-Water	0%	81%	19%	0%	0%	0%	0%	8.5
R2-Land	0%	56%	0%	0%	0%	27%	17%	8.4
R2-Water	0%	46%	0%	0%	0%	38%	17%	9.9
R3-Drought	0%	67%	0%	0%	6%	18%	9%	3.5
R3-Land	0%	51%	3%	0%	4%	20%	22%	3.9
R3-Water	0%	46%	8%	0%	4%	17%	24%	3.0

Table 7: Average ground water allocation across session for each round.

Section 3: Income

Across sessions, the participants were able to increase their income by shifting to higher income choices, while ensuring adequate water availability. Even after drought, the participants were able to increase their income more than their starting income

	Initial	R1 Land	R1 Water	R2 Land	R2 Water	R3 Drought	R3 Land	R3 Water
Head	18000	24000	24000	27000	27000	27000	31000	31000
Mid	18000	19333	20667	29333	29333	29333	31000	31000
Tail	18000	24333	25333	34000	34000	30000	34000	34000
Dryland	17000	19000	19667	24333	25333	20333	24000	25000
Highland	17000	18667	19000	22000	22000	19333	23000	23000

Table 8: Average income per acre across regions across sessions for each round.

Section 4: Water sharing arrangement

After the three rounds, when the participants were asked whether the current water sharing of canal water was fair, or there was possibility of reallocation based on mutual agreement. The participants were asked to imagine they were part of Water User Cooperative Society (WUCS), which had power to decide on how the water sharing could be between members. There was varying amount of debate and discussion in each session between members of fictional WUCS. The majority felt the distribution was not fair, and across discussion agreed to a higher share of canal water for dryland and highland areas, as they had more land units compared to other regions.

The proposed reallocation based on the agreements across sessions and its impact on water distribution and income is shown below.

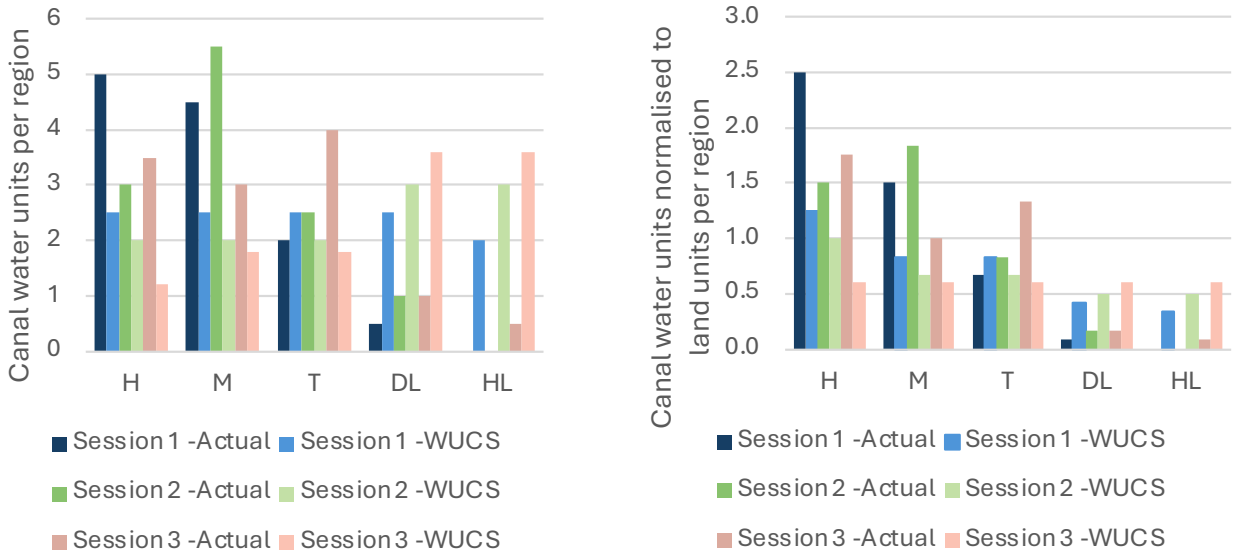


Figure 1. (Left) Canal water distribution actual vs post discussion. (Right) Canal water distribution actual vs post discussion normalised to land units[1].H- Head, M-Middle, T-Tail, DL-Dryland, HL-Highland

Post reallocation the share of canal water increased to mixed and small livestock. Also, across the three sessions there was 6% excess overall.

Canal	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total units
R3-Water	0%	21%	3%	14%	19%	28%	14%	0%	12
Reallocation	0%	27%	11%	17%	13%	19%	7%	6%	12

Table 9: Canal water share of different land-use post reallocation

1 Note: In the normalized graph on the right, equal share of 12 canal water across each land of the 20 land units leads to equal share of 0.6 units.

Ground water extraction reduced post reallocation of canal water as it was replaced with canal water. The groundwater level came close to the starting condition (6 units) even in a drought situation.

Borewell	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
R3-Water	0%	46%	8%	0%	4%	17%	24%	3.0
Reallocation	0%	38%	3%	0%	3%	26%	31%	5.7

Table 10: Ground water share of different land-use post reallocation

The income per acre on average decreased for head- end and middle areas and increased for dryland and highland areas post reallocation of canal water. The farmers in headend and middle areas while moving away from paddy choose water intensive crops like cotton, large livestock and large service industries based on availability of canal water. The reallocation led to decrease in available water which led to decrease in income. The additional water in dryland and highland areas was used towards cotton, mixed and small livestock, while decreasing the ground water usage for cotton, which led to increase in income. The participants in one of the sessions felt the income in head and middle areas could also be increased by changing crops to less water intensive crops.

