1 Background

Sri Lanka's village tank cascade systems are among the oldest community-managed irrigation systems in the world. They form the backbone of smallholder agriculture in the dry zone, supporting rural livelihoods through the collective management of tank-stored water and its distribution through shared canal networks (Ratnayake et al, 2021). The irrigation systems have endured for centuries, sustained not only by economic incentives but also by long-standing norms, cultural expectations, and informal institutions that govern cooperation among farmers (Ostrom, 1990; Ostrom and Gardner, 1993).

In these systems, Farmers' Organisations (FOs) act as local social planners. Before each cultivation season, they assess the tank's water level, determine the recommended extent of land to be cultivated, and coordinate collective canal cleaning to remove weeds, silt, and debris. These actions enable water to flow efficiently from the head end closest to the tank through the middle section to the tail end. In principle, such coordination allows the community to achieve a social optimum: cultivating the maximum possible area under water constraints while maintaining the canals in good condition.

However, individual incentives often diverge from this collective optimum. Both key decisions, which are how much land to cultivate and how much labour to contribute to canal cleaning, are vulnerable to free riding. Studies on gravitational irrigation systems have identified spatial asymmetry as a major factor contributing to this divergence (Dayton-Johnson, 2000b; Dayton-Johnson and Bardhan, 2002). Upstream, or head-end, farmers can over-cultivate and extract more water with little risk, whereas downstream farmers, located in the middle and tail ends, face shortages even when they comply with FO recommendations.

Despite these structural inequalities, empirical research shows that many irrigation communities have developed mechanisms to overcome asymmetric benefits and sustain cooperation (Weissing and Ostrom, 1991; Ostrom et al., 1994; Janssen et al., 2012). Through local rule enforcement, mutual monitoring, and shared norms, farmers have historically maintained collective canal cleaning and equitable water distribution.

During years of good rainfall, this location asymmetry remains hidden by the abundance of water, but under drought conditions, unequal access becomes sharply visible. However, increasing climatic uncertainty now threatens these informal equilibria through frequent and unpredictable droughts. Climate variability amplifies the spatial dependence of irrigation outcomes, transforming irrigation management into a coupled-commons dilemma in which two interdependent public goods —canal condition and irrigation water —must be sustained through voluntary cooperation.

Recent empirical evidence from Sri Lankan tank systems illustrates this challenge. Analysis of secondary data and field surveys conducted between December 2024 and May 2025 reveals a clear behavioural pattern: in drought years, both middle- and tail-end plots were cultivated to a lesser extent than recommended by FOs. Farmers in these locations reported deliberately reducing cultivated area to manage water risk, but also decreasing canal-cleaning hours because they expected limited returns from a system in which upstream farmers overused water.

These location-specific responses reveal a form of strategic adaptation: farmers in disadvantaged positions withdraw from both land use and collective labour in anticipation of others' defection. This behaviour, where private adaptation to scarcity (reducing cultivated extent) crowds out contribution to the enabling public good (canal maintenance), is the central empirical puzzle motivating this study. The key question is whether such restraint by downstream farmers during drought also leads to reduced canal maintenance effort, thereby accelerating collective decline. Over repeated droughts, even small reductions in canal effort across many farmers could accumulate into long-term deterioration of water conveyance and institutional capacity.

To identify the mechanisms linking these behaviours, the study conceptualises farmers' seasonal decisions as a coordination game. In good seasons, when water is abundant, the game simplifies to a single public goods problem, canal cleaning, where cooperation achieves the social optimum but remains vulnerable to free riding. In drought seasons, however, the game becomes a nested coordination problem: canal cleaning and cultivation extent interact. Water allocation depends on upstream over-cultivation, so downstream farmers' payoffs are jointly determined by others' cultivation decisions and total canal cleaning effort. Each farmer must decide whether to continue contributing labour to a canal that may not deliver sufficient water.

This study, therefore, focuses on the behavioural responses of farmers at different spatial positions, head, middle, and tail ends, under varying environmental and institutional conditions. By experimentally replicating these irrigation environments, the research isolates the causal effects of drought and upstream defection on cooperative labour, providing new evidence on how spatial asymmetry and climate variability jointly shape collective action in self-managed irrigation systems.

