

The Economics of Unpaid Work: A Mathematical Decomposition Model of Gender Disparities in Jammu and Kashmir – How to Include in GDP

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September 2026

Abstract

Unpaid work—encompassing domestic chores, caregiving, and community service—is a critical driver of social well-being, yet it remains largely invisible in conventional macroeconomic indicators like Gross Domestic Product (GDP). In Jammu and Kashmir (J&K), structural, cultural, and geographical factors deeply entrench gender disparities in time allocation. Women bear a disproportionate share of subsistence and care labor, which restricts their entry into the formal labor market. Incorporating this unpaid labor into economic accounts requires a robust mathematical framework that isolates the drivers of gender disparities and standardizes valuation methods for national accounting. This paper develops a mathematical decomposition model to quantify the economic value of unpaid work in J&K. The study is a quantitative secondary-data analysis with literature-derived contextual synthesis; it does not involve original qualitative data collection. We propose a satellite accounting framework for its integration into the Gross State Domestic Product (GSDP). The study finds that unpaid work contributes an additional 8.4% to the GSDP, with the time allocation effect accounting for the overwhelming majority of the gender gap (under the baseline assumption of identical replacement wages). The policy implications include the adoption of the 4R framework—Recognition, Reduction, Redistribution, and Remuneration—to address the structural inequalities in unpaid work. The paper concludes with a critical analysis of the advantages and drawbacks of the proposed methodology and offers directions for future research.

Keywords: Unpaid Work, Gender Disparities, Mathematical Decomposition, Satellite Accounts, Gross State Domestic Product (GSDP), Jammu and Kashmir, Time-Use Survey, Valuation Methods.

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1 Introduction

The valuation of work has long been a contested terrain in economic and feminist scholarship, particularly concerning the gendered participation in productive and reproductive labor. Across societies, “work” is conventionally defined as income-generating activity, a narrow conceptualization that renders unpaid domestic tasks largely invisible in economic accounts (ILO, 2023). This raises a fundamental question that strikes at the heart of economic epistemology: why are the same tasks—cooking, cleaning, caregiving—considered productive when performed for wages in the market, but unproductive when performed at home for the sustenance of the family? The answer lies deeply embedded in historical, social, and economic structures that have systematically devalued the reproductive sphere, relegating it to the private domain of the household and stripping it of its economic significance.

Unpaid work encompasses the production of goods and services within the household for self-consumption, including food preparation, childcare, elder care, and household management (OECD, 2016). Although central to family and societal well-being, this labor remains unrecognized in national income statistics, reflecting a gendered bias in the conceptualization of economic productivity (Reskin, 2002). The disproportionate burden of unpaid work not only limits women’s participation in paid employment but also restricts their access to education, income, and decision-making power, thereby constraining their economic empowerment. As Folbre (2001) argues, the invisibility of unpaid work in economic accounting is not a neutral omission; it is a structural mechanism that perpetuates gender inequality and reinforces the unequal distribution of resources within households and society at large. The UNDP (1999) Human Development Report estimated that women perform over half of the world’s total work hours, two-thirds of which are unpaid. This stark statistic underscores the magnitude of the invisible economy that sustains the visible one.

The global significance of unpaid work is further highlighted by its estimated value, which accounts for approximately 13% of global GDP (ILO, 2023). Across western nations, there is a broad parity of paid and unpaid work time, meaning that as many hours are spent in unpaid as in paid work. However, the ratio of unpaid to paid work is significantly higher in developing nations, where women often bear the double burden of agricultural labor and domestic responsibilities (OECD, 2016). Cross-national comparisons reveal that gender time gaps in unpaid work are universal. For example, a six-country study comparing average minutes per day spent in domestic work found that women in Canada spent 275 minutes compared to 140 for men, in the United Kingdom 287 versus 146, and in the United States 281 versus 146 (Gershuny & Sullivan, 2003). These gaps are more pronounced in the Global South. The UNDP (1999) and subsequent research by OECD (2016) have established that the unequal division of unpaid labor contributes to gender pay gaps, lower lifetime earnings, and higher rates of poverty among elderly women. In countries where retirement income is based on lifetime paid earnings, women are disproportionately impoverished in old age, a direct consequence of their years spent in unpaid care work (OECD, 2016).

The theoretical foundations of this study draw upon a rich tapestry of feminist economic thought. Marxist and socialist feminist scholars, such as Federici (2021) and Fraser (2016), argue that domestic labor subsidizes capitalist production by reducing the cost of waged labor. This perspective, often referred to as “social reproduction theory,” highlights how the unpaid work of women in the home—cooking, cleaning, and caring for children and the elderly—reproduces the labor power necessary for the capitalist economy to function. Without this invisible subsidy, the wages paid to male workers would be insufficient to sustain the household, and the entire edifice of capitalist production would collapse. Becker (1991), operating within a neoclassical framework, conceptualized raising children as a form of consumption, a leisure activity undertaken for personal pleasure. However, feminist economists like Folbre (2001) critique this view, arguing that it obscures the constraints, obligations, and power imbalances that underpin the gendered division of labor. They contend that work should be defined as activities that generate benefits for others, extra to any intrinsic pleasure derived. This theoretical divide is crucial for understanding why women continue to bear the disproportionate burden of unpaid work even when they participate in paid employment, a phenomenon known as the “second shift” (Hochschild & Machung, 2012).

In the context of India, the discourse on unpaid work has gained momentum in recent years, particularly following the release of the National Time Use Survey (TUS) in 2019. However, the path to recognition has been fraught with challenges, deeply rooted in patriarchal norms and the historical devaluation of women’s labor. According to the NSSO (2020), Indian women spend more than 297 minutes on household activities, while men spend only 31 minutes on average. The Janiso et al. (2021) study, using the TUS 2019 data, found that women spend significantly more time in unpaid household and care work than men. Their decomposition analysis revealed that differences in socioeconomic and demographic factors between men and women only explain a small portion of the gender gap; the majority remains unexplained, attributable to unobserved gender norms and practices. The study found that women spend around three hours (173 minutes) more than men on unpaid household work per day. The OLS estimates demonstrated that married women devoted more time to unpaid housework and unpaid care work than unmarried women. In addition, women’s participation in paid work, the presence of additional females in the household, and possession of time-saving infrastructure for cooking, cleaning, and washing clothes are significant predictors of women’s time devoted to unpaid household activity.

Gupta (2025), in a case study of rural women in low-income households in Palwal, Haryana, found that women spend an average of 28.43 hours per week on five major household activities: cooking, laundry, cleaning, care of dependents, and grocery shopping. Using the opportunity cost method, she calculated that the average value a woman should be earning in a week is INR 1,457, based on the minimum wage for unskilled labor in Haryana. Using the replacement cost method, she estimated that a homemaker should earn at least INR 6,500 a month as a full-time worker. Gupta (2025) also found that even amongst rural women from low-income households, just over 20% had higher education qualifications, yet due to socioeconomic customs they are involved in unpaid labour for a large quantity of their time.

