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Debating Gender without Infrastructure: Evaluating Goal Interdependencies for Sustainable Development in India

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Abstract

Objective of the present study is to explore the linkages between gender equality and resilient infrastructure, as highlighted by the literature, enshrined within the broader perspective of sustainable development. Theoretically, this paper evaluates the interdependencies between gender and infrastructure in Indian context. Synergies and trade-off across SDGs are established using the reports published by NITI Aayog since 2018. Our findings reveal the abysmal performance of Indian economy on Industry, Innovation & Infrastructure (SDG 9) and Gender Equality (SDG 5). Gender-Infrastructure linkages within SDGs appear weak and insignificant, furthering the pertinent question, of how representative and comparable are the definitions of gender and infrastructure. Incompleteness in SDG 9 is embraced through a proposed Composite Index and its relative importance with SDG 5 is further empirically tested. The achievement of Water and Sanitation, Clean Energy and Sustainable Cities is synergistically significant and imperative for Gender equality goal alongside Infrastructure, Innovation and Industry.

JEL Classification: H54, J16, O10, O18, O53, Q01

Keywords

Composite Index, Gender Equality, Infrastructure, Sustainable Development Goals (SDGs), Synergies

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Introduction

Gender inequality can, be characterised as a multidimensional and dynamic phenomenon, which is determined by an interplay of myriad complex economic, demographic and socio-cultural factors. Understanding of the multi-dimensional gender gaps and their evolution with economic growth and development assumes importance because gender equality matters both –intrinsically and instrumentally (World Bank, 2011). Intrinsically, gender equality is important because it would allow women to develop their capabilities and achieve their full potential. This is based on Sen's interpretation of development as expansion of individual freedom and capabilities.

On the other hand, closing of different gender gaps would act as an instrument for higher growth. As pointed out in the World Development Report 2012 (World Bank, 2011) "greater gender equality would contribute to economic efficiency and the achievement of other key development outcomes." The instrumental importance of gender equality is also reflected by the Sustainable Development Goal -5 (SDG 5), which aims to achieve gender equality and empowerment for all women and girls by 2030 for ensuring sustainable development.

However, it needs to be noted that the process of economic development is characterised by various transitions, which bring about a change in many of the factors such as increased share of services, lower fertility, educational expansion, growth in trade expansion, and especially infrastructure development (such as access to transport networks, electricity and energy sources and ICT infrastructure), which have mixed consequences for the economic empowerment of women. Hence, it becomes imperative to analyse women's economic participation subjective to these factors.

Given this backdrop, the main objective of this working paper is to assess the consequences of infrastructure development for gender equality along with suitable additional controls. This paper explores the dimensions stemming from the debate for benchmarking and measuring SDGs. As a theoretical construct, this paper evaluates the linkages between gender and infrastructure using descriptive analysis for India. This is followed by econometric modelling for the said objective where we empirically test the importance of infrastructure for greater gender equal world. The motivation behind selecting specific SDGs is driven by the direct relevance of gender equality and infrastructure development. These SDGs capture the critical domains where gender disparities are severe yet infrastructure could act to transform the situation in establishing an equal environment. We thus show why infrastructure matters for addressing gender issues and how these systematic barriers could be reduced through an inclusive growth. This study is a systematic attempt to explore the ignored interlinkage between SDG 5 (Gender Equality) and SDG 9 (Industry, Innovation & Infrastructure) which aims to provide researchers understand the complex relationships between sustainable development and further support the policymakers in designing multi-dimensional approaches to achieve the said targets.

Following the paper is structured as follows. Section 2 begins with discussion of Literature based upon Gender and Infrastructure in consonance with Economic Growth and Development. Section 3 provides a descriptive analysis of India's performance

on SDGs with special focus on SDG 5: Gender Equality and SDG 9: Industry, Innovation & Infrastructure. Further, in Section 4, we explore the interdependencies of gender and infrastructure through deviation based analysis, correlation-based synergies and further develop a composite index for India. We take the theoretical idea forward to analyse the dependencies. Post the descriptive approach, we conduct a preliminary study for testing the hypothesis that whether infrastructure matters for women empowerment using econometric modelling. Results of a balanced panel random effects model is established for statistically verifying the validity of this hypothesis in Section 5. The paper debates the need for dependencies and directed actions in the concluding section.

Literature Review

Gender Equality, Economic Growth and Development

Literature abounds with the discussion of the bidirectional relationship between gender equality/women empowerment, economic growth and development (Duflo, 2012). This particular section, however, focusses on that strand of literature, which assess the impact of gender equality/women on economic growth and development.

As highlighted by the World Bank Report – Engendering Development (World Bank, 2001), presence of gender inequities tend to lower the pace of poverty reduction and economic prosperity by bringing about a reduction in the productivity of farms and enterprises. Presence of gender-based disparities also weaken a nation's governance structures thereby making a dent in the successful implementation and effectiveness of development policies. Substantiating the argument through cross-country empirical evidence (World Bank, 2001), highlights that gender inequalities exacerbate the incidence of poverty, malnutrition, and various other deprivations, which significantly undermine the holistic development of a nation. Similarly, the World Development Report, 2012 (World Bank, 2011) published after a decade also empirically reinforces the idea that achievement of gender equality plays a critical role in enhancing economic efficiency and achievement of key development outcomes by way of generating productivity gains through a corrective allocation of women's talent and skills; positive spill-overs by way of greater investment in the human capital of the next generation; and to the development of more inclusive and representative institutions and policy choices over the long run.

Duflo (2012) also presents an extensive review of literature, which elucidates the role played by women empowerment in economic development. It deliberates on four key issues – first, women education would change outcomes for their children as well as the remaining population; second, the influence of women on decision making would also have an impact on different development outcomes; third, the changes brought about by women empowerment on various outcomes would be positive; and fourth, the policy instruments, which should be used by policy makers to ensure women empowerment. Citing empirical evidence from various studies conducted across the world, the paper concludes that women empowerment would bring about a change in the decision-making process with direct significant consequences for development. However, it casts aspersions on the hypothesis that a one-time effort at implementation of women's right would

create a virtuous cycle with a mutual reinforcement of women empowerment and economic development.

In addition to the above-mentioned comprehensive studies, which present an elaborate discussion on the impact of gender equality/women empowerment on economic growth development, there is plethora of theoretical and empirical literature, which provides evidence in favour of the positive role played by different facets of gender equality on economic growth and development. (Dollar & Gatti, 1999) estimate that gender disparities in secondary education are a hurdle for growth. However, the empirical evidence provided by them suggests that such inequalities have a significant impact in countries, which are at higher level of development as compared to countries at lower levels of development. Similarly, (Klasen, 1999, 2002; Klasen & Lamanna, 2009) through cross country and panel regressions also estimate the impeding impact of gender inequality in education on economic growth through both a direct lowering of average human capital levels and indirectly through its repercussions on investment and population growth. These findings are further substantiated by (Klasen & Lamanna, 2009), who find that gender disparities in education to have reduced economic growth across countries during the 1990s. In addition, (Klasen, 1999) also estimates gender-based education disparities to significantly impact other parameters of development like fertility and child mortality. Similarly, with respect to disparities in the labour market, (Klasen, 1999; Klasen & Lamanna, 2009) estimate a slow-down in economic growth due to the presence of gender biases in labour force participation. The findings of (Klasen, 1999) suggest that in comparison to East Asia, gender-based employment inequalities in South Asia and Sub-Saharan Africa would have reduced growth by about 0.3 per cent.

