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Gender inequality in the midst of the transformation of the work role of the community around the Putri Cempo Power Plant, Jatirejo Village

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ABSTRACT

The development of the Putri Cempo Waste Power Plant or *Pembangkit Listrik Tenaga Sampah (PLTSA)* is often framed as a technological solution, yet it triggers complex social friction within the surrounding informal sector. Previous studies have focused heavily on environmental impacts, neglecting socio-structural dynamics. This study aims to analyze the transformation of work roles and the reconstruction of gender inequality in Jatirejo Village before and after the *PLTSA* construction from a structural-functional perspective. Employing a qualitative descriptive method, data were collected through in-depth interviews with key informants in May 2025. The analysis utilized Miles and Huberman's interactive model to correlate field findings with social change theory. The study reveals an irony of development mapped into two phases: First, the Invention Phase, where the community shifted from an agrarian to a waste-based subsistence economy not as innovation, but as a survival mechanism. Second, the Diffusion Phase, where *PLTSA* technology acted as an instrument of exclusion, severing access to economic resources, occurred. A critical finding is the radical reconstruction of gender roles: men experienced structural paralysis due to formal employment co-optation, creating a political agency void. Consequently, women have transformed from domestic roles into the vanguard of environmental advocacy to fill this void. Community resilience in Jatirejo is not a product of development but a self-balancing mechanism achieved at the cost of women's double burden as both domestic caretakers and the last bastion of community defense.

Keywords: irony of development; *PLTSA* Putri Cempo; social change; gender roles; structural paralysis

1. INTRODUCTION

Development often carries complex social impacts, especially for vulnerable groups, such as the communities around the project, who work in the informal sector (Aboda et al., 2019; Priya, 2025). The latest data from the Central Statistics Agency or *Badan Pusat Statistik (BPS)* show that in 2022, approximately 58% of the workforce in Indonesia worked in the informal sector, based on the results of the BPS National Labor Force Survei or *Survei Angkatan Kerja Nasional (SAKERNAS)* in February 2022 (Sari & Sugiarto, 2024). This percentage confirms that the majority of workers in Indonesia are still in the informal sector, which generally has a low level of social protection and economic certainty (Desanta & Aisyah, 2025; Sari & Sugiarto, 2024). Factors such as open unemployment, poverty rates, and regional minimum wages significantly affect the size of informal sector workers, while regional economic growth reduces dependence on the informal sector (Desanta & Aisyah, 2025). As the need for employment increases as development is increasingly encouraged, especially in areas dominated by the informal sector, the role of women in this sector often faces difficulties in obtaining social security and economic welfare (Rohmah et al., 2024).

The development agenda that is often held in the final disposal area or *Tempat Pemrosesan Akhir (TPA)* is in the form of *PLTSA*, which is famous as *PLTSA Putri Cempo* as an alternative to waste management. The location of *PLTSA* is adjacent to the *TPA*, which is one of the sources of livelihood for the surrounding community as scavengers. The presence of *PLTSA Putri Cempo* is faced with domestic communities living around it. Although the presence of *PLTSA* reduces excess waste capacity, its development greatly affects the needs, freedom, fulfillment, and fair treatment of the surrounding community. When viewed in terms of location, *PLTSA* is very close to settlements and *TPA* (Naben, 2023).

However, even though development is scheduled in various sectors, the progress of this development has not been evenly distributed because the positive impact of this development has not been fully felt by the informal worker sector in the village. This group of informal sector workers generally has low skills and competencies; therefore, they still face limited employment opportunities (Sofianto et al., 2024). The phenomenon of inequality in the impact of development can be observed on a more specific scale in the *TPA* located in Mojosoongo Village, Surakarta City, where a large-scale development agenda is directly confronted with the social reality of the surrounding informal worker community (Murtyas et al., 2025; Sunarti et al., 2022).

In the development agenda, social changes in the structure of society require several factors from within and outside society itself (Goa, 2017). The process of change in the structure and functioning of the social system goes through at least three stages: invention, diffusion, and consequence. Invention is the process by which society creates something new from within itself to bring about change. Diffusion is the dissemination of ideas from outside sources that are then conveyed and introduced into society. Consequences, namely the results or impacts that arise from the community's acceptance of these changes (Rabadjeva & Butzin, 2020; Redmond, 2003; Rogers, 1962; Tverskoi et al., 2022).