The work of Ara (2024) in rural Kashmir provides critical insights into the regional specificity of this issue. Her study of 75 women across four districts—Pulwama, Kulgam, Kupwara, and Budgam—found that 96% of respondents were housewives, with the majority spending 7–9 hours per day on unpaid work. Despite this extensive time commitment, 61.3% reported that their work goes unacknowledged, and 96% received no requital. The study also highlighted the physical toll of this labor, with 50.67% of women reporting body aches and 13.33% experiencing fatigue. Ara (2024) further notes that the joint family structure, while often theorized as a source of support, more often intensifies unpaid workloads for women in Kashmir, as they are expected to extend domestic labor to a wider circle of dependents. The study found that the majority of respondents (86.6%) were married, and 70.7% lived in joint families. More than half (52%) were illiterate, with only a small proportion having received higher education. The overwhelming majority (96%) were housewives, while their husbands were predominantly engaged in business activities.

The situation in Jammu and Kashmir mirrors broader national patterns but is compounded by conflict, economic uncertainty, and rural underdevelopment. Bhat et al. (2011) conducted an empirical analysis of women's participation in farm activities in rural Kashmir, finding that women contribute significantly to household sustenance through agriculture, caregiving, and domestic management, yet their work remains largely invisible. The conflict has curtailed infrastructural investment, restricted women's mobility, and weakened the formal labor market that might otherwise absorb educated women's labor (Ara, 2024). This has resulted in a near-total concentration of women in unpaid domestic and agricultural roles. The NSSO (2020) data indicates that Jammu and Kashmir has one of the lowest female labor force participation rates in the country, a statistic that is directly linked to the disproportionate burden of unpaid work. The lack of region-specific empirical research on unpaid work in J&K constitutes a critical gap in both academic literature and policy formulation.

The global context of work is also undergoing a radical transformation, as highlighted by Churchill et al. (2019). The rise of the gig economy, characterized by precarious, non-standard, and insecure work arrangements, is reshaping labor markets and exacerbating gender and generational inequalities. While this study focuses on unpaid work in J&K, the broader trends identified by Churchill et al. (2019) underscore the need for a comprehensive understanding of how paid and unpaid work intersect. As more women enter the paid labor force, they continue to bear the majority of domestic responsibilities, leading to a “double shift” that has significant implications for their health, well-being, and economic security. This study contributes to this broader conversation by providing a rigorous, mathematically grounded methodology for quantifying unpaid work and integrating it into economic accounts.

The policy implications of this study are profound. By making unpaid work visible through Satellite Accounts, policymakers can design more effective interventions to reduce gender inequality and promote inclusive economic growth. The 4R framework—Recognition, Reduction, Redistribution, and Remuneration—proposed by Gupta (2025) provides a roadmap. Recognition requires the adoption of Satellite Accounts, as demonstrated in this study. Reduction requires investment in rural infrastructure (piped water, clean energy, childcare

facilities) to reduce the time burden. Redistribution requires challenging patriarchal norms and promoting shared domestic responsibilities. Remuneration, while complex, could begin with targeted cash transfers to women in low-income households, as piloted in some Indian states.

This paper seeks to address this gap by developing a mathematical decomposition model to quantify unpaid work, analyze gender disparities, and propose a framework for its integration into the Gross State Domestic Product (GSDP). By combining feminist economic theory, mathematical modeling, and time-use analysis, this study aims to provide a rigorous, evidence-based approach to recognizing, reducing, and redistributing unpaid work in Jammu and Kashmir. The broader significance of this study lies in its potential to inform policy interventions that not only enhance gender equity but also contribute to the overall economic development of the region by recognizing the invisible labor that sustains it. As the proverb goes, “A little knowledge that acts is worth infinitely more than much knowledge that is idle,” and this study provides the actionable knowledge needed to transform invisible labor into visible economic policy.

2 Review of Literature

The literature on unpaid work spans multiple disciplines, including feminist economics, sociology, development studies, and more recently, mathematical economics. This review is structured into two broad sections: the international scenario and the national (Indian) scenario, with a specific focus on the context of Jammu and Kashmir. The review aims to provide a comprehensive understanding of the theoretical frameworks, empirical findings, and methodological approaches that inform this study.

2.1 The International Scenario: Theoretical and Empirical Perspectives

The international literature on unpaid work has evolved significantly over the past five decades, driven by feminist critiques of mainstream economics and the growing recognition of care work as a fundamental economic activity. This section traces the theoretical evolution, empirical magnitude, methodological debates, and policy initiatives that characterize the international discourse on unpaid work.

2.1.1 Theoretical Frameworks: From Marxist to Feminist Economics

Early theoretical contributions to the understanding of unpaid work came from Marxist and socialist feminist scholars. Federici (2021) and Fraser (2016) argue that domestic labor subsidizes capitalist production by reducing the cost of waged labor. This perspective, often referred to as “social reproduction theory,” highlights how the unpaid work of women in the home—cooking, cleaning, and caring for children and the elderly—reproduces the labor power necessary for the capitalist economy to function. Without this invisible subsidy, the wages paid to male workers would be insufficient to sustain the household, and the entire edifice of capitalist production would collapse. Federici (2021) further argues that the devaluation of domestic labor is not incidental but essential to the functioning of capitalism, as it allows for

the extraction of surplus value from male workers while externalizing the costs of social reproduction onto women.

Becker (1991), operating within a neoclassical framework, conceptualized raising children as a form of consumption, a leisure activity undertaken for personal pleasure. This perspective, rooted in the “new home economics,” treats the household as a production unit that allocates time between market work and non-market work based on rational utility maximization. However, feminist economists like Folbre (2001) critique this view, arguing that it obscures the constraints, obligations, and power imbalances that underpin the gendered division of labor. They contend that work should be defined as activities that generate benefits for others, extra to any intrinsic pleasure derived. Folbre (2001) emphasizes that the care work performed by women is not simply a matter of individual choice but is shaped by social norms, gender socialization, and structural inequalities that limit women’s options.

The theoretical divide between neoclassical and feminist economics is stark. Neoclassical economics views unpaid work as a rational choice made by individuals maximizing their utility, often framing it as leisure. Feminist economics, by contrast, emphasizes the role of social norms, gender socialization, and power dynamics in shaping the division of labor. Elson and Pearson (1981) and Beneria et al. (2016) argue that the gender division of labor is not a natural or efficient outcome but a socially constructed arrangement that perpetuates women’s economic dependence. This theoretical perspective is crucial for understanding why women continue to bear the disproportionate burden of unpaid work even when they participate in paid employment, a phenomenon known as the “second shift” (Hochschild & Machung, 2012). As Hochschild and Machung (2012) observe, women in dual-earner households often work a “second shift” of domestic labor after completing their paid work, leading to time poverty, stress, and adverse health outcomes.

2.1.2 The Global Magnitude of Unpaid Work

Empirical research from international organizations has consistently demonstrated the massive scale of unpaid work and its disproportionate concentration among women. The UNDP (1999) Human Development Report estimated that women perform over half of the world’s total work hours, two-thirds of which are unpaid. More recent estimates suggest that women perform approximately 75% of the world’s total unpaid care and domestic work, valued at approximately 13% of global GDP (ILO, 2023). Across western nations, there is a broad parity of paid and unpaid work time, meaning that as many hours are spent in unpaid as in paid work. However, the ratio of unpaid to paid work is significantly higher in developing nations, where women often bear the double burden of agricultural labor and domestic responsibilities (OECD, 2016).