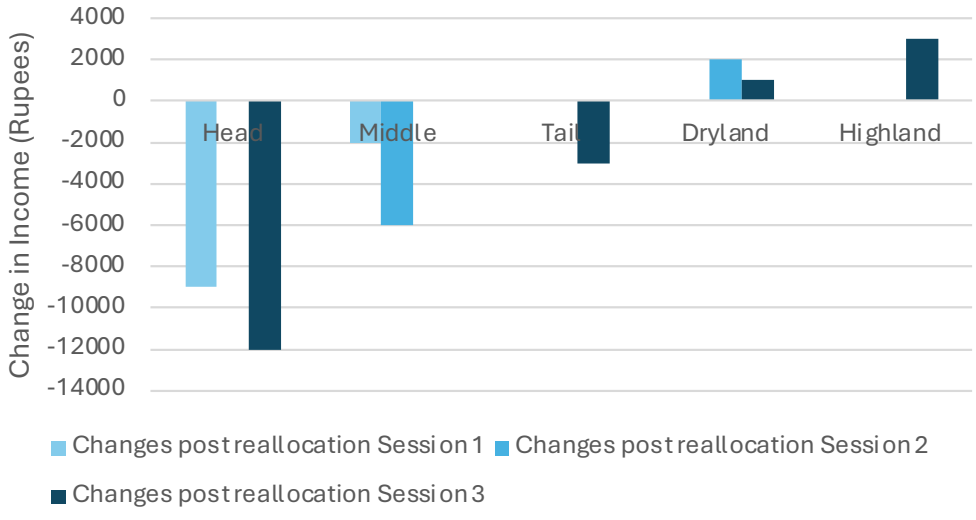


Figure 2. Change in income post reallocation of canal water

Section 5: Debrief with participants

On being asked whether they prefer the Raichur they have designed or the current one, all participants said they preferred the one they built. Across the session, the participants preferred the Raichur they had built, stating increased income, diverse cropping, presence of livestock and equitable distribution of the water as the reason for the same.
When asked if there was one change they would like to make, players reflected the share of natural and barren areas could be increased, and it would be better to have some paddy still.

Section 6: Questions on gameplay

When asked on what were the reasons behind participants action in the game, the participants suggested they were trying to achieve higher income, while balancing the available water. The water logging in soil motivated them to reduce the excess.
On overall experience participants reflected that initially it took some time for them to get the game, but then it was easy to understand and felt it was useful for them.

Session 1

Section 1: Land use choices

Overall	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	17%	37%	27%	0%	0%	0%	0%	10%	10%
R1-Land	3%	33%	23%	17%	3%	0%	0%	10%	10%
R2-Land	0%	20%	13%	13%	13%	17%	7%	7%	10%
R3-Land	0%	20%	12%	18%	15%	18%	3%	3%	10%

Table 11: Land use choices in Session 1

1. **Current setup: The overall land use was dominated by cotton, followed by mixed and paddy, and some land allocated towards nature and barren.**
2. **Round 1:**

- Land: The land team moved away from paddy and cotton towards small livestock and mixed. There was some paddy left in mid-end areas, while small livestock was added in all areas except head-end. The overall barren and nature land remained the same, with each area swapping from one to another.
- Water: In the first-round the water team redistributed canal water through FIC in head-end area and mid-end areas, and increased expansion of canal towards dryland and highland area.

3. **Round 2:**

- Land: The team further moved away from cotton, and diversified towards mixed, small and large livestock, small agricultural industries and large service industries. The share of nature land was reduced.
- Water: In round 2, the water team, added FIC to tail end areas, added FICs in one tile each in dryland and highland areas, and extended the canal to one more tile in dryland areas.

4. **Round 3:**

- Land: Post drought, there was consolidation towards small livestock, and small agricultural industries to manage both income and reduced water.
- Water: In the last round, the water team decided to add a FIC to one more tile in dryland areas.

Land use changes for each region are shown below:

Head-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	50%	50%	0%	0%	0%	0%	0%	0%	0%
R1-Land	0%	100%	0%	0%	0%	0%	0%	0%	0%
R2-Land	0%	50%	0%	0%	50%	0%	0%	0%	0%
R3-Land	0%	50%	0%	0%	50%	0%	0%	0%	0%

Table 12: Land use changes for head-end areas

Mid-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	33%	33%	0%	0%	0%	0%	0%	0%	33%
R1-Land	17%	17%	17%	17%	0%	0%	0%	33%	0%
R2-Land	0%	17%	17%	17%	17%	33%	0%	0%	0%
R3-Land	0%	17%	0%	33%	17%	33%	0%	0%	0%

Table 13: Land use changes for mid-end areas

Tail-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	33%	0%	0%	0%	0%	33%	0%

R1-Land	0%	0%	33%	33%	0%	0%	0%	0%	33%
R2-Land	0%	0%	0%	33%	0%	33%	0%	0%	33%
R3-Land	0%	0%	0%	33%	0%	33%	0%	0%	33%

Table 14: Land use changes for tail-end areas

Dryland

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	50%	0%	0%	0%	0%	0%	17%
R1-Land	0%	33%	17%	17%	17%	0%	0%	17%	0%
R2-Land	0%	17%	17%	17%	0%	17%	17%	17%	0%
R3-Land	0%	17%	25%	25%	8%	8%	0%	17%	0%

Table 15: Land use changes for dryland areas

Highland

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	50%	0%	0%	0%	0%	17%	0%
R1-Land	0%	17%	50%	17%	0%	0%	0%	0%	17%
R2-Land	0%	17%	33%	0%	0%	0%	17%	17%	17%
R3-Land	0%	17%	33%	0%	0%	17%	17%	0%	17%

Table 16: Land use changes for highland areas

Section 2: Water Distribution choices

Canal water

1. Current setup: The canal water was initially split between cotton and paddy and some allocation towards mixed, and 28% of canal water was excess in canal areas.
2. Round 1:

- Land: The land-use change in round 1 led to decrease in share of paddy and cotton, with marginal increase for mixed. The excess however increased by 58%.
- Water: The FIC and canal expansion led to decrease in the excess and increased allocation towards cotton.

3. Round 2:

- Land: The diversification in round 2, led to reallocation of canal water away from cotton and paddy towards large livestock, small agricultural industries and large service industries.
- Water: In round 2, the water team's addition of FIC in tail, dryland and highland and expansion of canal in dryland, led to marginal decrease of excess towards small agricultural industries.

4. Round 3 — Drought: Drought saw the removal of excess water, and remaining water redistributed between cotton, large livestock, small agricultural industries, and large service industries.

- Land: The land-use changes post drought saw increase in small livestock and small agricultural industries and decrease in large service industries and nature; this led to increase in their share away from service industries.
- Water: In the last round, the water team added FIC to one more tile in dry land areas, the water allocation remained the same.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total units
Initial	38%	30%	5%	0%	0%	0%	0%	28%	20
R1-Land	10%	25%	8%	0%	0%	0%	0%	58%	20
R1-Water	10%	45%	8%	0%	0%	0%	0%	38%	20
R2-Land	0%	25%	3%	0%	15%	10%	10%	38%	20
R2-Water	0%	25%	3%	0%	15%	15%	10%	33%	20

R3-Drought	0%	27%	6%	6%	27%	25%	8%	0%	12
R3-Land	0%	31%	0%	8%	31%	29%	0%	0%	12
R3-Water	0%	31%	0%	8%	31%	29%	0%	0%	12

Table 17: Canal water distribution

Ground water

1. Current setup: The groundwater was used towards cotton in the current setup primarily in dryland and highland areas.
2. Round 1:

- Land: The land-use change away from cotton towards mixed in highland area, led to decrease in share of cotton and increase of mixed. The groundwater extraction decreased by 1 unit.
- Water: The use of FIC and expansion of canal, led to further decrease of ground water allocation towards cotton. The groundwater extraction decreased by 4 units.