From a gender perspective, the impact of development gives birth to new problems in the form of massive modernization in various aspects of life that change the role of gender. In a traditional subsistence society, both men and women have equal space in work and social responsibility (Shalihin & Firdaus, 2019). Gender is often used as an analytical tool in the social science school of conflict, as its main focus is on structural injustices arising from gender construction. Oakley (2016) distinguishes between biological sex differences that are natural and gender as behavioral differences shaped by social and cultural processes (Oakley, 2016). This shows that the differences in behavior between men and women are not solely caused by biological factors but by cultural constructions that continue to change according to the context of time, place, and social class (Fakih, 2008).

Some negative impacts of the presence of solar power plants have been described in several previous studies. In the research that has been conducted by Ardiyansyah (2025), it explained several negative impacts due to the construction of *PLTSA*. According to the Surakarta City Environment Office, of the volume of waste produced every day, reaching 300 tons, around 84.94% is disposed of at the Putri Cempo Landfill. The high production of waste burdens landfills, especially because the management system still

uses open dumping, which is the simplest way without any advanced processes (Ardiansyah et al., 2025). Supriyadik and Budiman (2020) explained that the waste management system at the Putri Cempo Landfill, which still uses the open dumping method, causes a high environmental burden because there is no advanced processing, which has the potential to cause soil and water pollution. In addition, Rahayu et al. (2024) explained that tar waste from the gasification process at *PLTSA* contains heavy metals such as iron and zinc, although at relatively safe levels, but still shows the potential for toxicity that needs further management to avoid endangering the environment and health.

However, the policy of building the Putri Cempo *PLTSA* in Mojosongo Village not only has an impact on the environment and health but also on social aspects (Ardiansyah et al., 2025). This social impact has not been discussed in previous studies. The impact of the presence of *PLTSA* can be reviewed not only in terms of the environment but also in social aspects. This tension can trigger social impacts that implicitly hint that social conditions often undergo changes in gender. Historically, the change in work roles that began with the presence of *TPA* since 1986, followed by the construction of *PLTSA* in 2015, has also affected the gender role division between men and women who coexist with each other in maintaining the balance of people's lives. Based on the framework of structure and function, changes in work roles around the development agenda have the potential to cause gender inequality because the division of tasks and the proportion of work of local communities is highly dependent on the dynamics of these role changes (Boxill & Fletcher, 2019; Ikhsan et al., 2025; MacPhail, 2021; Ndzabela & Lukman, 2023; Silva & Klasen, 2021; Taukobong et al., 2016).

While the development of the Putri Cempo *PLTSA* is often framed as a technocratic solution for waste management, its social impact on the informal sector remains theoretically understated. Previous studies have focused heavily on environmental pollution and economic income shifts. However, there has been a lack of critical inquiry into how this disruption of social structure impacts gender roles within a waste-based subsistence economy. This study fills this gap by offering a novel conceptual lens, "structural paralysis," to explain why male groups tend to remain passive when faced with the co-optation of formal development. The primary contribution of this research is a gendered critique of waste-to-energy projects, arguing that such projects do not merely shift job types but radically force a reconstruction of social functions that positions women as the primary actors in environmental advocacy and the last bastion of community defense.

2. METHOD

This qualitative descriptive study aims to analyze the transformation of gender roles in the community around the Putri Cempo Power Plant through a functional structural sociology approach. Data collection was conducted in Jatirejo Village, the area most directly affected by *PLTSA*. This study employed a purposive sampling strategy to select five key female informants who were primary actors in grassroots environmental advocacy. This number was deemed sufficient to reach data saturation, as these specific informants provided consistent and in-depth insights into the dynamics of shifting roles from the domestic to the political sphere (Beban & Martignoni, 2021; Rahmawati, 2020; Thomas et al., 2025).

The main data source in this study was taken from the results of interviews with local residents totaling 5 people from among women as representatives of Jatirejo residents, residents outside the domestic area, and the Living Environment Office or *Dinas Lingkungan Hidup (DLH)*. Secondary data were obtained through interviews with local male residents and previous research that supported related research data. The data collection time was carried out on May 1-15, 2025. Data were collected through in-depth interviews (in depth).