However, in stark contrast (Seguino, 2000b, 2000a) find that as opposed gender-disparities in employment, presence of gender wage differentials gives a boost to economic growth. This is attributed to the positive link between wage differentials and investment and exports. The difference in wages is found to stimulate exports and provide the necessary foreign exchange for the investing in technology required to boost productivity and enhance economic growth. But these findings have been contradicted by (Schober & Winter-ebmer, 2011); based on analysis of data from meta-study pertaining to wage discrimination based on gender they don't find any evidence to substantiate that gender wage disparities could boost economic growth. Thus, we find that the existing literature is categorically skewed with evidence that gender equality is a positive for economic growth and development.

Infrastructure, Economic Growth and Development

Role of private sector in ushering growth and productivity is contingent upon the public sector investment spending (Aschauer, 1989). A large part of this investment goes into creation of capital stock of hard infrastructure which provides impetus to aggregate demand, employment and productivity. (Nijkamp, 1986) argues that disparity across regions and the varied level of development is factored upon the infrastructure endowments and the subsequent locational advantages, alongside other factors. Infrastructure itself acts as a corrective tool to synergize regions progressing along the path of Rostowian stages of development. Divergence in short

run could be covered up with demand stimulating investment through multiplier effect, but long-term sustenance makes infrastructure development a prerequisite through induced structural changes.

Unidirectional approach in making investment decision restricts the potential outcomes, as infrastructure creates both demand and supply side impacts. Duality of impacts is linked to endogeneity of the process of economic development, as highlighted by ((Maparu & Mazumder, 2017; Nijkamp, 1986). Causality is difficult to assert as transport amenities lead to economic development and urbanisation but urban agglomeration of economic activities fuels back the demand for transportation networks for better connectivity to an equal extent (Maparu & Mazumder, 2017). Investment in railways and road networks bear positive impact on industrialisation. Reduced cost of transport and logistics determines location of industrial firms (Ascani et al., 2012) whereas economic agglomeration and market expansion lead to demand for productive labour and successive migration (Maparu & Mazumder, 2017).

Although marginal in economic sense, Herranz-Loncán (2011) explains the importance of railways in achieving resource savings generated by narrowing distance gaps, integrating markets and paving way for political and administrative unity. Bi-directional linkages of construction sector are pointed by (Herranz-Loncán, 2011; Mallick & Mahalik, 2010) where intermediate structures prove beneficial for employment generation and input usage, whereas national wealth gets increased through construction-sector contrbutions in final form. Further, a reduction in construction growth rate negatively affects gross domestic product in short run. Specific to South Asia, (Sahoo & Dash, 2012) assert that goals of achieving human development and poverty reduction would be incompletely addressed without consideration for social overhead capital structures such as transportation, energy and information. Findings suggest that output elasticity of infrastructure appears positive and significant with energy, water and roads emerging as prominent variables. Interdependicies across labour, power and highway sectors result in robust effects on economic development. (Zhang & Ji, 2018) corroborate the findings for China specifically where output effect of infrastructure networks emerge positive, yet posit that higher stock of physical capital weakens the magnitude of impact over time, making the overall impact transitory in nature. Counter actions may dampen the effect of road and telecom systems in generating positive externalities.

Benefits of infrastrcuture are not confined to economic interpretation, but are social in nature as well. Manifestation of these benefits in social form are captured through more equitable access to education and health services for a greater inclusive approach to development. (Cui & Sun, 2019) evaluate the influence of urban infrastructure in producing socially valuable outcomes in four cities of China captured through a composit index measuring income, health and development potential effects. Urban neglect stemming from low urban infrastrcuture development resulted in lower social benefit and leaving scope for comprehensive development planning. In assessing the linkages of transport networks with wellbeing, (Popova, 2017) finds road length for Baltic nations is negatively correlated with poverty but positively related to population density.

Critical is the fact that infrastructure itself is indivisible and requires minimum capacity to operate (Nijkamp, 1986). Apart from the defining features such as spatially exclusiveness or immobility, non-substitutability and monovalence due to strict usage, infrastructure should also be distinguishably inclusive. Challenging enough, (Thacker et al., 2019a) warrant against the detrimental impact of infrastructure development on environment. While benefits of constructing systems towards employment and connectivity are visible in foreground, the displacement of lives, destruction to natural habitat and added environment exposures in the background cannot go amiss. Thus, development of sustainable and resilient infrastructure calls for cautious investment decision.

Gender and its Infrastructure dependency

The conceptualisation and approach to achieve sustainable development goals was never meant to be a process in isolation. Several studies have focused on the potential of infrastructure in benefitting women both directly and indirectly. In turn, women empowerment could also yield greater demand for development of gender specific or neutral infrastructure systems. The seminal report by (Ahmad, 2010) highlights the importance of gender dimension in infrastructure. Gender responsiveness is needed both at the supply side as well as demand side. It is the systematic bias stemming from social, economic and cultural differences that results in this imbalance (Ahmad, 2010). Representation of women in consultative process toward development of specific projects leads to greater good and results in bringing women to the forefront.

Equality in mobility requires engenderment of transport (Buiten, 2007). In developing nations, safety and security of women has remained a prime concern in poorly designed public modes of transport. In a survey-based study related to 'mobility poverty' experienced by women in Karachi, Pakistan, authors found that poor access to other important infrastructure facilities such as hospitals stemmed from lack of access to road connectivity. Overcrowded and unreliable transport services made is strenuous for women to travel (Iqbal et al., 2020). Studies also highlight the overreaching benefits of accessibility to infrastructure including; enhancing local economies which benefit women through increase in income and access to health facilities (Ahmed & Nahiduzzaman, 2016; Ewerling et al., 2017), relationship between distance to school and household work-load with female literacy (Porter et al., 2011), electricity, economic freedom and labour force participation (Kumar et al., 2020; Winther et al., 2018) and association between Water, Sanitation and Hygiene (WASH) services and women empowerment (Alkire et al., 2013; Dery et al., 2020; Kumari & Sharma, 2017).

With prevalence of differentiate access and opportunities, gender-based inequalities and inequities in infrastructure tend to exacerbate over time (Gaynor & Jennings, 2004). Societies have long defined roles and responsibilities for women differently, causing undue hindrances compared to their male counterparts, and thus forcing an environment of self-provision and sustenance. Limited by the choices, lack of access to information stereotypes women and thereby undervalues them on the basis of status, skill and pay in workplace. In the words of (Gaynor & Jennings, 2004), this

'triple-divide'[5] can be overcome by policymakers by making design and delivery of infrastructure more encompassing and robust. Infrastructure must, therefore, become gender-inclusive and gender must unpack itself in infrastructure services.