3. Round 2:

- Land: The land-use change in dryland and highland areas, led to split of groundwater between cotton and large service industries. The groundwater extraction increased by 1 unit.
- Water: The water team in round 2 focused on increasing distribution of canal, and there was no change to the water use from ground water.

4. Round 3: Drought:

- Because of drought leading to decreased rainfall and reduction in available canal water. The ground water usage increased, leading to only 3.5 units remaining (from starting value of 6), towards primarily cotton followed by large service industries and large livestock.
- Land: Post drought, the land team shifted the land use away from large service and small agricultural industries towards livestock and mixed in dryland areas. In highland areas, the shift was decrease in nature towards small agricultural industries and mixed. This led to decrease in share of large service and increase in mixed. The groundwater extraction increased by 1 unit.
- Water: The water team in the last round, added FICs and expanded canal, these actions had no impact on groundwater usage.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
Initial	0%	100%	0%	0%	0%	0%	0%	6
R1-Land	0%	86%	14%	0%	0%	0%	0%	7
R1-Water	0%	67%	33%	0%	0%	0%	0%	11
R2-Land	0%	50%	0%	0%	0%	0%	50%	10
R2-Water	0%	50%	0%	0%	0%	0%	50%	10
R3-Drought	0%	56%	0%	0%	17%	0%	28%	3.5
R3-Land	0%	53%	8%	0%	13%	0%	26%	2.5
R3-Water	0%	53%	8%	0%	13%	0%	26%	2.5

Table 18: Ground water distribution

Section 3: Income

Across rounds different players were able to improve their income. The highest income increase was in the tail areas, led by shifting to small livestock and small agricultural industries. The drought situation impacted highland alone in terms in income reduction, and post drought, there was shift of land-use away from nature towards small agricultural industries.

	Initial	R1 Land	R1 Water	R2 Land	R2 Water	R3 Drought	R3 Land	R3-Water
Head	18000	24000	24000	24000	24000	24000	24000	24000
Middle	18000	21000	21000	28000	28000	28000	32000	32000
Tail	18000	24000	24000	36000	36000	36000	36000	36000
Dryland	17000	20000	20000	29000	29000	24000	24000	24000
Highland	17000	19000	19000	21000	21000	18000	18000	18000

Table 19: Income per acre distribution across rounds

Section 4: Water sharing arrangement

Post the three rounds, the participants, were asked to reflect on the current water distribution between regions, and whether they felt a better redistribution was possible.

The participants playing as head-end felt the distribution was fair, while participants representing the dryland and highland areas felt it was not fair. The mid-end participants proposed that the distribution should be equal for each region.
The participants playing as water team felt, the head-end region can adopt less water intensive crop, which can then allow for increased allocation towards low land areas.
The proposed options in terms of redistribution are shown below.

Redistribution	HE	M	TE	DL	HL
Current	5	4.5	2	0.5	0
A1 (Selected)	2.5	2.5	2.5	2.5	2
A2	3	2	2	2	3

Table 20: Current Water sharing and proposed alternatives

Based on the discussion between participants, they decided to go ahead with A1. The consequences on canal water, groundwater allocation and income are shown below.
The redistribution led to increase in groundwater level.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total units
R3-Water	0%	31%	0%	8%	31%	29%	0%	0%	12
Reallocation	0%	35%	4%	8%	19%	23%	0%	10%	12

Table 21: Consequence on canal water use post reallocation.

Ground water	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
R3-Water	0%	53%	8%	0%	13%	0%	26%	2.5
Reallocation	0%	46%	8%	0%	8%	0%	38%	5.5

Table 22: Consequence on ground water use post reallocation.

The reallocation led to drop in income at head-end and mid-end respectively, and provided more water at dryland and highland areas, which led to increase in available groundwater. The session did not involve the change of land-use which was proposed, which would have increased the income at head-end area.

	R3-Water	Reallocation
Head	24000	15000
Middle	32000	30000
Tail	36000	36000
Dryland	24000	24000
Highland	18000	18000

Table 23: Consequence on income per acre post reallocation.

On being asked whether such a distribution is feasible and whether can be implemented on the ground, the participants said, using gate system for water distribution, it can be well implemented.

Section 5: Debrief with participants

On being asked whether they prefer the Raichur they have designed or the current one, all participants said they preferred the one they built. Dryland participants said they liked the one they created because it was more equal. Other participants attributed the preference to increase in income, greater share of mixed crops and presence of service industries and agricultural industries.
When asked if there was one change they would like to make, the dryland participants suggested they would replace natural land with income producing activity.

Section 6: Questions on gameplay

When asked on what were the reasons behind participants action in the game, the participants said they were trying to increase income, to balancing water usage and availability to ensuring they had borewell as their preference. One person said they were experimenting and did not have a preference. Participants also highlighted showing water logging in soil, and consequences on income helped them in deciding better.

Session 2

Section 1: Land use choices

Overall	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	17%	37%	27%	0%	0%	0%	0%	10%	10%
R1-Land	18%	25%	20%	18%	12%	0%	0%	3%	3%
R2-Land	12%	15%	10%	18%	7%	22%	13%	2%	2%
R3-Land	0%	7%	7%	33%	7%	32%	13%	2%	0%

Table 24: Land use choices

1. **Current setup:** The overall land use was dominated by cotton, followed by mixed and paddy, and some land allocated towards nature and barren.
2. **Round 1:**

- Land: The land team moved away from cotton and mixed towards small livestock and large livestock. The nature and barren land were also reduced.
- Water: In the first-round the water team redistributed canal water through FIC in headend area, and expansion of canal towards tow tiles in dryland and one lift irrigation in highland area.

3. **Round 2:**

- Land: In round 2, there was further shift away from paddy, cotton, mixed, natural and barren towards small agricultural industries and large service industries.
- Water: In round 2 the water team added FICs to mid-end and tail-end areas and extended the canal to two more tiles in dryland and one more tile in highland area through lift irrigation.

4. **Round 3:**

- Land: Post drought, there was consolidation towards small livestock and small agricultural industries. There was complete removal of paddy and barren areas.
- Water: In the last round, the water team decided to add 1 borewell in highland areas.