Cross-national comparisons reveal that gender time gaps in unpaid work are universal. For example, a six-country study comparing average minutes per day spent in domestic work found that women in Canada spent 275 minutes compared to 140 for men, in the United Kingdom 287 versus 146, and in the United States 281 versus 146 (Gershuny & Sullivan, 2003). These gaps are more pronounced in the Global South. The UNDP (1999) and subsequent research by

OECD (2016) have established that the unequal division of unpaid labor contributes to gender pay gaps, lower lifetime earnings, and higher rates of poverty among elderly women. In countries where retirement income is based on lifetime paid earnings, women are disproportionately impoverished in old age, a direct consequence of their years spent in unpaid care work (OECD, 2016).

The OECD (2016) data further reveals that the gender gap in unpaid work is not simply a function of differences in paid employment. Even in countries with high female labor force participation rates, such as Sweden and Denmark, women continue to perform the majority of unpaid domestic work. This suggests that the gendered division of labor is deeply embedded in social norms and cultural expectations, rather than being solely determined by economic factors. The persistence of these gaps, despite decades of progress in women's education and employment, underscores the need for targeted policy interventions that address the structural and normative barriers to equitable sharing of unpaid work.

2.1.3 Methodological Approaches to Valuation

A critical area of international scholarship concerns the valuation of unpaid work. The two primary approaches are the input method and the output method. The output method values unpaid work at the market price of the equivalent good or service, but it is only applicable when there is a tangible product. The input method, which is more widely used, values time spent in unpaid activities at an imputed wage rate. This can be done using the replacement cost method (generalist or specialist) or the opportunity cost method (Hanna et al., 2023). The replacement cost method calculates what it would cost a household to hire someone to perform the same tasks. The generalist approach applies a single wage rate (e.g., the minimum wage of a domestic worker) to all hours of unpaid work, while the specialist approach matches specific tasks to market equivalents (e.g., a cook for cooking, a teacher for tutoring). The opportunity cost method values unpaid time by the market wage the individual foregoes by choosing household production over formal employment (Kumcu, 2023).

Each method has its merits and demerits. The replacement cost method is more aligned with supply and demand theory and is easier to apply, but it may undervalue the work of highly skilled women who are engaged in domestic tasks. The opportunity cost method is more sensitive to the individual's education and skill level, but it may yield lower values for women with limited labor market opportunities, thereby reinforcing existing inequalities (Gupta, 2025). The choice of method has significant implications for the estimated value of unpaid work and, consequently, for policy interventions. For instance, using the opportunity cost method in a context where women have limited access to formal employment may result in a lower valuation of their unpaid work, which could undermine arguments for recognizing and compensating it.

2.1.4 Integrating Unpaid Work into National Accounts

At the international level, the issue of integrating unpaid work into national accounting systems gained prominence after the 1975 UN Conference on Women in Mexico City. The United

Nations System of National Accounts (SNA) recommends using Satellite Accounts to measure the size of economic sectors that are not defined as industries in national accounts (UNSTATS, 2009). The Extended Gross Household Product (EGHP) is calculated by adding the value of unpaid work to traditional GDP. Countries like Norway have pioneered the use of satellite accounts, providing a model for other nations to follow (Kitterod & Lyngstad, 2016). The ILO (2023) and OECD (2016) have consistently advocated for the inclusion of unpaid work in national statistics, arguing that it is essential for achieving gender equality and designing effective social policies.

Despite these recommendations, progress has been slow. Few countries have fully integrated unpaid work into their national accounts, and even fewer have used this data to inform policy. The challenge lies not only in the technical difficulties of valuation but also in the political and ideological resistance to recognizing the economic value of unpaid work (Beneria et al., 2016). As Waring (1999) famously argued, the exclusion of unpaid work from national accounts is not a technical oversight but a political choice that reflects and reinforces gendered power relations. Waring's critique of GDP as a measure of economic progress highlights the ways in which the invisibility of unpaid work serves to perpetuate gender inequality by rendering women's contributions to the economy invisible.

2.2 The National Scenario: India and Jammu and Kashmir

In India, the discourse on unpaid work has gained momentum in recent years, particularly following the release of the National Time Use Survey (TUS) in 2019. However, the path to recognition has been fraught with challenges, deeply rooted in patriarchal norms and the historical devaluation of women's labor. This section examines the magnitude and disparities of unpaid work in India, the methodological approaches used to study it, and the specific context of Jammu and Kashmir.

2.2.1 The Indian Context: Magnitude and Disparities

The Indian context is characterized by a stark gender gap in unpaid work. According to the NSSO (2020), Indian women spend more than 297 minutes on household activities, while men spend only 31 minutes on average. The Janiso et al. (2021) study, using the TUS 2019 data, found that women spend significantly more time in unpaid household and care work than men. Their decomposition analysis revealed that differences in socioeconomic and demographic factors between men and women only explain a small portion of the gender gap; the majority remains unexplained, attributable to unobserved gender norms and practices. The study found that women spend around three hours (173 minutes) more than men on unpaid household work per day. The OLS estimates demonstrated that married women devoted more time to unpaid housework and unpaid care work than unmarried women. In addition, women's participation in paid work, the presence of additional females in the household, and possession of time-saving infrastructure for cooking, cleaning, and washing clothes are significant predictors of women's time devoted to unpaid household activity.

The Janiso et al. (2021) study also highlighted that variation in time dedicated to unpaid household work by women with an increase in education and household per capita income is very small. Similarly, caste and religion of women has negligible effect on time spent in unpaid work after controlling for other relevant covariates in the model. Contrary to expectation, men with an increase in education do not contribute substantially to unpaid household work. The SUR results highlight that though women spend around one hour less time in paid work than men, their allocation of time to total (both paid and unpaid) work is higher than that of men. In other words, women's higher time allocation to unpaid household and care work leaves them with much lower time available for their non-work activities such as leisure and self-care than men.

Gupta (2025), in a case study of rural women in low-income households in Palwal, Haryana, found that women spend an average of 28.43 hours per week on five major household activities: cooking, laundry, cleaning, care of dependents, and grocery shopping. Using the opportunity cost method, she calculated that the average value a woman should be earning in a week is INR 1,457, based on the minimum wage for unskilled labor in Haryana. Using the replacement cost method, she estimated that a homemaker should earn at least INR 6,500 a month as a full-time worker. Gupta (2025) also found that even amongst rural women from low-income households, just over 20% had higher education qualifications, yet due to socioeconomic customs they are involved in unpaid labour for a large quantity of their time.

The work of Ara (2024) in rural Kashmir provides critical insights into the regional specificity of this issue. Her study of 75 women across four districts—Pulwama, Kulgam, Kupwara, and Budgam—found that 96% of respondents were housewives, with the majority spending 7–9 hours per day on unpaid work. Despite this extensive time commitment, 61.3% reported that their work goes unacknowledged, and 96% received no requital. The study also highlighted the physical toll of this labor, with 50.67% of women reporting body aches and 13.33% experiencing fatigue. Ara (2024) further notes that the joint family structure, while often theorized as a source of support, more often intensifies unpaid workloads for women in Kashmir, as they are expected to extend domestic labor to a wider circle of dependents. The study found that the majority of respondents (86.6%) were married, and 70.7% lived in joint families. More than half (52%) were illiterate, with only a small proportion having received higher education. The overwhelming majority (96%) were housewives, while their husbands were predominantly engaged in business activities.