Methods

Using the reports published by NITI Aayog since 2018, descriptive analysis of India's performance on SDGs with special focus on SDG 5: Gender Equality and SDG 9: Industry, Innovation & Infrastructure is provided in section 3. Further, we explore the interdependencies of gender and infrastructure through deviation-based analysis, correlation-based synergies. We further develop a composite index for India to provide a more comprehensive definition for Infrastructure. We take the theoretical idea forward to analyse the dependencies.

Post the descriptive approach, we conduct a preliminary study for testing the hypothesis that whether infrastructure matters for women empowerment using econometric modelling. Results of a balanced panel random effects model is established for statistically verifying the validity of this hypothesis sub-section. Theoretically, this paper evaluates the interdependencies between gender and infrastructure in Indian context. Synergies and trade-off across SDGs are established using the reports published by NITI Aayog since 2018. Evidence from random effects regression model using balanced panel of 36 states & Union Territories is established to test the synergies of goals with SDG 5 - Gender Equality.

Data

This paper relies upon the recently published three reports by NITI Aayog for the year 2018, 2019 and 2020 for the data pertaining to SDGs. The state-wise ranks and scores are used for the analysis. For the econometric analysis, data pertaining to State Domestic Product, Inflation and Tax revenue is obtained from the Reserve Bank of India Handbook of statistics on Indian States for 36 states/UTs. The description of the variables in the model setting is detailed in Table 1 below.

Table 1 Description of independent variables used in random effects model

Variable	Description	Source
SDG 5	Aggregate Score on goal: Gender Equality	NITI Aayog SDG Reports years 2018, 2019 and 2020
SDG 9	Aggregate Score on goal: Industry, Innovation and Infrastructure	
SDG 6	Aggregate Score on goal: Clean Water and Sanitation	
SDG 7	Aggregate Score on goal: Affordable and Clean Energy	
SDG 11	Aggregate Score on goal: Sustainable Cities and Communities	
$LnPC\_NSDP_{-1}$	Lagged value of log of Net State Domestic Product per capita	Handbook of Statistics on Indian States 2019-20, Reserve Bank of India
$(LnPC\_NSDP_{-1})^2$	Squared lagged value of log of per capita Net State Domestic Product	
Inflation	State-wise Consumer Price Index (CPI) inflation, (General)	
$LnTax\_Revenue_{-1}$	State-wise Own Tax Revenue	
Composite Index	Equally-weighted Geometric index of SDG 6, 7, 9 & 11	Compiled by Authors

[5]An idea of poor women as citizens poor society within a low-income country.

The random effects model includes explanatory variables related to infrastructure along with control variables (refer Table 1).

$$SDG5_{it} = \beta_0 + \beta_1 SDG5_{it-1} + \sum_k \beta_k x_{kit} + \sum_j \beta_j Controls_{jit} + v_{it} \quad \text{(Eq. 1)}$$

$v_{it} = a_i + u_{it}$ is a composite error term containing unobserved individual effects and idiosyncratic error terms.

India's performance on SDGs

Recent experience of declining growth projections for Indian economy has raised serious concerns over the role of state in accentuating the efforts to make India a $5 trillion economy. The sustenance of 'virtuous cycle' of economic development makes public sector investments an imperative precondition achieved through greater allocations towards developing resilient infrastructure and robust manufacturing base supported through innovative disruptions (Economic Survey 2018-19). Slippage of seven rank places on Pillar 2: Infrastructure[6], along with stagnant Research & Development (R&D) spending[7] posits challenges for India's dream run. In all seriousness, fiscal policy should focus on productivity-enhancing investments in infrastructure within the broader realm of environmentally-responsible process of economic development.

India improved its position from an 'Aspirant' to a 'Performer'[8] but goal level performance still remains unsatisfactory. The most considerate improvement over SDG 7 (Affordable and Clean Energy) was achieved through accentuated scheme based delivery of electricity and clean cooking fuel. For example, *Ujjwala Yojgna* empowered rural women through and enabled asset ownership with access of LPG based cooking fuel to over 72 million households[9]. Other areas of remarkable improvements included SDG 3 (Health and Well-Being), SDG 6 (Clean Water and Sanitation) and SDG 11 (Sustainable Cities and Communities). Effective integration of schemes for women and children resulted in narrowing the incidence in maternal and child mortality. Flagship programme of the government, *Ayushman Bharat* aims to achieve Sustainable Development Goals by underpinning the commitment to 'leaving no one behind'. The scheme is targeted to provision health insurance of Rs. 5 lacs per family per year to 100 million poor. Under SDG 11, making cities sustainable by reducing the environmental impact along with improved air quality and proper waste management by 2030 is the agenda of *Swachh Bharat Mission*. A facet of this mission also includes eradication of open defecation through access to toilets targeting SDG 6.

At an aggregate level, performance of India on SDG 9 has improved by 2019 but saw a decline in 2020 (refer Figure 1)[10]. Index score of 65 was achieved in the year 2019 to

6 Under the recently released Global Competitiveness Report (2019) by World Economic Forum, India's performance on infrastructure related parameter fell at the aggregate level. India was ranked 70th in the year 2019 with Singapore as the leading nation on this parameter.

7 As per NITI Aayog's SDG India Index Report 2019, contribution to R&D spending was meagre 0.7 percent of India's GDP over the past two decades.

8 NITI Aayog SDG India Index reports define Aspirant with score 49 or less, Performer with score up to 64, Front Runner with score up to 99 and Achievers with a perfect score of 100.

9 The direct benefit transfers saved the government exchequer a subsidy bill of Rs. 595 Billion.

10 Data for SDG 12 (Sustainable Consumption & Production), SDG 13 (Climate Action), SDG 14 (Life Below Water) and SDG 17 (Partnership for Goals) is not reported since these goals were not measured in the baseline report due

measure the performance on Infrastructure, Industry and Innovation front (compared to a score of 44 in the baseline report of 2018. Performance on Gender goal (SDG 5) was one of the lowest across all goals, a score which saw least improvement over the years. It is potent to question as to why India has not been able to make a significant dent on gender based parameters? What impedes the performance and is it only intrinsic to sub-indicators centric to women empowerment or does it actually go beyond that? We try to assess the low performance over the two indices; namely gender and infrastructure, using the disaggregated analysis in the subsequent sections and explore the interconnectedness across these two goals.