Land use changes for each region are shown below:

Head-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	50%	50%	0%	0%	0%	0%	0%	0%	0%
R1-Land	50%	0%	0%	25%	25%	0%	0%	0%	0%
R2-Land	50%	0%	0%	25%	0%	0%	25%	0%	0%
R3-Land	0%	0%	0%	25%	0%	50%	25%	0%	0%

Table 25: Land use changes for head-end areas

Mid-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	33%	33%	0%	0%	0%	0%	0%	0%	33%
R1-Land	0%	33%	33%	17%	17%	0%	0%	0%	0%
R2-Land	0%	33%	0%	17%	17%	33%	0%	0%	0%
R3-Land	0%	0%	0%	17%	17%	33%	33%	0%	0%

Table 26: Land use changes for mid-end areas

Tail-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	33%	0%	0%	0%	0%	33%	0%
R1-Land	33%	33%	0%	33%	0%	0%	0%	0%	0%
R2-Land	0%	0%	0%	33%	0%	33%	33%	0%	0%

R3-Land	0%	0%	0%	67%	0%	33%	0%	0%	0%

Table 27: Land use changes for tail-end areas

Dryland

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	50%	0%	0%	0%	0%	0%	17%
R1-Land	8%	42%	17%	8%	8%	0%	0%	17%	0%
R2-Land	8%	25%	17%	8%	8%	17%	8%	8%	0%
R3-Land	0%	17%	17%	25%	8%	17%	8%	8%	0%

Table 28: Land use changes for dryland areas

Highland

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	50%	0%	0%	0%	0%	17%	0%
R1-Land	0%	17%	50%	8%	8%	0%	0%	0%	17%
R2-Land	0%	17%	33%	8%	8%	25%	0%	0%	8%
R3-Land	0%	17%	17%	33%	8%	25%	0%	0%	0%

Table 29: Land use changes for highland areas

Section 2: Water Distribution choices

Canal water

1. **Current setup:** The canal water was initially split between cotton and paddy and some allocation towards mixed, and 28% of canal water was excess in canal areas.
2. Round 1:

- Land: The land use change in round 1 led to a decrease in share of paddy and cotton and allocated towards large livestock. Given the lesser requirement of water, this led to increase in excess in available water.
- Water: Post FIC in head-end, and expansion of canal to dry land and lift irrigation in highland areas, the water excess was diverted towards paddy, cotton and large livestock.

3. Round 2:

- Land: The shift in land-use towards small agricultural industries and large service industries, led to increased canal water allocation towards the same. The excess led to marginal increase.
- Water: In round 2, addition of FIC, and expansion of canal, led to reduction of excess to 3%, with increased allocation towards large livestock.

4. Round 3 —

- Drought: Drought saw the removal of excess water, and increased allocation paddy in head-end and mid-end areas, small agricultural industries also saw an increased allocation, while share of cotton and large service reduced.
- Land: The land-use changes post drought saw reduction of paddy and cotton in current canal area, leading to redistribution of water towards small agricultural industries and large service.
- Water: In the last round, the water team decided to add 1 borewell in highland areas, which led had no impact on the canal water distribution.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total Units
Initial	38%	30%	5%	0%	0%	0%	0%	28%	20
R1-Land	28%	20%	5%	0%	5%	0%	0%	43%	20
R1-Water	35%	38%	5%	0%	10%	0%	0%	13%	20
R2-Land	24%	29%	0%	0%	5%	10%	15%	18%	20
R2-Water	25%	33%	5%	0%	10%	10%	15%	3%	20
R3-Drought	38%	21%	0%	4%	10%	17%	10%	0%	12

R3-Land	0%	0%	4%	13%	15%	38%	31%	0%	12
R3-Water	0%	0%	4%	13%	15%	38%	31%	0%	12

Table 30: Canal water distribution

Ground water

1. **Current setup:** The groundwater was used towards cotton in the current state primarily in dryland and highland areas.
2. **Round 1:**

- Land: The land use change towards mixed led to greater allocation towards the same and away from cotton.
- Water: The redistribution through FIC, and expansion of canal, saw reduction of groundwater extraction by 3 units.

3. **Round 2:**

- Land: The shift of land use away from cotton, towards small agricultural industries saw a shift of allocation towards the same.
- Water: The FIC and expansion of canal further reduced the groundwater extraction by 0.75 units.

4. **Round 3: Drought:**

- Because of the drought, the ground water usage increased, leading to only 3.8 units remaining (from starting 6), towards primarily cotton followed by small agricultural industries.
- Land: Post drought, the land-use changes did not impact the groundwater level.
- Water: The water team in the last round, provided borewell to the highland area, leading to increased extraction by 1.5 units, and increased allocation towards mixed.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
Initial	0%	100%	0%	0%	0%	0%	0%	6.00
R1-Land	0%	86%	14%	0%	0%	0%	0%	5.50
R1-Water	0%	75%	25%	0%	0%	0%	0%	8.50
R2-Land	0%	33%	0%	0%	0%	67%	0%	8.75
R2-Water	0%	20%	0%	0%	0%	80%	0%	9.25
R3-Drought	0%	63%	0%	0%	0%	38%	0%	3.38

R3-Land	0%	63%	0%	0%	0%	38%	0%	3.38
R3-Water	0%	53%	16%	0%	0%	32%	0%	1.88

Table 31: Ground water distribution

Section 3: Income

Across rounds different players were able to improve their income. The highest income increase was in the head and tail end areas. The drought situation impacted the dryland and highland areas more, but by end of the rounds, they were able to recover.

	Initial	R1 Land	R1 Water	R2 Land	R2 Water	R3 Drought	R3 Land	R3 Water
Head	18000	21000	21000	24000	24000	24000	36000	36000
Middle	18000	19000	23000	30000	30000	30000	31000	31000
Tail	18000	21000	23000	36000	36000	24000	36000	36000
Dryland	17000	18000	19000	21000	24000	18000	25000	25000
Highland	17000	17000	17000	21000	21000	19000	24000	24000

Table 32: Income per acre distribution across rounds

Section 4: Water sharing arrangement

Post the three rounds, the participants, were asked to reflect on the current water distribution between regions, and whether they felt a better redistribution was possible.

The participants in water team felt the distribution was fair. The participants representing the dryland region mentioned that in real world even if they ask for their fair share, the head and mid-end area farmers won't agree. The discussion eventually was between equal distribution for all regions, and higher distribution for highland and dryland areas as it has more land spaces. Eventually the group decided on the latter.