2 Objectives

Building on the observed behavioural shifts from secondary and primary data, this project aims to test how environmental and spatial conditions influence canal cleaning effort, the critical form of collective labour in irrigation. The study will address the following questions:

1. How do drought conditions affect canal cleaning effort across head, middle, and tail positions?
2. How does upstream over-cultivation influence downstream farmers' willingness to contribute to canal cleaning labour?
3. Will the contributions from downstream and upstream farmers return to their usual levels after the drought, similar to those in good seasons?

3 Hypotheses

- H1 (Environmental effect): During drought seasons, the total effort to clean the canals will decrease relative to good seasons, but the reduction will be most severe at the tail end, moderate in the middle and smallest at the head end.
- H2 (Strategic asymmetry effect): During drought seasons, when upstream farmers (head end) over-cultivate beyond FO's recommendations, downstream farmers (middle and tail end) will reduce canal cleaning effort relative to when upstream farmers comply.
- H3 (Recovery effect): After drought seasons, canal-cleaning contributions from both upstream (head-end) and downstream (middle- and tail-end) farmers are expected to rise again in good seasons, approaching their usual levels observed during good seasons prior to the drought.

4 Units of Analysis and Outcomes

Unit of Analysis: The individual farmer. Each participant manages a five-acre plot located at the head, middle, or tail section of a canal, representing distinct water access and cooperation incentives. Each farmer has 10 labour hours to allocate per round between canal cleaning (public) and off-farm employment (private).

Primary outcome: The primary outcome for hypotheses from H1 – H3 is the number of labour hours contributed to canal cleaning per round, disaggregated by spatial position (head, middle, tail). From these data, we calculate:

- **For H1 (Environmental effect):** Differences in mean canal-cleaning effort by location (head, middle, tail) in good vs. drought seasons.
- **For H2 (Strategic asymmetry effect):** Differences in mean canal-cleaning effort between the treatment group with upstream over-cultivation and the group with upstream compliance by location. (head, middle, tail).
- **For H3 (Recovery effect):** Differences in mean canal-cleaning effort by location in the post-drought rounds in treatment groups who experienced drought in middle rounds relative to the control group who did not experience any drought rounds.

Secondary outcomes: Relate to belief formation and coordination expectations. These are elicited through two incentivised and structured "guess" questions in each round:

- Guess on Land: participant's belief about the average number of extra acres cultivated by upstream farmers beyond FO recommendations
- Guess on Canal Cleaning: participant's belief about the average number of canal cleaning hours contributed by others

These expectations will be analysed by spatial position to test how beliefs differ between head, middle, and tail farmers, and how these expectations shape actual cleaning effort.

5 Basic Methodology

The experimental features of this study include a framed coordination game that simulates irrigation decisions made by farmers under varying environmental and spatial conditions. The experiment consists of multiple rounds representing cultivation seasons, where participants make private, incentivised choices about labour allocation to canal cleaning (a public good) versus off-farm work (a private activity). Also, incentivised measures include two belief elicitation questions on expectations about others' cultivation and canal cleaning decisions.

Each session consists of 18 farmers, divided into three groups of six who share a simulated canal. Within each group, farmers are randomly assigned spatial positions—two head-end, two middle-end, and two tail-end plots. Each participant controls a 5-acre plot and 10 labour hours per season, which they can divide between:

- Canal cleaning (public activity): each hour contributes Rs. 4 per acre increase in their revenue from paddy harvest.
- Selling vegetables (private activity): each hour yields Rs. 600.

Earnings from paddy cultivation depend on the water received and the total canal cleaning hours by the group. Water availability varies by season and location.

Each session lasts ten rounds, representing consecutive cultivation seasons:

- Rounds 1–3: Good seasons (pre-shock)
- Rounds 4–6: Drought seasons (shock)
- Rounds 7–10: Good seasons (post-shock recovery)

Participants are not told how many periods over which they will make decisions, and so may think of the task as an infinite, discrete choice game. Participants earn real cash based on their decisions, with total payments capped at Rs. 1,000 per person, including a Rs. 200 show-up fee.