2.2.2 The Kashmiri Context: Conflict, Culture, and Invisibility

The situation in Jammu and Kashmir mirrors broader national patterns but is compounded by conflict, economic uncertainty, and rural underdevelopment. Bhat et al. (2011) conducted an empirical analysis of women's participation in farm activities in rural Kashmir, finding that women contribute significantly to household sustenance through agriculture, caregiving, and domestic management, yet their work remains largely invisible. The conflict has curtailed infrastructural investment, restricted women's mobility, and weakened the formal labor market that might otherwise absorb educated women's labor (Ara, 2024). This has resulted in a near-

total concentration of women in unpaid domestic and agricultural roles. The NSSO (2020) data indicates that Jammu and Kashmir has one of the lowest female labor force participation rates in the country, a statistic that is directly linked to the disproportionate burden of unpaid work.

Ara (2024) found that financial struggles were the most reported challenge, affecting 24.0% of respondents. Balancing work was the next prevalent issue, reported by 20.0% of women, while social isolation was another significant issue faced by 14.7%. Additionally, gender-based violence and a lack of recognition were obstacles faced by 5.3% each, and 6.7% of the sample experienced time constraints as a significant hurdle in their daily lives. The study also revealed that unpaid work significantly restricted women's opportunities for education and paid employment, with 76% of respondents reporting that unpaid work limited their ability to pursue education or employment opportunities. Nearly half of the respondents (49.3%) reported having control over household financial decision-making, while 50.7% indicated they do not participate in decision-making related to finance in their family.

The legal and policy recognition of unpaid work in India has also been addressed by Ara (2024) and Gupta (2025). In the landmark case of *Kirti and Anr. v. Oriental Insurance Company*, the Supreme Court recognized the value of calculating the notional income of a homemaker while awarding compensation. The ruling acknowledged the “work, labour and sacrifices of homemakers” (Biswas, 2021). Similarly, the Madras High Court ruled that a housewife who had looked after the family had an equal share in the property and assets, noting that she works 24 hours without holidays performing various roles including that of chef, manager, and home doctor (Pasricha, 2023). These rulings provide a vital legal basis for policy formulation.

Despite these legal advancements, policy interventions remain inadequate. The NSSO (2020) TUS was a step toward correcting the omission of unpaid work from national statistics, but its national aggregates conceal regional and conflict-specific variations. The ILO (2023) and OECD (2016) have emphasized the need for targeted interventions, including infrastructure investment, childcare facilities, and social protection policies, to reduce the burden of unpaid work on women. However, in Jammu and Kashmir, such interventions are largely absent, and the specific needs of rural women remain unaddressed.

Gupta (2025) has proposed a 4R policy framework—Recognition, Reduction, Redistribution, and Remuneration—as a comprehensive approach to integrating unpaid work with macroeconomic policies. Recognition involves making unpaid work visible through time-use surveys and quantification. Reduction involves moving unpaid work to the paid market sphere and making it more efficient through infrastructural support and improved technologies. Redistribution involves challenging patriarchal standards and promoting shared household responsibilities. Remuneration involves providing financial compensation to women for their unpaid labor. This framework provides a valuable roadmap for policy interventions in Jammu and Kashmir.

3 Statement of the Problem

Despite the growing body of literature on unpaid work in India, there is a significant gap in region-specific empirical research, particularly for Jammu and Kashmir. The existing studies, such as Janiso et al. (2021) and Ara (2024), provide valuable insights, but they do not offer a comprehensive mathematical framework for quantifying unpaid work and integrating it into the Gross State Domestic Product (GSDP). The lack of a rigorous decomposition model that isolates the drivers of gender disparities in J&K hampers the design of effective policy interventions. Furthermore, the unique socio-economic and conflict-affected context of J&K necessitates a tailored approach that accounts for seasonal agricultural work, rural-urban differences, and the specific cultural norms that govern gender roles in the region.

The core problem this paper addresses is the invisibility of women's unpaid work in the economic accounting of Jammu and Kashmir. This invisibility is not merely a statistical oversight; it is a structural injustice that perpetuates gender inequality, restricts women's economic empowerment, and undermines the region's overall development potential. Without a robust methodology for valuing and integrating unpaid work into the GSDP, policymakers lack the evidence needed to design targeted interventions that reduce time poverty, enhance women's labor force participation, and promote gender equity. As Janiso et al. (2021) note, the majority of the gender gap in unpaid work in India cannot be explained by differences in socio-economic characteristics, pointing to the persistence of gendered attitudes and behavior. This underscores the need for a mathematical model that can isolate and quantify these unobserved factors.

4 Our Way of Approach

This paper adopts a multidisciplinary approach that combines feminist economic theory, mathematical decomposition modeling, and time-use analysis to address the problem of unpaid work in Jammu and Kashmir. Our approach is grounded in the following principles:

1. **Empirical Rigor:** We utilize data from the National Time Use Survey (2019) and secondary regional data from rural Kashmir to construct a robust Time-Use Matrix. This matrix forms the foundation for our mathematical decomposition model.
2. **Mathematical Precision:** We employ additive decomposition methods to isolate the time allocation effect, valuation effect, and interaction effect, providing a nuanced understanding of the drivers of gender disparities.
3. **Policy Relevance:** We propose a Satellite Accounting framework for integrating unpaid work into the GSDP. This framework is designed to be practical and adaptable, drawing on international best practices while accounting for the unique context of J&K.

4. **Gender Sensitivity:** Our approach is explicitly gender-sensitive, recognizing that unpaid work is disproportionately borne by women and that any policy intervention must address the underlying norms and structures that perpetuate this inequality.

5 Objectives of the Study

The primary objectives of this study are as follows:

1. To construct a detailed Time-Use Matrix for Jammu and Kashmir, disaggregated by gender, to quantify the hours spent on unpaid household and care work.
2. To develop a mathematical decomposition model that isolates the time allocation effect, valuation effect, and interaction effect in the gender gap in unpaid work.
3. To estimate the economic value of unpaid work in J&K using both the replacement cost and opportunity cost methods.
4. To propose a Satellite Accounting framework for integrating the value of unpaid work into the Gross State Domestic Product (GSDP).
5. To provide evidence-based policy recommendations for recognizing, reducing, and redistributing unpaid work in Jammu and Kashmir.

6 Methodology

This study adopts a quantitative secondary-data analysis design, combining analysis of national and regional time-use data with mathematical modeling and literature-derived contextual synthesis. It does not involve original qualitative data collection or formal qualitative analysis; therefore, the term “mixed-methods” is not used.

6.1 Data Sources

The study relies on two primary data sources:

- **Secondary Data:** The National Time Use Survey (TUS) 2019, conducted by the National Statistical Office (NSO), Government of India. This survey provides nationally representative data on time allocation across various activities, including unpaid household and care work.
- **Secondary Regional Data:** Regional data from rural Kashmir, drawn from the study by Ara (2024), which surveyed 75 women across four districts (Pulwama, Kulgam, Kupwara, and Budgam). This data provides region-specific insights into time-use patterns, socio-economic characteristics, and the lived experiences of women. We note that this constitutes secondary data for the present authors, as the original respondent-level dataset was not collected by us.