Redistribution	H	M	T	DL	HL
Current	3	5.5	2.5	1	0
A1 (Selected)	2	2	2	3	3
A2	2.4	2.4	2.4	2.4	2.4

Table 33: Current canal water distribution and proposed alternatives

Based on the reallocation of water, the allocation of canal water, groundwater and income is shown below.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total units
R3-Water	0%	0%	4%	13%	15%	38%	31%	0%	12
Reallocation	0%	21%	21%	15%	8%	25%	10%	0%	12

Table 34: Consequence on canal water use post reallocation.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
R3-Water	0%	53%	16%	0%	0%	32%	0%	1.88
Reallocation	0%	45%	0%	0%	0%	55%	0%	5.88

Table 35: Consequence on ground water use post reallocation.

The income of mid-end area reduced, while that of dryland improved.

	R3-Water	Reallocation
Head	36000	36000
Mid	31000	25000
Tail	36000	36000
Dryland	25000	27000
Highland	24000	24000

Table 36: Consequence on income per acre post reallocation.

Section 5: Debrief with participants

On being asked whether they prefer the Raichur they have designed or the current one, all participants choose the one they designed. The reason for the same included that they were sharing water even in drought, their income was higher than when they started, and there were diverse jobs available while agriculture still was important.
When asked if there was one change they would like to make, dryland participant reflected that paddy should have been there despite its low income.

Section 6: Questions on gameplay

When asked on what were the reasons behind participants action in the game, the participants reflected, that income, water availability, focus on agriculture, soil quality and equal distribution were among the various factors. One participant from highland reflected there were no thought as such.
Players also reflected it was hard at the beginning, but as they game progressed, it was easy and found the session helpful.

Session 3

Section 1: Land use choices

Overall	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	17%	37%	27%	0%	0%	0%	0%	10%	10%
R1-Land	5%	25%	27%	15%	2%	7%	7%	13%	0%
R2-Land	0%	22%	15%	27%	2%	17%	7%	12%	0%
R3-Land	0%	15%	10%	30%	5%	17%	12%	12%	0%

Table 37: Land use choices

1. **Current setup: The overall land use was dominated by cotton, followed by mixed and paddy, and some land allocated towards nature and barren.**
2. **Round 1:**

- Land: The land team moved away from paddy and cotton towards diversification. There was some paddy left in head areas. The barren land was removed.
- Water: In the first-round the water team redistributed canal water through FIC in headend and mid-end areas, and expansion of canal towards dryland and lift irrigation to highland area.

3. **Round 2:**

- Land: In round 2, paddy was removed completely and the share of small livestock was increased followed by small agricultural industries.
- Water: In round 2 the water team added FICs to tail end areas, and extended canal in dryland and lift irrigation to highland areas by 1 and 2 tiles respectively.

4. **Round 3:**

- Land: Post drought, the share of cotton was reduced further, while that of small livestock and large service industries increased.
- Water: In the last round, the water team decided to add 1 borewell in dryland area.

Land use changes for each region are shown below:

Head-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	50%	50%	0%	0%	0%	0%	0%	0%	0%
R1-Land	25%	25%	0%	25%	0%	0%	25%	0%	0%
R2-Land	0%	25%	0%	25%	0%	25%	25%	0%	0%
R3-Land	0%	25%	0%	25%	0%	25%	25%	0%	0%

Table 38: Land use changes for head-end areas

Mid-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	33%	33%	0%	0%	0%	0%	0%	0%	33%
R1-Land	0%	33%	33%	0%	0%	0%	0%	33%	0%
R2-Land	0%	33%	0%	33%	0%	0%	0%	33%	0%
R3-Land	0%	33%	0%	33%	0%	0%	0%	33%	0%

Table 39: Land use changes for mid-end areas

Tail-end

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	33%	0%	0%	0%	0%	33%	0%
R1-Land	0%	0%	33%	33%	0%	33%	0%	0%	0%

R2-Land	0%	0%	17%	50%	0%	33%	0%	0%	0%
R3-Land	0%	0%	17%	33%	17%	33%	0%	0%	0%

Table 40: Land use changes for tail-end areas

Dryland

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	50%	0%	0%	0%	0%	0%	17%
R1-Land	0%	33%	33%	8%	8%	0%	0%	17%	0%
R2-Land	0%	33%	25%	8%	8%	8%	8%	8%	0%
R3-Land	0%	0%	25%	25%	8%	8%	25%	8%	0%

Table 41: Land use changes for dryland areas

Highland

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Nature	Barren
Initial	0%	33%	50%	0%	0%	0%	0%	17%	0%
R1-Land	0%	33%	33%	8%	0%	0%	8%	17%	0%
R2-Land	0%	17%	33%	17%	0%	17%	0%	17%	0%
R3-Land	0%	17%	8%	33%	0%	17%	8%	17%	0%

Table 42: Land use changes for highland areas

Section 2: Water Distribution choices

Canal water

1. Current setup:
- The canal water was initially split between cotton and paddy, and 28% of canal water was excess in canal areas.
2. Round 1:
- Land: The land use change in round 1 led to a decrease in share of paddy and cotton towards mixed, small agricultural industries and large service industry. Given the lesser requirement of water, this led to an increase in excess.
- Water: Post FIC and canal expansion the water excess was diverted towards large service industries and large livestock.
3. Round 2:
- Land: In round 2, the land use shift towards small livestock and small agricultural industries, further increased the excess water in canal command areas.
- Water: In round 2, the water team, by adding FICs and expansion of canal, was able to reduce the excess and increase the share of cotton.
4. Round 3 —
- Drought: Drought saw the removal of excess water, and increased allocation for all type of crops, while there was reduction of allocation towards mixed crops.
- Land: The land-use changes post drought saw reduction of mixed crops and cotton and saw an increase towards livestock (small and large) and large service industry.
- Water: In the last round, the water team decided to add 1 borewell in dryland area had not impact on canal water distribution.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total units
Initial	38%	30%	5%	0%	0%	0%	0%	28%	20
R1-Land	10%	15%	10%	0%	0%	5%	5%	55%	20
R1-Water	10%	15%	10%	0%	5%	5%	10%	45%	20
R2-Land	0%	15%	3%	0%	10%	8%	5%	60%	20
R2-Water	0%	35%	8%	0%	10%	8%	5%	35%	20
R3-Drought	0%	35%	6%	17%	13%	19%	10%	0%	12
R3-Land	0%	31%	6%	21%	13%	19%	10%	0%	12
R3-Water	0%	31%	6%	21%	13%	19%	10%	0%	12

Table 43: Canal water distribution

Ground water

1. Current setup:
- The groundwater was use towards cotton in the current setup primarily in dryland and highland areas.
2. Round 1:
- Land and Water: The groundwater usage was unchanged as the land use changes were not done in borewell areas, and canal water was also not extended to borewell areas.
3. Round 2:
- Land: The land use change in round 2, led to decrease in allocation of cotton towards small agricultural industries, with marginal decrease in groundwater extraction.
- Water: The redistribution of led to increased allocation towards small agricultural industries and reduction of ground water use by 4 units.
4. Round 3:
- Drought: Because of drought the ground water usage increased, leading to only 3.8 units remaining (from starting 6), towards primarily cotton followed by small agricultural industries.
- Land: Post drought, the land team shifted the land use away from cotton towards small livestock and large service, leading to greater allocation towards large service industries.
- Water: The water team in the last round, provided borewell to dryland area, which led to increased allocation towards large service.