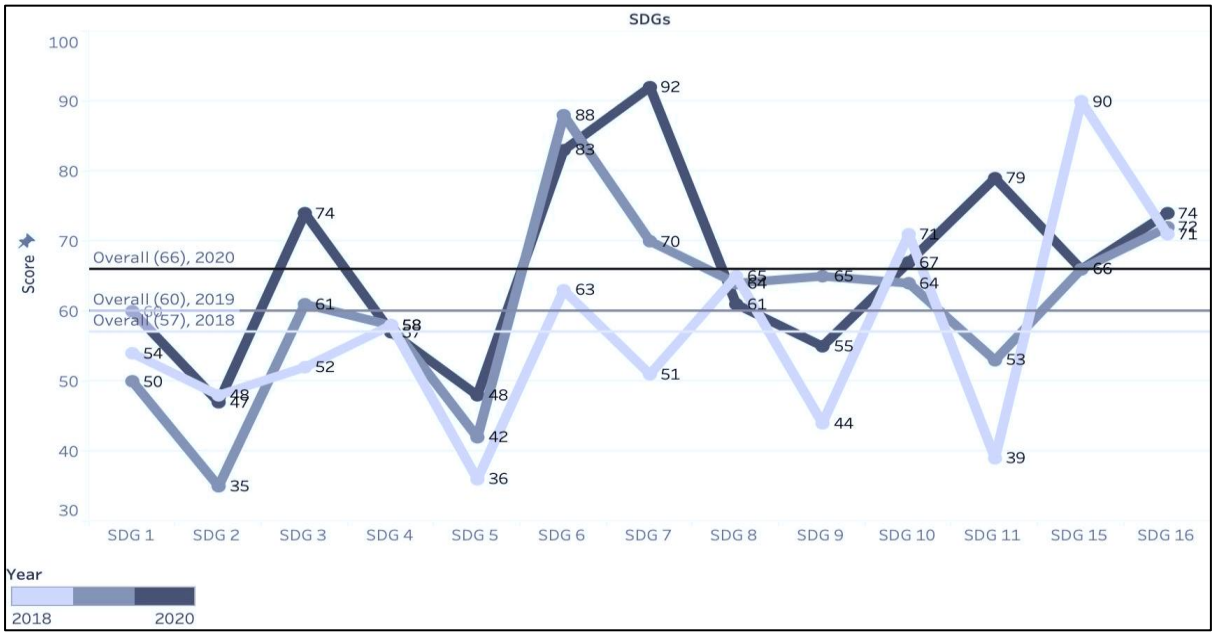

Figure 1 India's performance of SDGs over time
National score of overall SDG index shown alongside individual goals. Large variation is seen within goals across time.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

India and Gender Equality: Performance on SDG 5

Persistence of myriad forms of gender inequalities remain the Achilles Heel in India's journey towards the achievement of Sustainable Development Goals by 2030. The rationale for the same can be accorded to the intrinsic and instrumental role played by gender equality in achieving development outcomes (World Bank, 2011).

According to data compilations in NITI Aayog's SDG India Index Report 2019, the performance of India at an aggregate level on Sustainable Development Goal (SDG) 5 i.e. Gender Equality has the second lowest national score of 42[11]. This is a matter of immense concern as it highlights that the process of growth and development in India has been far removed from being gender

to lack of indicators. These goals have been excluded for analysis in further sections.

[11] According to the SDG India Index Report 2019, SDG 2 pertaining to Zero Hunger has the lowest national score of 35

inclusive. However, as compared to 2018, first year wherein the tracking of the country's performance on SDGs started, SDG 5 score has witnessed an improvement of about six points from the lowest national score of 36 in the baseline report. Though our data analysis (refer Figure 2) suggests that overtime difference in national performance can be attributed merely to the inclusion of three new sub-indicators – (i) Rate of crimes against women per 100,000 female population; (ii) Proportion of sexual crime against girl children to total crime against children during the calendar year; and (iii) Operational gender disaggregated landholdings.

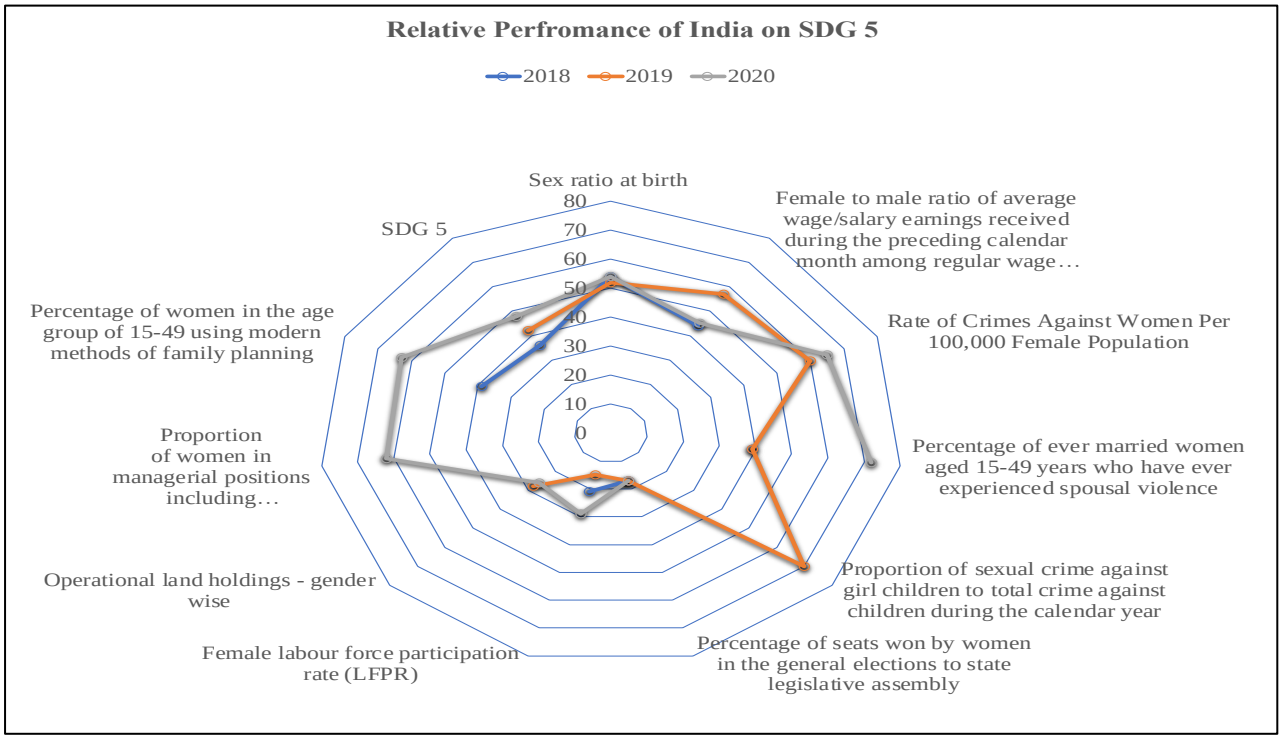

Figure 2 Overtime Performance of India on SDG 5

A web diagram showing the variability of parameters in Gender performance over time. Each year, there has been a methodological shift in variables mapping gender equality.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

Data categorically reflects that performance on sub-indicators common across the three years pertaining to sex ratio at birth, political participation and labour force participation either worsened in 2019 or remained the same. It is important to point out that female labour force participation[12] indicator score has registered a significant decline from 21 to 15 over just one year and remains a bottleneck for India's holistic development. Ratio of average earnings by females over males declined along with a reduction in land holdings held by females. Female labour force participation has not seen a significant increment in three years. Improvement in family planning and addition of sub-indicator on women in managerial positions led to improvement in overall score on SDG 5.