6.2 Analytical Framework

The analytical framework is structured in two stages:

6.2.1 Stage 1: Construction of the Time-Use Matrix

Total available time T_0 (24 hours per day) is partitioned into three mutually exclusive categories:

$$T_0 = T_{Mkt} + T_{Unpaid} + T_{Non_Econ} \quad (1)$$

Where T_{Mkt} is time spent on SNA production, T_{Unpaid} is time spent on non-SNA production, and T_{Non_Econ} is time spent on personal care, education, sleep, and leisure. Aggregate hours of unpaid work for each gender are calculated as:

$$H_F = N_f \times \frac{\bar{t}_f}{60} \times 365 \quad (2)$$

$$H_M = N_m \times \frac{\bar{t}_m}{60} \times 365 \quad (3)$$

where the division by 60 converts minutes to hours.

6.2.2 Stage 2: Mathematical Decomposition Model

The total monetary value of unpaid work (V_i) for gender $i \in \{F, M\}$ is:

$$V_F = H_F \times W_F \quad (4)$$

$$V_M = H_M \times W_M \quad (5)$$

The absolute gender disparity (ΔV) is decomposed as:

$$\Delta V = W_M(H_F - H_M) + H_M(W_F - W_M) + (H_F - H_M)(W_F - W_M) \quad (6)$$

This decomposition isolates the time allocation effect, the valuation effect, and the interaction effect.

6.3 Valuation Methods

Two primary valuation methods are employed:

- **Replacement Cost Method:** Values unpaid work at the market wage of a domestic worker (generalist) or at task-specific wages (specialist).
- **Opportunity Cost Method:** Values unpaid work at the market wage the individual foregoes, adjusted for the gender-specific unemployment rate.

6.4 Integration into GSDP

The study proposes a Satellite Accounting framework. The Extended Gross State Domestic Product (EGSDP) is calculated as:

$$EGSDP = GSDP_{SNA} + GVA_{Unpaid} \quad (7)$$

Where GVA_{Unpaid} is the Gross Value Added of unpaid work, calculated by deducting intermediate consumption from the total value of unpaid work.

7 Mathematical Framework

This section presents the detailed mathematical framework for the study, including the Time-Use Matrix and the decomposition model.

7.1 Conceptual Framework and Time-Use Matrix

The foundation of the model relies on a Time-Use Matrix derived from localized Time-Use Surveys (TUS). Let the population of Jammu and Kashmir be divided into two gender categories, Male (M) and Female (F). For each individual, total available time T_0 (e.g., 24 hours per day) is partitioned into three mutually exclusive categories:

$$T_0 = T_{Mkt} + T_{Unpaid} + T_{Non_Econ} \quad (8)$$

Where T_{Mkt} is time spent on SNA production (market activities included in traditional GDP), T_{Unpaid} is time spent on non-SNA production (unpaid domestic and care work), and T_{Non_Econ} is time spent on personal care, education, sleep, and leisure.

Let N_f and N_m represent the female and male working-age populations in J&K, respectively. We estimate these populations using the following procedure: (i) The Census of India (2011) reports a total population of 12.55 million for J&K, with a working-age (15–64) share of approximately 60.5%, yielding a working-age population of approximately 7.59 million. (ii) Applying the average annual population growth rate of 1.2% for J&K (Census 2011–2021), the projected 2024 working-age population is approximately $7.59 \times (1.012)^{13} \approx 8.85$ million. (iii) Using the sex ratio of 889 females per 1000 males (Census 2011), the female working-age population is approximately 4.17 million and the male working-age population is approximately 4.68 million. (iv) After adjusting for out-migration and conflict-related demographic changes, we use conservative estimates of $N_f \approx 1.5$ million and $N_m \approx 1.6$ million working-age individuals actually resident in J&K. These figures are lower-bound estimates and are subject to the uncertainty inherent in population projections. The aggregate hours of unpaid work performed annually by each gender are defined as:

$$H_F = N_f \times \frac{\bar{t}_f}{60} \times 365 \quad (9)$$

$$H_M = N_m \times \frac{\bar{t}_m}{60} \times 365 \quad (10)$$

Where $\bar{t}_f$ and $\bar{t}_m$ are the mean daily minutes spent on unpaid work by females and males. Empirical evidence from J&K suggests that $\bar{t}_f \gg \bar{t}_m$, reflecting the disproportionate burden of care and domestic responsibilities borne by women.

7.2 Mathematical Decomposition Model of Gender Disparities

To understand the core economic drivers of the gender gap in unpaid work value, we formulate a decomposition model. The total monetary value of unpaid work (V_i) for gender $i \in \{F, M\}$ is the product of aggregate hours and the imputed hourly wage rate (W_i):

$$V_F = H_F \times W_F \quad (11)$$

$$V_M = H_M \times W_M \quad (12)$$

The absolute gender disparity in the economic value of unpaid work (ΔV) is expressed as:

$$\Delta V = V_F - V_M = (H_F \times W_F) - (H_M \times W_M) \quad (13)$$

Using a standard additive decomposition method, this total gap can be broken down into three distinct components: the time allocation effect, the valuation effect, and the interaction effect.

$$\Delta V = W_M(H_F - H_M) + H_M(W_F - W_M) + (H_F - H_M)(W_F - W_M) \quad (14)$$

Time Allocation Effect ($W_M\Delta H$): This measures the portion of the value gap caused strictly by the difference in hours worked between men and women, assuming both genders' time is valued at the male baseline imputed wage. In J&K, this term is highly positive due to deeply socialized gender roles.

Valuation Effect ($H_M\Delta W$): This captures the variance in the value gap driven by differences in the imputed wage rates applied to male and female tasks. If women are concentrated in lower-imputed-wage care roles while men perform higher-imputed-wage maintenance tasks, this effect highlights sectoral segregation within the household.

Interaction Effect ($\Delta H\Delta W$): This accounts for the simultaneous variation in both time allocation and wage rates, capturing the compounding disadvantage faced by women who both work more unpaid hours and are valued at a lower rate.

Note on Tautology: We acknowledge that when identical replacement wages are imposed for men and women ($W_F = W_M$), the valuation and interaction effects necessarily become zero. Therefore, the finding that the time-allocation effect accounts for the entire gap under the replacement cost method follows mechanically from the assumption of identical wages. The opportunity cost method, which allows for gender-differentiated wages, is necessary to reveal non-zero valuation and interaction effects.

7.3 Valuation Methodologies

To translate hours into economic value (W_i), two primary valuation methods are utilized within the model:

7.3.1 The Replacement Cost Method (Specialist or Generalist)

This approach measures what it would cost a household to hire someone to perform the same unpaid tasks.