	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
Initial	0%	100%	0%	0%	0%	0%	0%	6.0
R1-Land	0%	100%	0%	0%	0%	0%	0%	6.0
R1-Water	0%	100%	0%	0%	0%	0%	0%	6.0
R2-Land	0%	86%	0%	0%	0%	14%	0%	6.5
R2-Water	0%	67%	0%	0%	0%	33%	0%	10.5
R3-Drought	0%	82%	0%	0%	0%	18%	0%	3.8
R3-Land	0%	38%	0%	0%	0%	23%	38%	5.8
R3-Water	0%	33%	0%	0%	0%	20%	47%	4.8
Reallocation	0%	23%	0%	0%	0%	23%	54%	5.8

Table 44: Ground water distribution

Section 3: Income

Across rounds different players were able to improve their income. The highest income increase was in the head-end followed by other areas. The drought situation impacted dryland areas the most, and post drought, all regions were able to increase their income, and surpassed pre drought levels.

	Initial	R1 Land	R1 Water	R2 Land	R2 Water	R3 Drought	R3 Land	R3 Water	Reallocation
Head	18000	27000	27000	33000	33000	33000	33000	33000	21000
Mid	18000	18000	18000	30000	30000	30000	30000	30000	30000
Tail	18000	28000	29000	30000	30000	30000	30000	30000	27000
Dryland	17000	19000	20000	23000	23000	19000	23000	26000	27000
Highland	17000	20000	21000	24000	24000	21000	27000	27000	30000

Table 45: Income per acre distribution across rounds

Section 4: Water sharing arrangement

Post the three rounds, the participants, were asked to reflect on the current water distribution between regions, and whether they felt a better redistribution was possible.

The dryland participants felt that they should get more water and the share of tail end can be reduced. Water team and tail end participants also felt that lower regions should ask for more water from higher regions. Upon discussion, the group was not favour of equal distribution for each region since each region is unequal. Eventually they settled for equitable distribution of water based on land in each region.

Redistribution	H	M	T	DL	HL
Current	3.5	3	4	1	0.5
A1	3.5	3	2	2	1.5
A2	1.5	1.5	2	3	4
A3	2.4	2.4	2.4	2.4	2.4
A4 (Selected)	1.2	1.8	1.8	3.6	3.6

Table 46: Current canal water distribution and proposed alternatives

The consequence because of the reallocation is shown below for canal water, ground water and income. The excess marginally increased and the groundwater increased by 1 unit.

Canal	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	Excess	Total units
R3-Water	0%	31%	6%	21%	13%	19%	10%	0%	12
Reallocation	0%	25%	8%	29%	10%	8%	10%	8%	12

Table 47: Consequence on canal water usage post reallocation

Borewell	Paddy	Cotton	Mixed	Small Livestock	Large Livestock	Small Agri	Large Service	GW Level
R3-Water	0%	33%	0%	0%	0%	20%	47%	4.8
Reallocation	0%	23%	0%	0%	0%	23%	54%	5.8

Table 47: Consequence on ground water usage post reallocation

In term of income the income of dryland and highland areas increased, while that of head and tail end reduced.

	R3-Water	Reallocation
Head	33000	21000
Mid	30000	30000
Tail	30000	27000
Dryland	26000	27000
Highland	27000	30000

Table 47: Consequence on income per acre post reallocation

Section 5: Debrief with participants

On being asked whether they prefer the Raichur they have designed or the current one, many farmers preferred the one the created, the reason for the same included, equitable sharing of water, income being higher even during drought and income from livestock.
When asked if there was one change they would like to make, the participants reflected barren and natural land should have been more. One participant also reflected half a tile of paddy could be added.

Section 6: Questions on gameplay

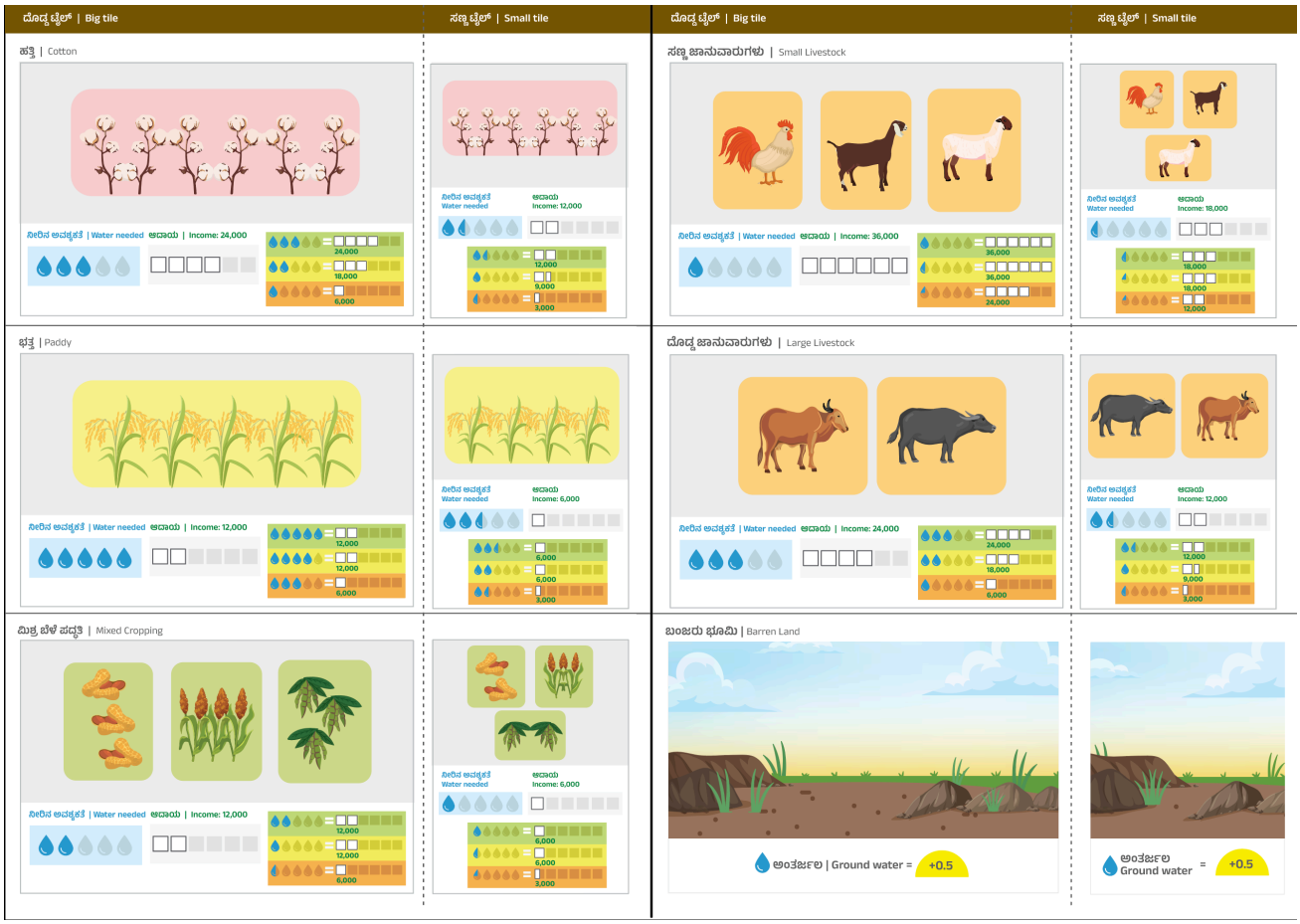
When asked on what were the reasons behind participants action in the game, participants suggested diversifying the crops, increasing income were their motives.