[12] According to the SDG India Index Report 2019, female labour force participation rate in India in the present stands at 17.5 per cent and is witnessing a decline

Further, delving deeper into a disaggregated analysis of SDG 5, data suggests that the performance of states/union territories (UTs) is not exemplary (refer Figure 3). Overtime performance of 16 states/UTs had worsened with respect to gender equality in 2019 as compared to 2018. As of 2020, best performance among states/UTs has been that of Andaman & Nicobar followed by Puducherry and Lakshadweep. States of Chhattisgarh, Kerala and Himachal Pradesh scored better than rest of the states. Meanwhile, Assam, Delhi and Telangana trail with lowest scores among states and UTs respectively, their performance also reversed across three years of analysis. The decline in the index score from 43 to 26 over the considered time period was the highest in the case of Telangana, which paradoxically witnessed a gross state domestic product (GSDP) growth of 10.4 per cent[13] in fiscal 2018.

With respect to SDG 5 performance over three years, none of the states/UTs have been classified as either front runners or achievers[14], thereby reflecting the massive challenges pertaining to gender inequality, which lie ahead of both national and state level policy makers.

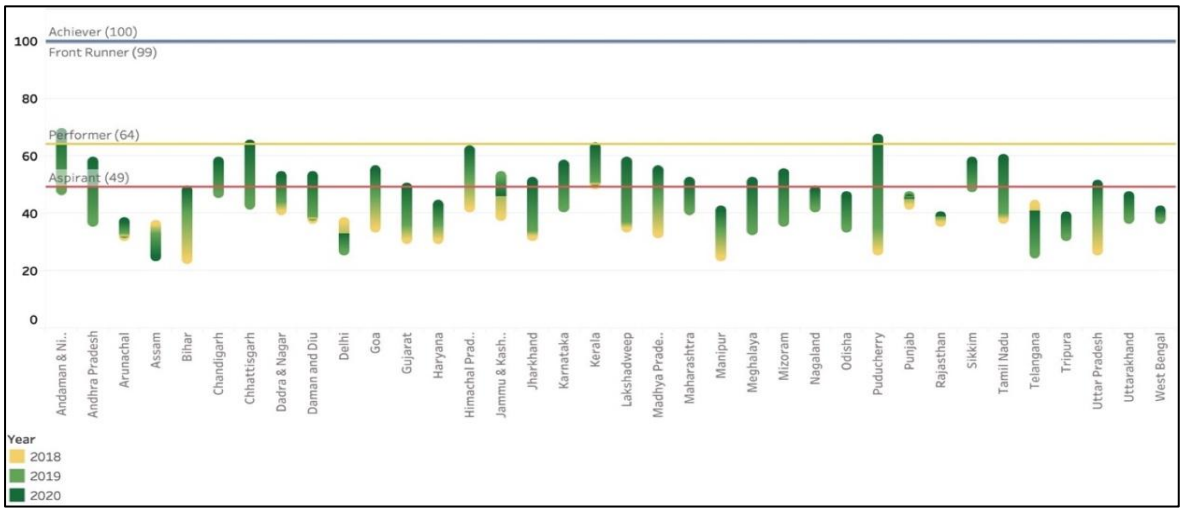

Figure 3 Changes in State/UT performance on SDG 5 over time

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

Thus, through probing of data we categorically ascertain that gender inequality presents a significant challenge before Indian policy makers as economic growth overtime by itself has not proven to be an antidote for the same. This necessitates the formulation and implementation of nuanced as well as targeted policy actions to ensure progress towards the achievement of SDG 5 by 2030. Moreover, the focus on SDG 5 is specifically important considering its interdependencies with various other SDGs. India also needs to incorporate parameters set by United Nations to assess SDG 5 such as *cases of Child marriage or unionisation, under-age mutilation, recognition to time spent on unpaid domestic care and work, state-level laws for women rights pertaining to health and*

[13] Based on a States of Growth 2.0 – The scorecard, and the workout on how each state has got to where it has, January 2019 by CRISIL

[14] Based on the index score performance the report classifies states and UTs as Aspirants (Score<49); Performers (Score: 50-64); Front Runners (Score: 65-99); and Achievers (Score =100)

education and gender-wise access to communication technology[15].

India and Infrastructure: Performance on SDG 9

Refining the analysis at indicator level provides justification for improvement in performance of infrastructure-based goal at national level. The NITI Aayog's SDG India Index Reports of 2019 and 2020 incorporate modifications in the list of sub-indicators used to measure SDG 9 over the baseline report. Common sub-indices, namely (i) Percentage of targeted habitations connected by all-weather roads under Pradhan Mantri Gram Sadak Yojana; (ii) Number of mobile connections per 100 persons in rural and urban area, (iii) Number of Internet subscribers per 100 population, witness subsequent advancements over time (refer Figure 4).

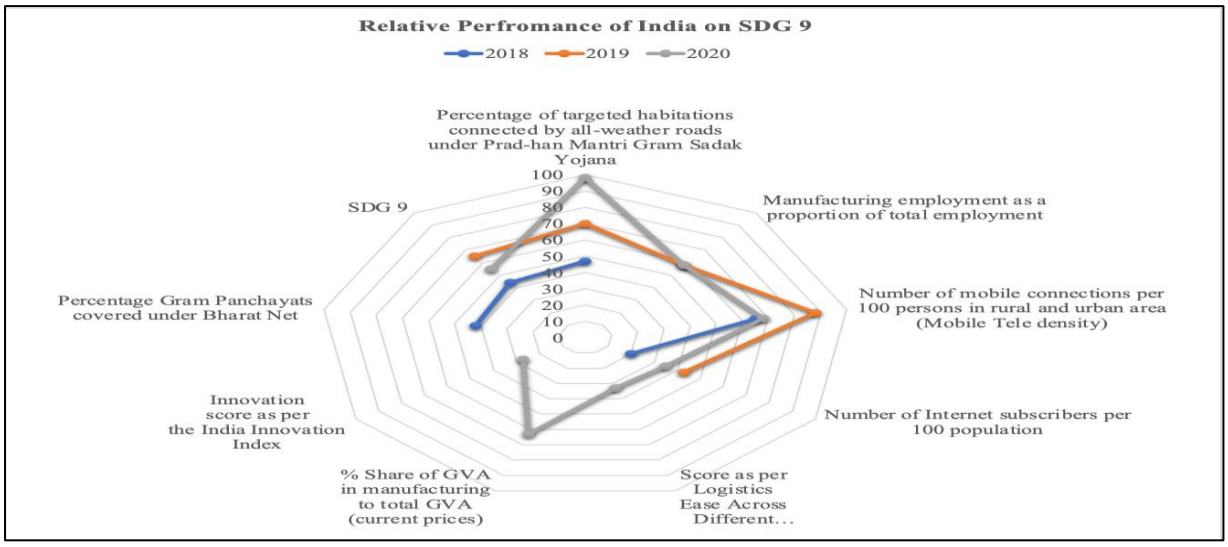

Figure 4 Overtime Performance of India on SDG 9

Similar variability of parameters gauging SDG 9 is seen. Newer sub-indicators result in tweaking the score to higher side.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

Inclusion of new sub indicator: 'Manufacturing employment as a proportion of total employment' ushered the score from the base year. The insertion of new sub-indicator-led improvement in the infrastructure performance is camouflaged[16] due to the fact that only 12.13 percent of workforce in India is engaged in manufacturing sector. Digitalisation and need for smarter productive systems has accentuated the need for seamless connectivity. Not only the overall strength of users covered through mobile and internet connectivity has risen, domestic network-based coverage of gram panchayats for delivery of digital services was also significant[17]. Another factor of adjustment is the seeming inclusion of share of Gross

[15] https://sdgs.un.org/goals/goal5 (accessed on 20 November 2021).