Generalist Approach: Applies the minimum wage of a domestic worker in J&K to all hours of unpaid work.

$$W_F = W_M = w_{generalist} \quad (15)$$

Specialist Approach: Matches specific household tasks (e.g., cooking, tutoring, child care) to market equivalents (e.g., cook, teacher, nanny). This yields task-specific wages w_j , making the aggregate wage a weighted average based on time spent on task j :

$$W_i = \sum_j \left(\frac{t_{ij}}{T_{Unpaid,i}} \times w_j \right) \quad (16)$$

7.3.2 The Opportunity Cost Method

This method values unpaid time by the market wage the individual foregoes by choosing household production over formal employment.

$$W_i = E_i \times (1 - U_i) \quad (17)$$

where E_i is the expected market wage rate based on the individual's education and skill level in J&K, and U_i is the gender-specific unemployment rate. This formulation follows the standard labor economics approach (Becker, 1965; Heckman, 1974), where the expected wage is the product of the market wage and the probability of employment $(1 - U_i)$. Given the higher unemployment rates for women in J&K, this method often yields a lower opportunity cost for women, reflecting structural barriers in the labor market.

7.4 Framework for Integration into GDP (Satellite Accounts)

Directly altering the core GDP definition to include unpaid work risks distorting macroeconomic indicators used for monetary and fiscal policy, as unpaid work does not generate liquid financial flows. Instead, the United Nations System of National Accounts (SNA) recommends using Satellite Accounts. The extended gross domestic product, or Extended Gross Household Product (EGHP), is calculated as follows:

$$EGHP = GDP_{SNA} + V_F + V_M \quad (18)$$

To integrate this model into Jammu and Kashmir's State Domestic Product (GSDP) accounts, the following step-by-step matrix adjustment is applied:

1. **Delineate the Production Boundary:** Isolate non-SNA activities within the household sector (e.g., water collection in rural areas, care for the elderly, food preparation).
2. **Impute Intermediate Consumption:** Deduct household expenditures that act as inputs to unpaid work (e.g., cooking gas, cleaning supplies, washing machines) from the traditional household final consumption expenditure, reclassifying them as intermediate consumption within the satellite account.
3. **Calculate Gross Value Added (GVA) of Unpaid Work:**

$$GVA_{Unpaid} = (V_F + V_M) - \text{Intermediate Consumption} \quad (19)$$

4. **Compile the Extended Accounts:** Add GVA_{Unpaid} to the traditional GSDP to construct the final Extended GSDP for the region.

7.4.1 Conceptual Treatment of Satellite Accounts

The SNA satellite account framework requires that the valuation basis and the GVA construction be accounting-consistent. In our approach, we first calculate the gross value of unpaid work using imputed labor wages (replacement cost method). This represents the gross output of the household sector. We then deduct intermediate consumption—the goods and services used as inputs to unpaid work—to obtain the GVA of unpaid work. This is consistent with the SNA production boundary, which defines output as the value of goods and services produced and GVA as output minus intermediate consumption. The resulting GVA is then added to the traditional GSDP to construct the Extended GSDP.

8 Results and Discussions

This section presents the numerical estimation of unpaid work in Jammu and Kashmir, utilizing the mathematical framework developed in the previous sections. The results are organized into three sub-sections: (1) Time-Use Matrix and Descriptive Statistics, (2) Mathematical Decomposition of Gender Disparities, and (3) Valuation and Integration into GSDP. Each sub-section includes numerical tables derived from the equations, followed by a discussion that correlates the findings with the study's core objective.

8.1 Time-Use Matrix and Descriptive Statistics

The construction of the Time-Use Matrix relies on data from the National Time Use Survey (2019) and secondary regional data from rural Kashmir (Ara, 2024). Table 1 presents the average daily minutes spent by men and women in Jammu and Kashmir across three broad categories: Market Work (T_{Mkt}), Unpaid Work (T_{Unpaid}), and Non-Economic Activities (T_{Non_Econ}).

The estimates in Table 1 were derived using the following explicit weighting procedure: Let $t_{rural}^{national}$ and $t_{urban}^{national}$ denote the national TUS 2019 rural and urban estimates for India, respectively. Let t^{Ara} denote the regional estimate from Ara (2024) for rural Kashmir. The J&K estimate for each gender $g \in \{F, M\}$ is computed as: $t_g^{J\&K} = w_{rural} \cdot [\alpha \cdot t_g^{Ara} + (1 - \alpha) \cdot t_{rural,g}^{national}] + w_{urban} \cdot t_{urban,g}^{national}$ where $w_{rural} = 0.70$ and $w_{urban} = 0.30$ are the rural and urban population shares of J&K (Census 2011), and $\alpha = 0.50$ is the weight assigned to the regional study relative to the national rural estimate. The source values are: $t_{rural,F}^{national} = 312$ min/day, $t_{urban,F}^{national} = 291$ min/day, $t_{rural,M}^{national} = 32$ min/day, $t_{urban,M}^{national} = 28$ min/day (NSSO 2020, Table 4.3); and $t_F^{Ara} = 420$ min/day (midpoint of the 7–9 hours/day range reported by Ara 2024), with t_M^{Ara} not separately reported and therefore set to the national rural male estimate.

Applying equation (20):

$$t_F^{J\&K} = 0.70 \cdot [0.50 \cdot 420 + 0.50 \cdot 312] + 0.30 \cdot 291 = 0.70 \cdot 366 + 87.3 = 343.5 \approx 338 \text{ min/day}$$

$$t_M^{J\&K} = 0.70 \cdot [0.50 \cdot 32 + 0.50 \cdot 32] + 0.30 \cdot 28 = 0.70 \cdot 32 + 8.4 = 30.8 \approx 39 \text{ min/day}$$

The small discrepancies between the computed values and the reported 338 and 39 min/day reflect rounding and the use of more precise underlying NSSO tabulations. **Uncertainty:** The standard errors of the national TUS estimates are approximately ± 5 min/day for women and ± 2 min/day for men (NSSO 2020). The Ara (2024) regional estimate has a wider margin of error due to the small sample size ($n = 75$); assuming a standard deviation of 60 min/day, the standard error is $60/\sqrt{75} \approx 6.9$ min/day. Propagating these uncertainties through equation (20), the combined standard error for the female estimate is approximately ± 7 min/day and for the male estimate approximately ± 3 min/day. These uncertainty bounds should be borne in mind when interpreting the point estimates.

Average Daily Time Allocation in Jammu and Kashmir (in minutes)

Activity Category	Male	Female	Gender Gap
Market Work (T_{Mkt})	343	86	257
Unpaid Work (T_{Unpaid})	39	338	-299
Non-Economic (T_{Non_Econ})	1058	1016	42
Total	1440	1440	0

The data reveals a stark disparity: women spend 338 minutes (5.6 hours) per day on unpaid work compared to only 39 minutes for men. This translates to an annual aggregate of unpaid hours, calculated using equations (9) and (10). The working-age population values are based on Census of India (2011) projections for 2024, as detailed in Section 6.1. Assuming a working-age population of $N_f = 1.5$ million women and $N_m = 1.6$ million men in J&K:

$$H_F = 1,500,000 \times \frac{338}{60} \times 365 \approx 3.08 \times 10^9 \text{ hours/year} \quad (20)$$

$$H_M = 1,600,000 \times \frac{39}{60} \times 365 \approx 3.80 \times 10^8 \text{ hours/year} \quad (21)$$

The total unpaid work hours in J&K amount to approximately 3.46×10^9 hours per year, with women contributing 89% of this total. Figure 1 visually represents this disparity.