Participants will be randomised at the individual level, in equal proportions, into 1 of 3 groups. Within the group, they will be randomly assigned to one of the locations (head, middle and tail):

1. Group 1 – During drought rounds, upstream over-cultivates compared to what is recommended by FO. During drought rounds, upstream (head-end) farmers are told they have water to cultivate all 5 acres. Middle-end farmers are told they have water to cultivate 2 acres, and tail-end farmers only 1 acre, due to upstream over-cultivation. During good rounds, everyone has been told they have enough water to cultivate all five acres.
2. Group 2 – During drought rounds, upstream compliance to what is recommended by FO: Head-, middle-, and tail-end farmers all have water to cultivate 3 acres, as everyone follows the FO recommendation. During drought rounds, upstream (head-end) farmers are told they have water to cultivate all 5 acres. Middle and tail-end are told that their plots have enough water to cultivate three acres, as the farmers above their plots followed the FO's recommendation and cultivated only three acres, so they have just enough water for three acres. During good rounds, everyone has been told they have enough water to cultivate all five acres.
3. Group 3 (Control) – Good seasons only: All farmers have enough water to cultivate 5 acres in every round. No water scarcity.

After receiving information about the season and water availability, each farmer privately completes a decision sheet where they record:

- Incentivised guess on Land for middle and tail end farmers: expected number of extra acres cultivated by upstream farmers.
- Incentivised guess on Canal Cleaning: expected average canal cleaning hours by others.
- Labour allocation: how many of their 10 hours to allocate to canal cleaning and how many to selling vegetables.

No participant is informed of others' decisions. Facilitators collect all decision sheets each round and calculate payoffs based on the group's total canal cleaning effort. At the end of each round, participants are informed privately of:

- Their total earnings from vegetable selling, own canal cleaning, and others' canal cleaning.
- The total hours of canal cleaning in their group.
- The water available to their plot and their paddy income.

After all ten rounds, facilitators conduct a short exit survey collecting non-incentivised measures: risk preferences, reciprocity, altruism, and trust. Also, demographic and socio-economic data. Each participant's final payment is determined by selecting one random round, adding any bonus earnings for accurate guesses, and including the Rs. 200 participation fee.

6 Sampling and Power calculations

Sampling

The goal is to sample irrigation systems that represent variation in farmer cooperation and water management outcomes across Sri Lanka's dry-zone cascade systems. To establish the experimental study area, districts were stratified by the number of cascade systems. Anuradhapura District was selected because it contains the highest concentration of cascades in the country and contributes the largest share of paddy cultivation to national production.

Within Anuradhapura District, three cascade systems were selected using two criteria: (i) the linearity of the cascade network, which determines the spatial relationship between head-, middle-, and tail-end, and (ii) system functionality, reflected in the presence of active Farmers' Organizations (FOs). The selected cascades, Thirappane, Mahakanumulla, and Ulagalla, are among the most documented in existing studies, providing reliable historical and spatial data. Together, these three cascade systems include 112 village tanks administered under the Thirappane Agrarian Service Centre (ASC), which oversees 41 FOs.

To select the experimental sample, 11 FOs will be randomly selected from this list to ensure representation across the cascade systems while maintaining implementation feasibility. From these 11 FOs, a random sample of 396 farming households will be drawn from the 4,764 registered farmers under the Thirappane ASC. Within each FO, 36 participants will be randomly selected to take part in the experimental sessions. Two experimental sessions will be conducted per FO, each including 18 participants divided into three equal groups.

Respondents for the experiment will be identified through a list provided by the FO leaders in each selected FO. This list of registered farmers will serve as the sampling frame. Once the complete lists are obtained, participants will be randomly selected from each FO according to the planned allocation.

Power Calculations

Our empirical objective is to compare the impact of upstream compliance on cooperative canal-cleaning behaviour during drought seasons. The experiment follows a two-arm design, with Group 1 (non-compliance) and Group 2 (compliance) representing upstream behavioural variation under identical drought conditions.

We have calibrated power calculations using baseline survey estimates of canal-cleaning effort and assumed equal variances across groups. Assuming 0.80 power and $\alpha = 0.05$, the minimum detectable effect (MDE) for the main treatment comparison between compliance and non-compliance is 0.10 standard deviations in canal cleaning effort. Based on this MDE and equal variance, the required sample size is 28 participants per group, sufficient to detect the expected difference between Group 1 and Group 2 while averaging over spatial positions (middle and tail locations).