[16] In absence of uniform target, the new indicator aimed at promoting inclusiveness and productivity through greater share of employment in manufacturing sector, the national target is set using the average performance-based score of top three states.

[17] The sub indicator measuring this performance was eliminated from the calculation of SDG 9 in the recent report for

Value Added (GVA) in manufacturing as percentage of total GVA which results in keeping the overall score of SDG 9 afloat[18]. In reality, manufacturing growth in India has been on a steady decline since year 2016. The rate of growth was 5.7 percent in FY2019 compared to that of 13.1 percent in FY2016 (Government of India, 2020). Incompleteness in capturing the industrial performance if factored in through under performance on Innovation Index. A miniscule contribution to R&D (0.7 percent of GDP in precise) is insufficient to create a competitive advantage for the Industrial sector at global forefront (Department of Science & Technology, 2020).

The analysis is further extended to sub-national level to gauge the performance of states/union territories (UTs) on SDG 9. Large variation is witnessed across states over scores. Compared to the base year, 20 states and UTs were listed in the 'Performer's' category, of which 4 were 'Achievers' with complete score in the year 2019 (namely Dadra & Nagar Haveli, Daman & Diu, Delhi and Puducherry). Inclusion of newer sub-indices saw a sharp variation in the performance of these states. India fails to gauge the performance of these regions due to paucity of data. The absolute uptrend is visible for 11 states and UTs.

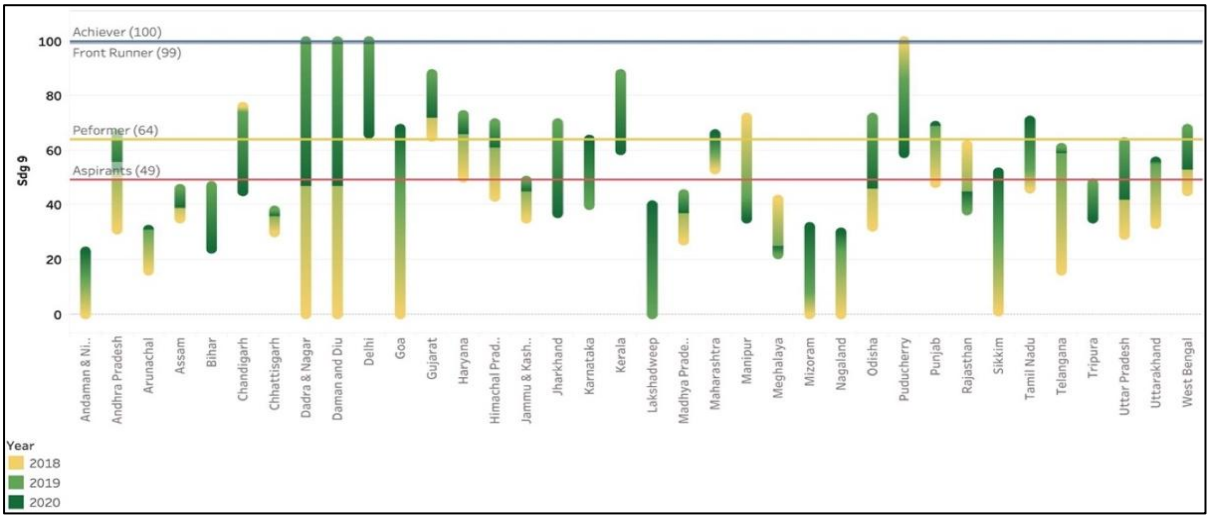

Figure 5 Changes in State/UT performance on SDG 9 over time

Larger deviation in performance of states/UTs on SDG 9 is witnessed over time.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

Spanning the state/UTs level analysis over time shows a striking trend pertaining to infrastructure, industry and innovation-based performance. Majority of states witness a decline in performance by 2020. A 'temporal rewind' occurs in the performance (see Figure 5) for states such as Karnataka, Rajasthan, Manipur and Meghalaya in progressing forward from the year 2018 to 2019. While Karnataka demotes from being a 'Performer' state to an 'Aspirant', Meghalaya witnesses a decline of 20 points and remains in the 'Aspirant' category.

the year 2019. No specific reason was provided for the same.

[18] As per the recent Economic Survey (2020-21), the share of manufacturing in Industry as a percentage of GVA was around 16.5 percent.

While there was a steep decline in the number of internet users in Karnataka over the years, Meghalaya saw a reduction in percentage of households connected through all-weather roads.

Surprising results emerge for the states of Manipur and Rajasthan over time. Manipur, which, with a decline of 29 points in index score, is dragged to an 'Aspirant' status in the year 2019 from being the leading state on SDG 9 in the year 2018. Similarly, all the 'Achievers' see a reversal in the year 2020 with Delhi and Puducherry being dragged to the status of Performing states. Chandigarh, Jharkhand and Manipur also lose their status with inclusion of newer sub-indicators. Performance of Chandigarh and Puducherry deteriorates over time as except for the excluded sub-indicator, their performance on all other sub-indicators was nil in 2019 against 2018.

A mix of factors such as decline in connectivity through all-weather roads, low proportion of employment in manufacturing sector and poor performance over innovation and logistics metrics played a pivotal role in demotion of the state, alongside relative improvement in performance of other states.

On the other hand, Rajasthan loses significantly on index score (from 62 in year 2018 down to 38 in the year 2019) because of two reasons – first, due to sharp decline in percentage of households connected through all-weather roads and second, due to sudden exclusion of sub-indicator capturing connectivity at gram panchayat level; a factor where Rajasthan scored very high.

Deviation-based analysis, SDG Synergies and Composite Index

Deviation in score-based performance of SDG 5 & SDG 9

Comparisons can be drawn between the performance of states/UTs over time on SDG 5 and SDG 9 using a deviation-based perspective. The performance of states/UTs is mapped using the deviation from the overall country score on the goals addressing Gender and Infrastructure outcomes. The analysis presented here objectifies to capture the idea of positive relation between performance of attaining more gender stable scores and infrastructure improvement. The states with higher performance deviation over SDG 5: Gender should exhibit a higher performance deviation over SDG 9: Infrastructure. There are clubs of states/UTs which exhibit a higher performance above the country scores over both of the goals which can be referred to as 'Leaders'. States/UTs with equal poor performance over Gender and Infrastructure are thus referred to as 'Laggards'. Across all the 36 states and UTs analysed, only Kerala emerges as a *Leader* state with an improvement over time against both the goals.