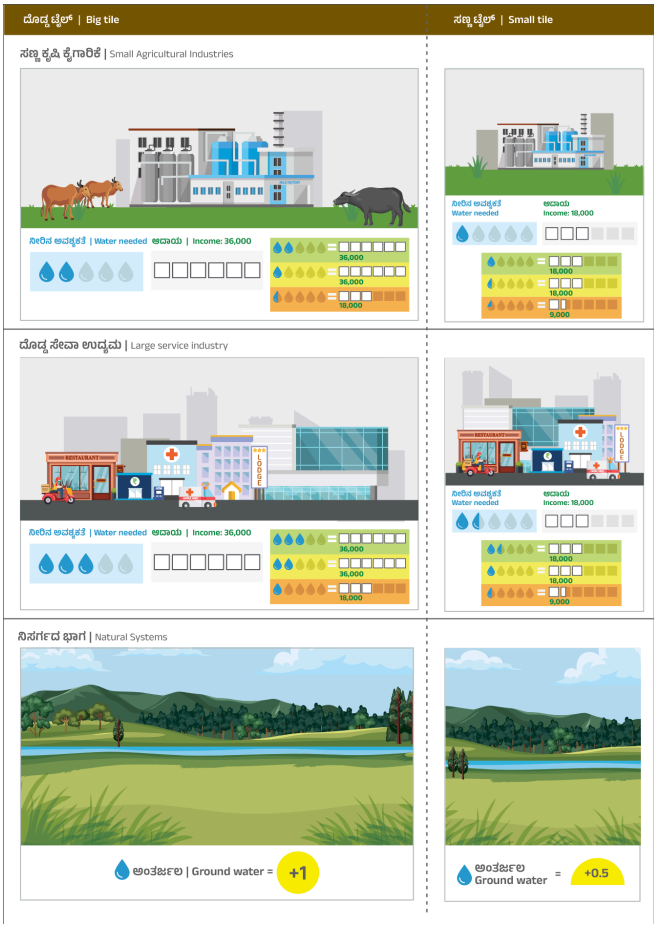
Next steps

The insights from these sessions' forms part of larger research and implementation carried out by WELL Labs in Raichur. The insights would be communicated with different stakeholders from government in Raichur towards an action plan to make the vision reality.