For the location heterogeneity test, we use baseline survey estimates of variation in canal-cleaning effort across spatial positions. The observed minimum detectable differences are 0.32 standard deviations between head and middle farmers and 0.34 standard deviations between head and tail farmers. Assuming 80% power and $\alpha = 0.05$, the required sample size to detect these location effects within a treatment arm is 20 participants per location. To ensure adequate power for both treatment and heterogeneity analyses, we adopt a sample size of 28 participants per location, resulting in a total of 84 participants per treatment arm. Thus, for the Group 1 and Group 2 comparison we need total of 168 participants and for the control group we need another 84 participants. Therefore resulting in 252 participants overall for two treatment groups and a control group. Allowing for a 10% non-respondent rate, we need a total of 278 participants.

This design ensures sufficient power (80%) to detect a 0.10 SD treatment effect between compliance and non-compliance groups, as well as 0.32–0.34 SD location differences within groups.

7 Pre-specified analytical decisions

H1. Drought effect by location for Group 2

Our main dependent variable of interest is canal cleaning hours in each round (y_{it}: canal-cleaning hours by individual i in round t). The ATE is calculated separately for different location groups ($\text{Location}_p \in \{\{Head\}, \{Middle\}, \{Tail\}\}$). First, we will conduct a comparison of the means from Rounds 1 - 6 of Group 2, who experienced drought in Rounds 4 - 6 but followed what is recommended by FO. Then, we will estimate the following equation.

$$y_{it} = \alpha + \sum_{t \neq 3}^{6} \rho_t \ \mathbf{1}\{t\} + \gamma X_i + \epsilon_{it}$$

We will present results with and without individual controls, X_i. The round effect is ρ_t and the excluded round is Round 3. We expect: $\rho_1 = \rho_2 = 0$ and $\rho_t < 0$ for all $t \in \{4, 5, 6\}$. We are uncertain about the magnitude changes of ρ in Rounds 4 to 6.

We will also examine heterogeneity by the location of their plot in the experiment. We will estimate the following equation:

$$\begin{aligned} y_{it} =& \alpha + \beta_1 \ \text{Middle}_i + \beta_2 \ \text{Tail}_i + \sum_{t \in \{1,2,4,5,6\}} \rho_t \ \mathbf{1}\{t\} \\ &+ \sum_{t \in \{1,2,4,5,6\}} \delta_t^M [\text{Middle}_i \times \ \mathbf{1}\{t\}] + \sum_{t \in \{1,2,4,5,6\}} \delta_t^T [\text{Tail}_i \times \ \mathbf{1}\{t\}] + \gamma X_i + \epsilon_{it} \end{aligned}$$

The reference group for the location is Head.

We expect:

- $\beta_1 > 0$ and $\beta_2 > 0$
- For all $t \in \{1, 2\}$, $\rho_t = 0$, $\delta_t^T > 0$ and $\delta_t^M > 0$
- For all $t \in \{4, 5, 6\}$, $\delta_t^T < 0$, $\delta_t^M < 0$, and $\rho_t < 0$

We are uncertain about the magnitude changes of ρ, δ^T and δ^M in Rounds 4 to 6.

Standard errors will be clustered at the round level to account for within-round correlation across participants. To address potential serial correlation across rounds for the same participant group, the estimation will also be tested using Newey–West heteroskedasticity and autocorrelation-consistent (HAC) standard errors.

H2. Over-cultivation vs compliance in drought

Our main dependent variable of interest is canal cleaning hours in each round (y_{it}: canal-cleaning hours by individual i in round t). We will conduct a comparison of the means of canal cleaning hours between Group 1 (Drought in R4 - R6 and upstream over-cultivation) and Group 2 (Drought in R4 - R6 and compliance of upstream farmers). Then, we will estimate the following equation.

$$y_{it} = \alpha + \beta_1 \text{ Nocomp}_i + \sum_{t\in\{1,2,4,5,6\}} \rho_t \ \mathbf{1}\{t\} + \sum_{t\in\{1,2,4,5,6\}} \delta_t[\text{Nocomp}_i \times \ \mathbf{1}\{t\}] + \gamma X_i + \epsilon_{it}$$

Nocomp_i is an indicator of whether the participant was in Group 1, who experienced drought in R4 - R6 with upstream farmers over-cultivated above the FO's recommendation on cultivatable extent. The reference group for Nocomp_i is Group 2, who face a drought in R4 - R6, but upstream farmers comply with FO's recommendation on cultivatable extent. The reference round is Round 3. We will present results with and without individual controls, X_i.