Regions such as Delhi, Gujarat and Haryana have had consistently lower performance than country scores over gender targets but has outperformed on infrastructure front whereas regions such as Andaman & Nicobar, Chhattisgarh and Sikkim have been constantly out-scoring on gender parity with under-scoring over infrastructure goal compared to overall country score. *Laggard* includes the states of Arunachal Pradesh, Assam and Bihar which is an area of concern as they have consistently underscored over both the goals in comparison to overall country level performance.

A greater positive performance is visible across Gender compared to a greater

negative performance across different states/UTs over time. The extent of these improvements (measured by the thickness of the shaded region) has enhanced over recent years. This hint towards a lesser dependence of gender equality over infrastructure or more so, over the incompletely defined infrastructure.

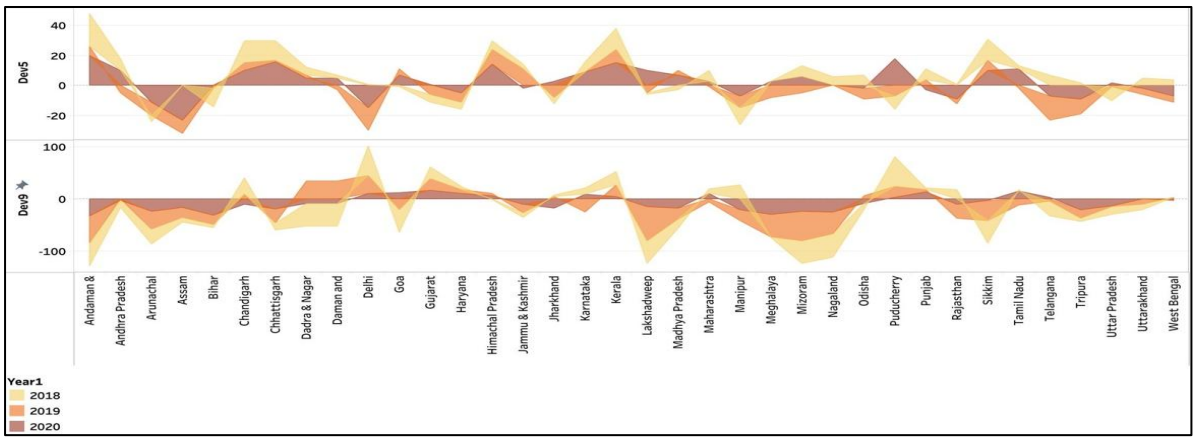

Figure 6 Deviation of state/UTs scores on SDG 5 and SDG 9 over time.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

Special focus can be drawn on 'Leaders' (shown in Figure 6) in deviation-based performance over time. States with high overall SDG scores, namely Kerala, Punjab along with Chandigarh in the UT category, are also the states/UTs which out-perform the country-level performance on Gender and Infrastructure over time.

Interestingly, performance for regions namely, Maharashtra, Karnataka, Rajasthan and Delhi have deteriorated over time. Status for Maharashtra, Karnataka and Rajasthan got diminished from a 'Leader' to that of a 'Laggard' state by 2019 thereby symbolising an overall reduction in performance over both goals in comparison to country-level performance. The overall SDG performance at aggregate level for these states saw a similar deceleration. Dadar & Nagar Haveli and Himachal Pradesh saw an improvement in performance by attaining 'Leader' status in the year 2019. Himachal Pradesh was also a 'Front Runner' in overall SDG performance at aggregate level.

Redefining Infrastructure

Data across the three reports exhibits a negative relationship between SDG 5 and SDG 9 with insignificant association (refer Figure 7). Regions with consistently higher performance over infrastructure goal have not secured a considerate performance over their gender goals and vice-versa. On the other hand, states and UTs also exhibit a positive relation across other goals (refer Figure 8); such as SDG 6 (Clean Water & Sanitation), SDG 7 (Affordable and Clean Energy) and SDG 11 (Sustainable Cities), with SDG 5 (Gender).

The reason for such analysis stems from the fact that the very definition of infrastructure is incompletely captured by SDG 9 from the lens of sustainability. 'Big-five' networks of infrastructure system are estimated to affect 72 percent of SDGs (Thacker et al., 2019b). Using a global dataset, (Adshead et al., 2019) identify 12 SDGs which can be directly influenced by 31 distinct targets under the broader definition of infrastructure.

Multiple infrastructure sectors contribute to SDG target which must be collectively considered rather than a single indicator. For example, A focused target such as target 5.b (*Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women*) is addressed using a single indicator linked to Digital communication sector. Whereas multi-dimensional targets such as target 6.2 (*By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations*), which have a significant impact on women and children, can be addressed using wastewater/solid waste management systems along with health infrastructure. Even within infrastructure as a target, sub-targets may refer to system wide network of infrastructure facilities without a specific elucidation. For example, target 9.1 (*Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all*) is vaguely captured using percentage of inhabitants connected with all-weather roads. It lends an incomplete perspective to the idea quality and reliability for development and well-being which is not restricted road transport.

Singular infrastructure intervention would achieve sustainable development outcomes insufficiently, thus calling for its complements to make the process robust. Hence, the definition of infrastructure could not be restricted to access to physical or tangible infrastructure. Studies catalogue the synergies between SDG 9 (Infrastructure) with water, energy and sustainable cities (Adshead et al., 2019; Bhaduri et al., 2016; Fuso Nerini et al., 2017; Thacker et al., 2019b). Interdependencies across these infrastructure systems lends a newer character to the process of achieving sustainability targets within national capacity and policy framework. Cross inter-sectoral dependencies are strongly present across SDG 6, SDG 7, SDG 9 and SDG 11 thereby increasing the likelihood of meeting other targets by 2030 under controlled scenario (Adshead et al., 2019).