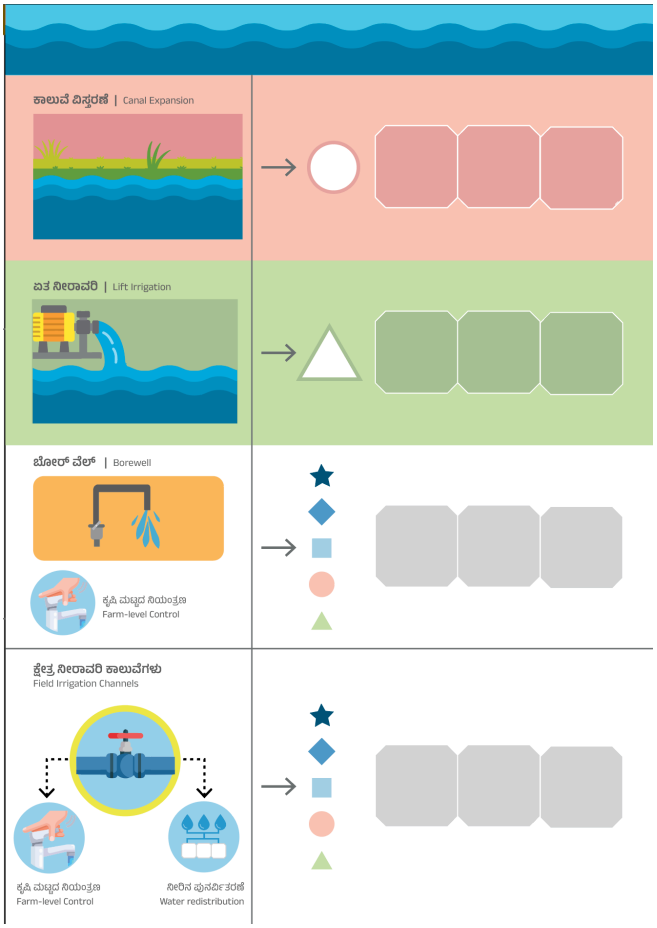
Annexure: Game Assets

1. Land Choices

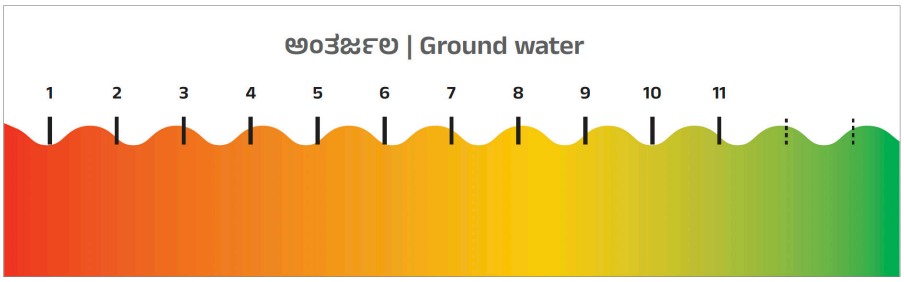


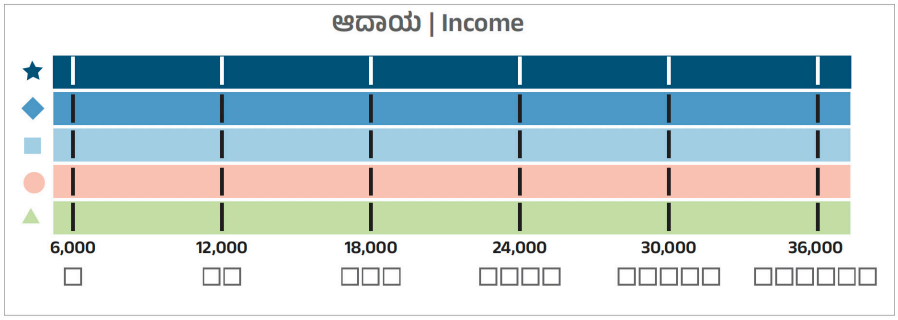


2. Water Choices

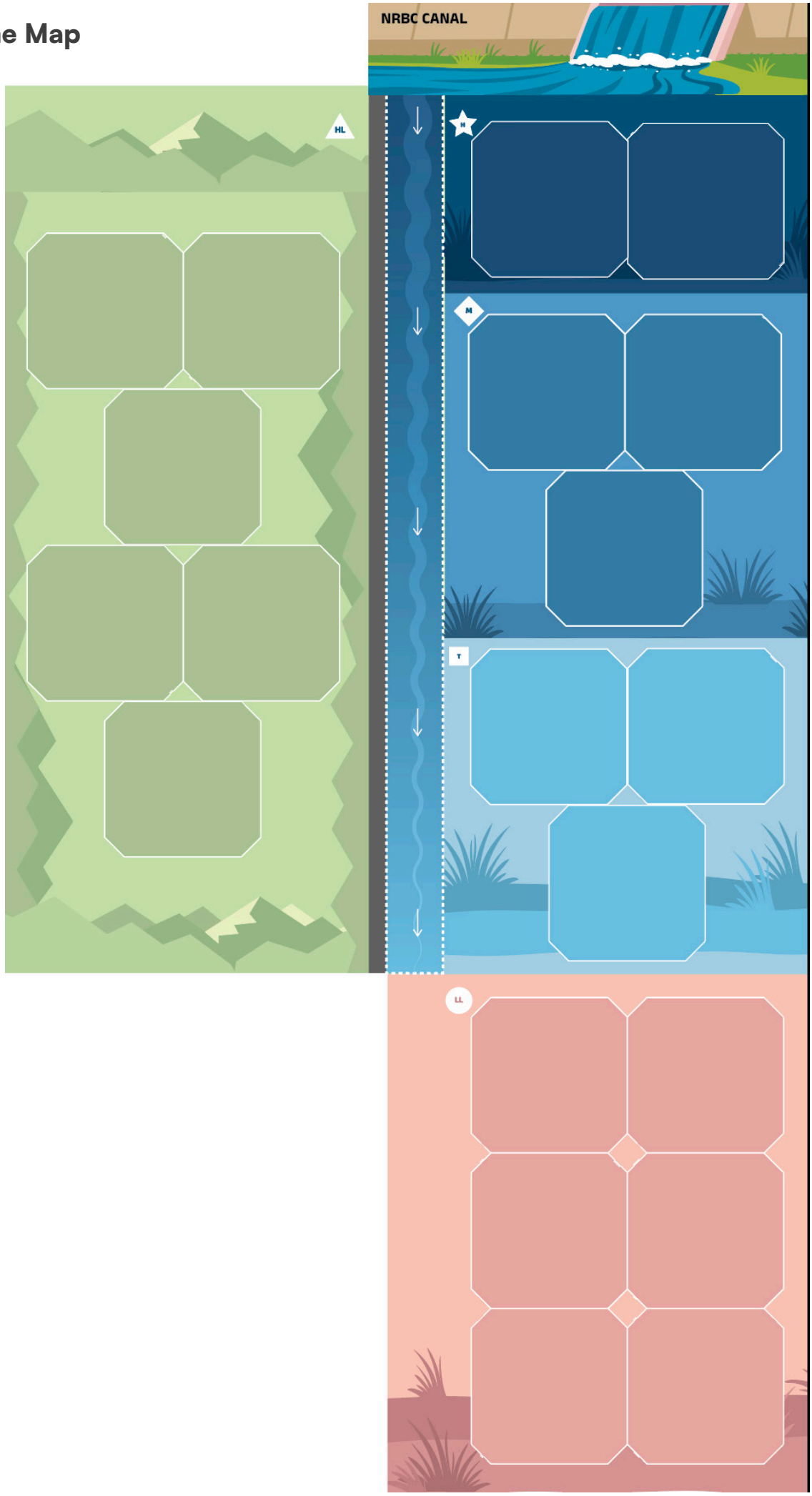


3. Game Indicator (Income + Ground water level)

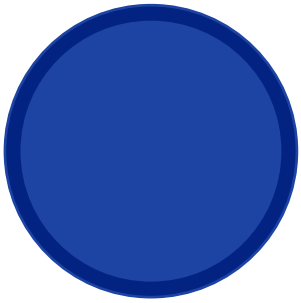




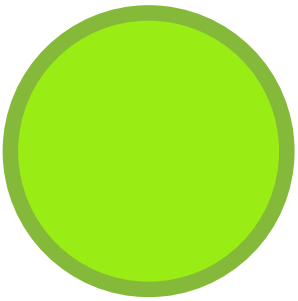
4. Game Map



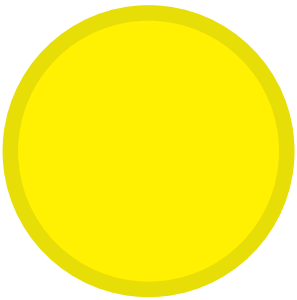
5. Water tokens



Rain water



Canal water



Ground water

6. Water logging in soil indicator