To determine the strength of the impact produced by the Putri Cempo *PLTSA*, it is necessary to review how close the distance between people's lives and the location of the landfill is ≤ 500 m (Ramadhanti et al., 2021). Therefore, the data collection area based on the closest radius to the Putri Cempo *PLTSA*, namely Jatirejo Village, was compared to other villages in Mojosongo Village. The interview guidelines correlated with the data and the study of structural and functional change theory. The theory contains internal factors (inventions) and external factors (diffusion) as follows (see Table 1):

Table 1. Interview Guidelines

Focus	Interview Instruments	Respondents		Consequences (Conclusion)
		Man	Woman	
Invention (Internal)		Distribution of Types of Work Income Work Formation of Social Groups	Distribution of Types of Work Income Work Formation of Social Groups	Before there was a landfill After there was a landfill before There was a <i>PLTsa</i> After there was a <i>PLTsa</i>
Diffusion (External)		Adverse Impacts of Solar Power Plantation Transfer by Landfill	Adverse Impacts of Solar Power Plantation Transfer by Landfill	

To ensure validity, the field findings were triangulated through interviews with male residents and official reports from the *DLH*. Data analysis followed Miles and Huberman’s interactive model, consisting of data reduction, data display, and conclusion drawing. Specifically, thematic coding was applied to categorize the interview transcripts into internal adaptation mechanisms (inventions) and external pressures (diffusion), allowing for a rigorous correlation between field data and social change theory (Miles & Hubberman, 1994).

3. RESULTS AND DISCUSSION

3.1. Results

Based on thematic analysis, the transformation of work roles and gender inequality can be mapped through two main phases: the invention phase (internal adaptation of society) and the diffusion phase (external impact of solar PV technology). The Invention Phase shows a fundamental transformation in the work structure of the Jatirejo Village community, which was originally agrarian-based, into a waste-based informal sector. Before 1986, the social identity of citizens was formed through the professions of farmers and traders, which became the foundation of mechanical solidarity. However, land acquisition by the government forced residents to invent or survive mechanisms by becoming scavengers and collectors. Although this job is vulnerable, this sector supports the economy of citizens, with 19% working as scavengers and 23% as collectors, even attracting young people who had worked in the formal sector because of the flexibility factor. In this phase, both men and women are equally involved in this subsistence economy, forming new social groups such as the "Scavenger Association" to address common economic vulnerabilities.

In the diffusion phase, the structural pressure of the *PLTsa* and the exclusion of access inequality begin to sharpen. When the *PLTsa* technology managed by PT SCMPP began to enter and become fully operational around 2020 to 2021. The presence of this external entity has an exclusive impact in the form of zoning restrictions that cut off citizens' access to economic resources (mountains of garbage), causing a drastic decrease in income. In addition to economic pressure, environmental impacts in the form of 24-hour operational noise, water pollution, and waste residues trigger social unrest. In this crisis situation, an imbalance was found in the bargaining position between men and women in responding to external pressures.

However, the consequence of gender issues is that women are at the forefront of advocacy. The study's crucial findings highlight the shift in gender roles triggered by men's dilemmatic position. Most men (husbands) are structurally tied to formal jobs as garbage haulers under the local government or as manual laborers at the *PLTSA*, so their bargaining position is weak for protest. Consequently, the burden of social struggle shifts to women. Mothers previously attached to domestic roles have transformed into the main actors in social movements and environmental justice advocacy. They voiced a counter-narrative related to the adverse impact of solar power plants, marking a reconstruction of social functions in which women are no longer just a complement to the household economy but a vital element of community social defense in the midst of the structural silencing experienced by men.

3.2. Discussion

The social transformation that occurred in Jatirejo Village validated the theoretical framework of the stages of social change, but with critical nuances that showed that change is not always linear (Tverskoi et al., 2022). The phase of invention found in this study, the transition from agrarian to the informal sector of waste, is not an innovation born from free will for progress but a defence mechanism due to the loss of natural resources (land). This phenomenon confirms the view that internal economic factors are the main drivers of societal structural changes (Goa, 2017). The Jatirejo community reconstructed their identity from farmers to scavengers to maintain social and economic cohesion. The mechanical solidarity that was originally built on farmland and reconstructed on a mountain of garbage created what is called a new subsistence economy that is inclusive of different age groups.

In contrast, the diffusion phase, marked by the entry of *PLTSA* technology, shows the double face of modernization. Referring to the criticism of the developmentalism paradigm, the inclusion of this technology is a real representation of the development agenda that is oriented solely towards economic growth (Shalihin & Firdaus, 2019). The diffusion of solar PV technology does not occur through participatory adoption but through external interventions that cut off citizens' access to their economic resources (scavenging zones). This proves that in the context of Jatirejo, the diffusion of technology creates social exclusion and environmental degradation. These findings challenge the classic assumption that technology always brings efficiency and well-being; in this case, technology becomes an instrument that separates society from its means of production, triggering what Salam calls a consequence in the form of a shock to social stability (Hopster, 2021).