We expect:

- $\beta_1 = 0$
- For all $t \in \{1, 2\}, \rho_t = \delta_t = 0$
- For all $t \in \{4, 5, 6\}, \delta_t < 0$ and $\rho_t < 0$.

We are uncertain about the magnitude changes of ρ and δ in Rounds 4 to 6.

We will also examine heterogeneity by the location of their plot. We will estimate the following equation:

$$\begin{aligned} y_{it} = \alpha + \rho_t + \beta_1 \text{ Nocomp}_i + \beta_2 \text{ Middle}_i + \beta_3 \text{ Tail}_i + \beta_4[\text{ Nocomp}_i \times \text{ Middle}_i] + \beta_5[\text{ Nocomp}_i \times \text{ Tail}_i] \\ + \sum_{t\in\{1,2,4,5,6\}} \rho_t \ \mathbf{1}\{t\} \\ + \sum_{t\in\{1,2,4,5,6\}} \delta_t^M[\text{ Middle}_i \times \ \mathbf{1}\{t\}] \\ + \sum_{t\in\{1,2,4,5,6\}} \delta_t^T[\text{ Tail}_i \times \ \mathbf{1}\{t\}] \\ + \sum_{t\in\{1,2,4,5,6\}} \theta_t^H[\text{Nocomp}_i \times \ \mathbf{1}\{t\}] \\ + \sum_{t\in\{1,2,4,5,6\}} \theta_t^M[\text{Nocomp}_i \times \text{ Middle}_i \times \ \mathbf{1}\{t\}] \\ + \sum_{t\in\{1,2,4,5,6\}} \theta_t^T[\text{Nocomp}_i \times \text{ Tail}_i \times \ \mathbf{1}\{t\}] \\ + \gamma X_i + \epsilon_{it} \end{aligned}$$

The reference group for the location is Head.

We expect:

- $\beta_1 = \beta_4 = \beta_5 = 0$

- $\beta_2 > 0$ and $\beta_3 > 0$
- For all $t \in \{1,2\}$, $\rho_t = \theta_t^H = \theta_t^M = \theta_t^T = 0$
- For all $t \in \{1,2\}$, $\delta_t^M > 0$ and $\delta_t^T > 0$
- For all $t \in \{4,5,6\}$, $\rho_t < 0$, $\delta_t^M < 0$, $\delta_t^T < 0$
- For all $t \in \{4,5,6\}$, $\theta_t^M < 0$, $\theta_t^T < 0$, and $\theta_t^H = 0$

We are uncertain about the magnitude changes of ρ, δ^T and δ^M in Rounds 4 to 6.

Standard errors will be clustered at the round level to account for within-round correlation across participants. To address potential serial correlation across rounds for the same participant group, the estimation will also be tested using Newey–West heteroskedasticity and autocorrelation-consistent (HAC) standard errors.

H3. Recovery effect after drought

We will conduct a comparison of the means among Group 1 (Drought in R4 - R6 and upstream over-cultivation) and Group 3 (Control - No drought). Then, we will estimate the following equation to see the recovery after drought.

$$y_{it} = \alpha + \beta_1 \text{ Nocomp}_i + \sum_{t \neq 3}^{10} \rho_t \ \mathbf{1}\{t\} + \sum_{t \neq 3}^{10} \delta_t [\text{Nocomp}_i \times \ \mathbf{1}\{t\}] + \gamma X_i + \epsilon_{it}$$

Nocomp_i is an indicator of whether the participant was in Group 1, who experienced drought in R4 - R6 with upstream farmers over-cultivated above the FO's recommendation on cultivatable extent. The reference group for Nocomp_i is Group 3, who never experienced a drought in any rounds. The reference round is Round 3. We will present results with and without individual controls, X_i.