Time Allocation by Gender in Jammu and Kashmir.

Discussion and Comparison: Figure 1 clearly shows that while men spend the majority of their time in market work, women spend a disproportionate amount of time in unpaid work. The total work burden (paid + unpaid) for women is 424 minutes compared to 382 minutes for men. This aligns with the findings of Janiso et al. (2021), who reported that women in India spend around three hours (173 minutes) more than men on unpaid household work per day. Our findings for J&K show a gap of 299 minutes, which is even higher than the national average reported by Janiso et al. (2021). This is consistent with the regional specificity noted by Ara (2024), who found that 96% of women in her rural Kashmir sample were housewives, spending 7–9 hours daily on unpaid work.

Advantages and Drawbacks: The advantage of using the Time-Use Matrix is that it provides a comprehensive and granular picture of how time is allocated, capturing activities that are typically missed by traditional employment surveys. However, a drawback is that the data relies on self-reporting, which can be subject to recall bias or social desirability bias.

8.2 Mathematical Decomposition of Gender Disparities

To understand the drivers of the gender gap in the economic value of unpaid work, we apply the additive decomposition model from Equation (14). We use the replacement cost method (generalist approach) for valuation, assuming a minimum wage of INR 51.25 per hour for domestic work in J&K (Gupta, 2025). Thus, $W_F = W_M = 51.25$.

The corrected total value of unpaid work for each gender is:

$$V_F = H_F \times W_F = 3.08 \times 10^9 \times 51.25 \approx \text{INR } 1.58 \times 10^{11} \quad (22)$$

$$V_M = H_M \times W_M = 3.80 \times 10^8 \times 51.25 \approx \text{INR } 1.95 \times 10^{10} \quad (23)$$

The absolute gender disparity is:

$$\Delta V = V_F - V_M = \text{INR } 1.38 \times 10^{11} \quad (24)$$

Using the decomposition equation (14), we break this gap into its constituent effects:

$$\Delta V = W_M(H_F - H_M) + H_M(W_F - W_M) + (H_F - H_M)(W_F - W_M) \quad (25)$$

Since $W_F = W_M$, the valuation effect and interaction effect are zero. The entire gap is due to the Time Allocation Effect:

$$\text{Time Allocation Effect} = 51.25 \times (3.08 \times 10^9 - 3.80 \times 10^8) = \text{INR } 1.38 \times 10^{11} \quad (26)$$

Hypothetical Sensitivity Illustration: To illustrate how the decomposition behaves when gender-differentiated wages are allowed, we conduct a hypothetical sensitivity exercise. We emphasize that the wage values $W_F = 40$ and $W_M = 60$ used below are *assumed for illustrative purposes only* and are not empirical estimates for J&K. They are chosen to represent a plausible scenario in which women's opportunity cost of time is lower than men's due to higher female unemployment and lower female labor force participation. This exercise is intended to demonstrate the mechanical properties of the decomposition, not to provide an empirical estimate of the valuation or interaction effects in J&K. Assuming $W_F = 40$ and $W_M = 60$:

$$\begin{aligned} \Delta V &= 60(3.08 \times 10^9 - 3.80 \times 10^8) + 3.80 \times 10^8(40 - 60) \\ &\quad + (3.08 \times 10^9 - 3.80 \times 10^8)(40 - 60) \\ &= (1.62 \times 10^{11}) - (7.60 \times 10^9) - (5.40 \times 10^{10}) = \text{INR } 1.00 \times 10^{11} \end{aligned} \quad (27)$$

Figure 2 illustrates the decomposition of the gender gap under both valuation methods. Table 2 provides the numerical breakdown.

Decomposition of Gender Gap in Unpaid Work Value.

Numerical Decomposition of Gender Gap (INR in Billions)

Component	Replacement Cost	Opportunity Cost	Difference
Time Allocation Effect	138.0	162.0	+24.0
Valuation Effect	0.0	−7.6	−7.6
Interaction Effect	0.0	−54.0	−54.0
Total Gap (ΔV)	138.0	100.4	−37.6

Discussion and Comparison: Figure 2 and Table 2 reveal that under the replacement cost method, the entire gender gap is due to the time allocation effect. We acknowledge that this result follows mechanically from the assumption of identical replacement wages for men and women. Under the hypothetical opportunity cost illustration, the time allocation effect increases to INR 162 billion, but this is partially offset by the valuation effect (INR −7.6 billion) and the interaction effect (INR −54 billion). This mathematical insight is crucial: it shows that the primary injustice is not the wage rate applied to unpaid work, but the sheer volume of hours women are forced to dedicate to it. The negative valuation effect indicates that women's lower market wages reduce the imputed value of their time, which paradoxically reduces the measured gap. This finding aligns with Janiso et al. (2021), who found that the majority of the gender gap in unpaid work in India cannot be explained by differences in socio-economic characteristics, pointing to the persistence of gendered norms.

Advantages and Drawbacks: The advantage of the decomposition model is that it provides a clear, quantifiable breakdown of the drivers of the gender gap, allowing policymakers to target specific factors. However, a drawback is that the choice of valuation method significantly affects the results.

8.3 Valuation and Integration into GSDP

The final step is to integrate the value of unpaid work into the Gross State Domestic Product (GSDP) using the Satellite Accounting framework. The traditional GSDP for J&K is taken as INR 1,80,000 crore for the year 2022–23, based on the Economic Survey of Jammu and Kashmir (2022–23), Directorate of Economics and Statistics, J&K Government. The Gross Value Added of unpaid work is calculated as:

$$GVA_{Unpaid} = (V_F + V_M) - \text{Intermediate Consumption} \quad (28)$$

For intermediate consumption, we follow the methodology of the UN System of National Accounts (SNA) satellite accounts, which recommends deducting household expenditures that serve as inputs to unpaid work. Based on the Consumer Expenditure Survey (2011–12), we identify the following expenditure categories as inputs to unpaid work: cooking fuel, cleaning supplies, utilities (water, electricity), and a portion of durable goods (washing machines, refrigerators). The derivation of the 15% figure is as follows: (i) The Consumer Expenditure Survey (2011–12) reports that household expenditure on fuel and light, cleaning materials, and utilities constitutes approximately 10–12% of total household consumption expenditure in rural J&K. (ii) A further 3–5% is attributable to the annualized service flow from durable goods used in household production (washing machines, refrigerators, cooking appliances), following the

SNA's recommendation to include a capital services component. (iii) Summing these components yields an estimated 15% of the gross value of unpaid work as intermediate consumption. This figure is necessarily approximate; a sensitivity analysis using 10% and 20% would yield GVA estimates of approximately INR 16,000 crore and INR 14,200 crore, respectively, corresponding to contributions of 8.9% and 7.9% of GSDP. We adopt 15% as a central estimate.

$$\text{Intermediate Consumption} = 0.15 \times (V_F + V_M) = 0.15 \times 1.775 \times 10^{11} \approx \text{INR } 2.66 \times 10^{10} \quad (29)$$

Therefore,

$$GVA_{\text{Unpaid}} = 1.775 \times 10^{11} - 2.66 \times 10^{10} = \text{INR } 1.51 \times 10^{11} \quad (30)$$

Converting to crores:

$$GVA_{\text{Unpaid}} = \frac{1.51 \times 10^{11}}{10^7} = 15,100 \text{ crore} \quad (31)$$

Table 3 presents the calculation of the Extended GSDP.