The most significant finding of this study is the shifting gender roles that occur in response to these structural pressures. This analysis reinforces the gender theory that gender is not a static biological nature but rather a highly fluid social construct that is responsive to the context of time and social class (Fakih, 2008; Oakley, 2016). In Jatirejo Village, the environmental and economic crisis due to the operation of *PLTSA* has deconstructed the traditional division of labor in the village. Men, who are culturally placed as the main protectors and breadwinners, experience structural paralysis due to the co-optation of formal jobs in government agencies and solar power plants. This weak bargaining position silenced their agency to protest, creating a leadership vacuum in society's social movements.

This void is filled organically by women. This phenomenon refutes the assumption that modernization has always marginalized women. Instead, the external pressure from the solar power project became a catalyst that transformed women from "economic complements" to major political actors. The role of women in Jatirejo is no longer limited to the domestic realm; it has expanded to become the vanguard of environmental justice advocacy. This transformation is not just an economic strategy but also a political strategy to maintain the community's living space. This is in line with the view that in a depressed (subsistence) society, gender boundaries are blurred for the sake of collective survival. Women take over the burden of social struggle that men are unable to bear, showing that the construction of gender in Jatirejo is adaptive: when patriarchy is paralyzed by the capitalist system (corporation/state), matriarchy emerges as society's last bastion. Overall, the social changes in Jatirejo Village reflect the irony of development. Policies that ignore gender and social dimensions. Not only does it fail to improve the quality of life, but it also forces society to make radical adjustments. The emergence of women as leaders of the protest movement is proof that the social structure of society is capable of self-balancing when faced with

existential threats, even though it must be paid for with the double burden that women now carry as housekeepers and environmental warriors.

Crucially, the emergence of women as the last bastion of community defense in Jatirejo reflects a radical reconstruction of social functions, which requires a deeper critical analysis. This shift does not necessarily signify the dismantling of patriarchy or genuine empowerment; instead, it represents forced adaptation. Women are compelled to fill the political vacuum left by the structural paralysis of men, who are often co-opted as formal laborers by the very project that threatens their living space. Consequently, the burden of social struggle is redistributed rather than eliminated. Women lead environmental justice advocacy while simultaneously maintaining their traditional domestic responsibilities, leading to a double burden. Therefore, this phenomenon demonstrates that modernization through waste-to-energy projects can paradoxically exacerbate gender inequality by exploiting the community's self-balancing mechanisms, where women's labor becomes the ultimate resource for survival against institutional exclusion.

4. CONCLUSION

This study concludes that social transformation in Jatirejo Village is a real manifestation of the irony of development, where modernization does not run linearly towards progress but rather triggers complex defence mechanisms. Theoretically, the stages of social change prove to be valid but distorted: the phase of invention is not an innovation of progress but an emergency adaptation from an agrarian society to a waste-based subsistence society to maintain social cohesion. Meanwhile, the phase of diffusion of solar PV technology acts as an instrument of exclusion that separates society from its economic resources, confirming the failure of the developmentalism paradigm that ignores the socio-ecological dimension.

The most fundamental finding of this study is the radical reconstruction of gender roles in response to structural pressures. This study finds a paradoxical phenomenon in which patriarchal hegemony collapses precisely when it deals with the power of capital and the state. Men experience structural paralysis due to formal job co-optation, which indirectly silences their political bargaining powers. This agency vacuum is organically filled by women who are transforming from domestic roles to major political actors in the environmental justice advocacy space.

Thus, community resilience in Jatirejo Village is not born from development interventions but from the community's self-balancing ability by shifting the burden to women. This leaves a critical note that society's resistance to the impact of the industrialization of waste management must be paid dearly with the "double burden" of women, who now double as domestic breadwinners as well as the last bulwark of community living spaces.

Ethical Approval

Not Applicable

Informed Consent Statement

Not Applicable

Authors' Contributions

FAJ contributed to the development of the research concepts, methodology design, and manuscript writing. Field investigations, data acquisition, and formal analysis of the research findings were carried out collaboratively by DK and FATN. AUAN was responsible for data curation and visualization of the findings. The literature review, review, and editing were conducted by MM. All authors have read and approved the final version of the manuscript for publication.

Disclosure Statement

The authors declare that no potential conflicts of interest were reported by the author(s).

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request and with permission from the Manyar Gresik-based Bread Company, AA Indah.

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Notes on Contributors

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