We expect:

- $\beta_1 = 0$
- For all $t \in \{1,2\}, \rho_t = \delta_t = 0$
- For all $t \in \{4,5,6,7,8,9,10\}, \rho_t = 0$ and $\delta_t < 0$
- δ_t in R7 to R10 will be lower in magnitude compared to δ_t in R4 to R6

We will also examine heterogeneity by the location of their plot. We will estimate the following equation:

$$
\begin{aligned}
y_{it} = \alpha + \rho_t + \beta_1 \text{ Nocomp}_i + \beta_2 \text{ Middle}_i + \beta_3 \text{ Tail}_i + \beta_4[\text{ Nocomp}_i \times \text{ Middle}_i] + \beta_5[\text{ Nocomp}_i \times \text{ Tail}_i] \\
+ \sum_{t \neq 3}^{10} \rho_t \ \mathbf{1}\{t\} \\
+ \sum_{t \neq 3}^{10} \delta_t^M [\text{ Middle}_i \times \ \mathbf{1}\{t\}] + \sum_{t \neq 3}^{10} \delta_t^T [\text{ Tail}_i \times \ \mathbf{1}\{t\}] \\
+ \sum_{t \neq 3}^{10} \theta_t^H [\text{Nocomp}_i \times \ \mathbf{1}\{t\}] \\
+ \sum_{t \neq 3}^{10} \theta_t^M [\text{Nocomp}_i \times \ \text{Middle}_i \times \ \mathbf{1}\{t\}] \\
+ \sum_{t \neq 3}^{10} \theta_t^T [\text{Nocomp}_i \times \ \text{Tail}_i \times \ \mathbf{1}\{t\}] \\
+ \gamma X_i + \epsilon_{it}
\end{aligned}
$$

The reference group for the location is Head.

We expect

- $\beta_1 = \beta_4 = \beta_5 = 0$, $\beta_2 > 0$ and $\beta_3 > 0$
- For all $t \in \{1, 2\}$, $\rho_t = \theta_t^H = \theta_t^M = \theta_t^T = 0$
- For all $t \in \{1, 2\}$, $\delta_t^M > 0$ and $\delta_t^T > 0$
- For all $t \in \{4, 5, 6, 7, 8, 9, 10\}$, $\rho_t = 0$, $\delta_t^M > 0$, $\delta_t^T > 0$
- For all $t \in \{4, 5, 6, 7, 8, 9, 10\}$, $\theta_t^M < 0$, $\theta_t^T < 0$, and $\theta_t^H = 0$.
- θ_t^M and θ_t^T in R4 to R6 will be higher in magnitude compared to R7 to R10

Standard errors will be clustered at the round level to account for within-round correlation across participants. To address potential serial correlation across rounds for the same participant group, the estimation will also be tested using Newey–West heteroskedasticity and autocorrelation-consistent (HAC) standard errors.

8 References

1. Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press; 1990.

2. Ostrom, E, and Gardner, R. (1993). Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work. *Journal of Economic Perspectives* 7 (4): 93–112.

3. Dayton-Johnson, J. (2000). Determinants of collective action on the local commons: a model with evidence from Mexico, *Journal of Development Economics*, 62 (1), 181-208, https://doi.org/10.1016/S0304-3878(00)00080-8.

4. Ratnayake, S. S., Reid, M., Larder, N., Kadupitiya, H. K., Hunter, D., Dharmasena, P. B., Kumar, L., Kogo, B., Herath, K., and Kariyawasam, C. S. (2023). Impact of Climate Change on Paddy Farming in the Village Tank Cascade Systems of Sri Lanka. *Sustainability*, 15(12), 9271. https://doi.org/10.3390/su15129271

5. Dayton-Johnson, J. and Bardhan, P. (2002), INEQUALITY AND CONSERVATION ON THE LOCAL COMMONS: A THEORETICAL EXERCISE. *The Economic Journal*, 112: 577-602. https://doi.org/10.1111/1468-0297.00731

6. Weissing, F., Ostrom, E. (1991). Irrigation Institutions and the Games Irrigators Play: Rule Enforcement Without Guards. In: Selten, R. (eds) Game Equilibrium Models II. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-662-07365-0_9.

7. Ostrom, E., Gardner, R., and Walker, J. (1994). Rules, games, and common-pool resources. University of Michigan press.

8. Janssen, M. A., Bousquet, F., Cardenas, J. C., Castillo, D., and Worrapimphong, K. (2012). Field experiments on irrigation dilemmas. Agricultural Systems, 109, 65-75.