Integration of Unpaid Work into GSDP (INR in Crores)

Component	Value (INR Crores)	Percentage of GSDP
Traditional GSDP (SNA)	1,80,000	100%
Gross Value Added of Unpaid Work (GVA_{Unpaid})	15,100	8.4%
Extended GSDP (EGSDP)	1,95,100	108.4%

Comparison of Traditional GSDP and Extended GSDP. The extended GSDP value of ₹1,95,100 crore is consistent with Table 3.

Discussion and Comparison: Figure 3 shows that unpaid work contributes an additional 8.4% to the GSDP. This means that if unpaid work were included in national accounts, the true size of Jammu and Kashmir's economy would be approximately 1.08 times larger than officially reported. This revised estimate is consistent with lower-bound estimates in the literature. The results demonstrate the economic significance of unpaid work and underscore the urgent need for policy interventions.

The policy implications are clear. The 4R framework—Recognition, Reduction, Redistribution, and Remuneration—proposed by Gupta (2025) provides a roadmap. Recognition requires the adoption of Satellite Accounts, as demonstrated in this study. Reduction requires investment in rural infrastructure (piped water, clean energy, childcare facilities) to reduce the time burden. Redistribution requires challenging patriarchal norms and promoting shared domestic responsibilities. Remuneration, while complex, could begin with targeted cash transfers to women in low-income households, as piloted in some Indian states.

Advantages and Drawbacks: The advantage of integrating unpaid work into GSDP via Satellite Accounts is that it provides a more accurate picture of the economy and highlights the economic contribution of women. However, a drawback is that it may lead to an inflated

estimate of economic welfare if not accompanied by a corresponding increase in actual market production.

9 Summary

This research paper has developed a comprehensive mathematical framework for quantifying unpaid work and integrating it into the Gross State Domestic Product (GSDP) of Jammu and Kashmir. The study began by establishing the conceptual and theoretical foundations of unpaid work, drawing on feminist economic theory, Marxist social reproduction theory, and neoclassical critiques. It then reviewed the international and national literature, highlighting the global magnitude of unpaid work and the persistent gender disparities that characterize it.

The methodology employed a quantitative secondary-data analysis design, combining data from the National Time Use Survey (2019) with secondary regional data from rural Kashmir (Ara, 2024). The analytical framework was structured in two stages: the construction of a Time-Use Matrix and the development of a mathematical decomposition model. Two valuation methods—the replacement cost method and the opportunity cost method—were employed to translate hours of unpaid work into monetary value.

The corrected analysis reveals a stark gender disparity in time allocation: women in J&K spend 338 minutes per day on unpaid work compared to only 39 minutes for men. This translates to an annual aggregate of 3.08×10^9 hours for women and 3.80×10^8 hours for men. The mathematical decomposition model showed that the entire gender gap in the value of unpaid work is due to the time allocation effect under the replacement cost method (a result that follows mechanically from the assumption of identical replacement wages). Under the hypothetical opportunity cost illustration, the time allocation effect increases, but is partially offset by the negative valuation effect, reflecting women's lower market wages.

The valuation and integration into GSDP showed that unpaid work contributes an additional 8.4% to the GSDP, meaning that the true size of Jammu and Kashmir's economy is approximately 1.08 times larger than officially reported.

10 Conclusion

This study has provided a rigorous, mathematically grounded framework for quantifying unpaid work and integrating it into the Gross State Domestic Product (GSDP) of Jammu and Kashmir. The findings confirm that unpaid work is a massive, invisible subsidy to the economy, disproportionately borne by women. The time allocation effect accounts for the overwhelming majority of the gender gap, highlighting that the primary injustice is not the wage rate applied to unpaid work, but the sheer volume of hours women are forced to dedicate to it.

The policy implications are clear. The 4R framework—Recognition, Reduction, Redistribution, and Remuneration—provides a comprehensive roadmap for addressing the

structural inequalities in unpaid work. Recognition requires the adoption of Satellite Accounts, as demonstrated in this study. Reduction requires investment in rural infrastructure (piped water, clean energy, childcare facilities) to reduce the time burden. Redistribution requires challenging patriarchal norms and promoting shared domestic responsibilities. Remuneration, while complex, could begin with targeted cash transfers to women in low-income households, as piloted in some Indian states.

The study also highlights the importance of region-specific data. National aggregates conceal significant regional and conflict-specific variations, underscoring the need for localized time-use surveys and tailored policy interventions.

The corrected estimate shows that unpaid work contributes an additional 8.4% to the GSDP. This study reaffirms that unpaid care and domestic labor underpin both household welfare and the functioning of the broader economy. Without women's unpaid contributions, the paid economy could not operate efficiently. Yet, because this labor is excluded from GDP calculations and social protection policies, women's economic value remains systematically underestimated. By making this work visible through rigorous mathematical modeling and satellite accounting, policymakers can design more effective interventions to reduce gender inequality and promote inclusive economic growth.

11 Future Prospects

While this study provides a robust framework for quantifying unpaid work and integrating it into the GSDP, several avenues for future research remain:

1. **Primary Data Collection:** The study relied on secondary data from the National Time Use Survey (2019) and secondary regional data from a relatively small sample in rural Kashmir (Ara, 2024). Future research should involve large-scale, region-specific time-use surveys in Jammu and Kashmir to capture the full diversity of unpaid work across rural and urban areas, different agro-climatic zones, and various socioeconomic groups.
2. **Intersectional Analysis:** Future research should incorporate an intersectional approach, examining how unpaid work disparities vary by caste, class, religion, and ethnicity. This would provide a more nuanced understanding of the multiple axes of inequality that shape women's time allocation.
3. **Longitudinal Studies:** Longitudinal studies tracking changes in unpaid work over time would be valuable for understanding how economic development, conflict, and policy interventions affect the gendered division of labor. Such studies could also assess the long-term impacts of unpaid work on women's health, earnings, and retirement security.
4. **Refinement of Valuation Methods:** The choice of valuation method significantly affects the estimated value of unpaid work. Future research should explore hybrid approaches that combine elements of the replacement cost and opportunity cost

methods, and develop standardized methodologies for satellite accounting that can be applied consistently across regions.

5. **Policy Evaluation:** Once satellite accounts are implemented, future research should evaluate the impact of specific policy interventions—such as cash transfers, childcare facilities, and infrastructure investment—on reducing the burden of unpaid work and promoting women’s economic empowerment.
6. **Technological Change:** The ongoing digital revolution and the rise of the gig economy (Churchill et al., 2019) are transforming the nature of work. Future research should examine how these changes affect the distribution of unpaid work, particularly as more women enter the paid labor force while continuing to bear the majority of domestic responsibilities.
7. **Climate Change:** In agrarian regions like Jammu and Kashmir, climate change is altering agricultural cycles and water availability, which could have significant implications for women’s unpaid work. Future research should explore the intersection of climate change, unpaid work, and gender inequality.

By addressing these future research avenues, scholars and policymakers can build on the foundation laid by this study to create a more equitable and inclusive economic system that recognizes and values the contributions of all workers, both paid and unpaid.

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