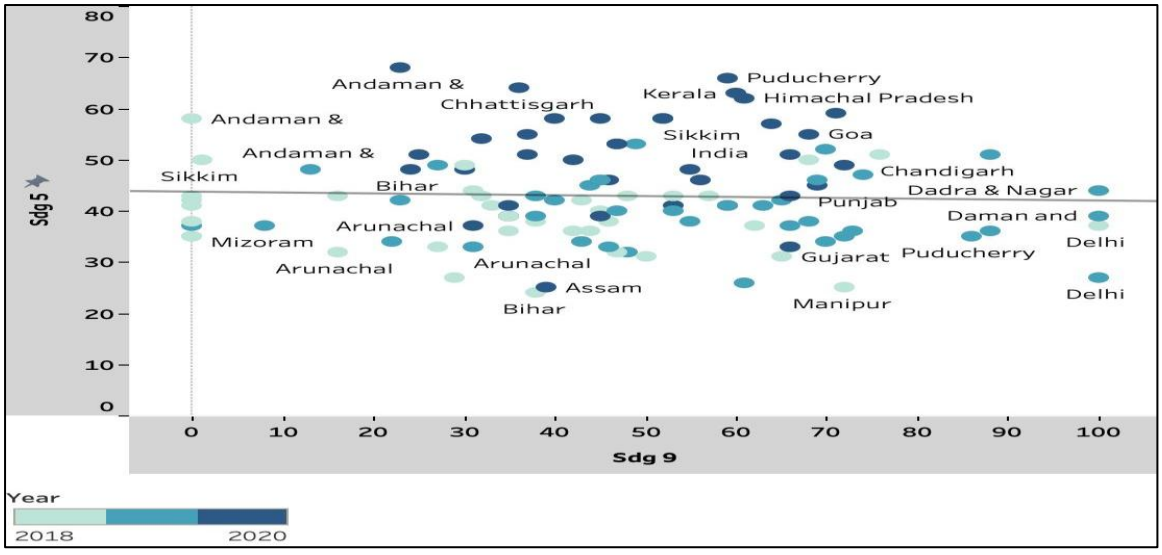

Figure 7 Relationship of SDG 5 with SDG 9 across all states over time

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

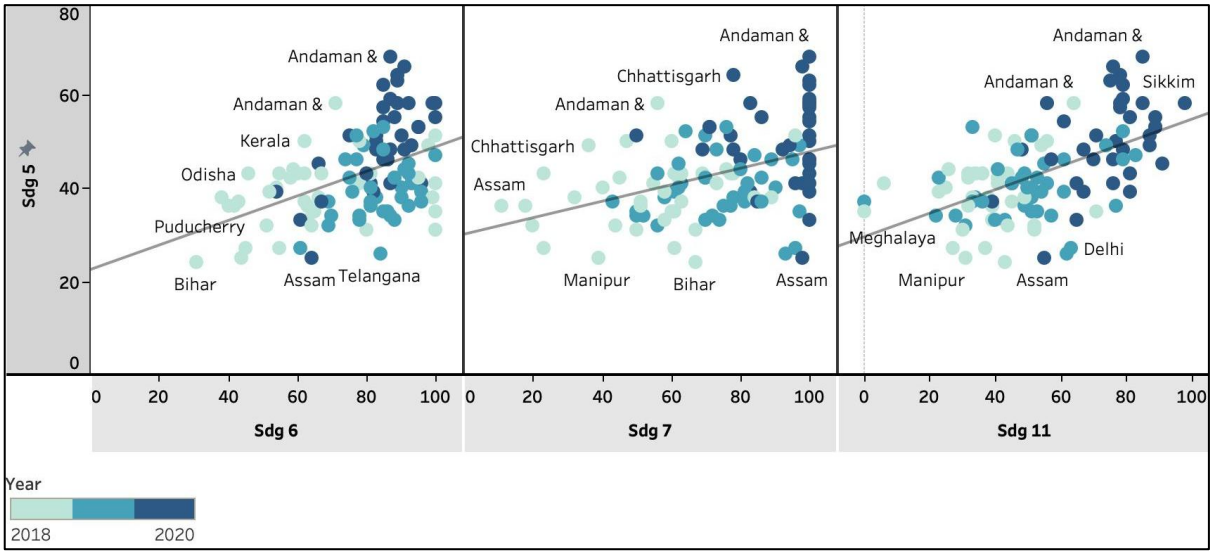

Figure 8 Relationship of SDG 5 with SDG 6, 7 and 11 across all states over time

Strong positive synergies are visible across goals 6, 7 and 11 with goal 5.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

Infrastructure development and gender equality possess positive relationship has been evenly discussed in the literature. Sources of energy are equally vital for the society to achieve a better standard of living with an equal commitment to the environment (Rathi & Vermaak, 2018). Provisioning of electricity and cleaner sources of energy would entail the broader spectrum of resilient infrastructure along with sustainable industrial development, a facet well recognized in the literature (Fuso Nerini et al., 2017; Kumar et al., 2020; Winther et al., 2018), yet ignored in policy and practice. Made vulnerable by inadequacies, access to sanitation could provide means of recognition and empowerment of marginalised groups (Diep et al., 2021). External interventions (through improvements in water and sanitation) along with invested implementation of health, hygiene and immunisation programmes could subvert incidents of child and maternal mortality (Alkire et al., 2013; Dery et al., 2020; Ewerling et al., 2017; Kumari & Sharma, 2017; Lama & Job, 2014; Victora et al., 2011).

Synergies in Indian context and Composite Index

Decision makers and researchers carrying a vision for national infrastructure development need to exploit the nexus across sustainable development goals. This forms the basis for developing a Composite Index serving as inclusive representative of Infrastructure. Not restricting to the normative approach to assess the synergies between Gender and Infrastructure adopted in previous studies (Diep et al., 2021; Fuso Nerini et al., 2017; Thacker et al., 2019b), our assessment relies upon more statistical method of evaluating the importance of Infrastructure for Gender Development. We use Spearman's rank correlation analysis to identify unique combinations of indicators influencing Gender. The approach quantifies the synergies across different SDGs on the basis of correlations (Pradhan et al., 2017). Pairwise correlation coefficients are

computed ascertain the strength and degree of relationships across SDG scores obtained by states/UTs over three years. Strength should not be perceived as a precise measure and is rather a categorical classifier to group SDGs. In the positive spectrum, correlations between 0.6 to 1 are classified as '*strong synergies*' contrary to '*weak synergies*' classified in the range of 0.2 to 06. In the equally opposite spectrum, correlations of negative magnitude signify '*trade-offs*' amongst SDGs. Significance of interconnectedness is expressed using p-values[19] and the synergy-trade-off combinations are classified further as significant or insignificant relationships. Since approaches in the cited studies combine the correlation analysis with the existing literature to assign and validate strength across SDGs, we hedge the paucity of literature in Indian context through purely correlation-based synergies. Correlations do not imply causation and the dependencies symbolise synergistic co-benefits or trade-off problems across benefits amongst SGDs(Pradhan et al., 2017).

We use the synergy-trade-off balance to develop a 'Composite Index' to capture the essence and eminence of water, sanitation, clean energy, sustainable dwelling and waste management in affecting the lives of women folks. Composite index tries to cover the aspect of completeness in infrastructure by considering the multi-dimensional aspect of sustainability and defined targets. It provides an adequate characterization to the idea of infrastructure within the realm of sustainability (Ravallion, 2012).

Results based on Interdependencies

Reported in Figure 9 in a matrix format, the diagonal elements are excluded to eliminate self-dependency. A total of 41 pairwise synergies and 9 pairwise trade-off is reported[20] across SDGs. All the pairs of synergies and trade-offs are statistically significant at 5 percent level of significance with most of the dependences being weak in nature. Gender appears to have 6 significant synergies and only one trade-off (with SGD 15). Most importantly, SDG 5 (Gender) and SDG 9 (Infrastructure) have insignificant and unclassifiable dependency corroborating the factual absence of infrastructure from gender debate. Synergies of Gender is highest with Sustainable cities (SDG 11), Health & Well Being (SDG 3), Clean Energy (SDG 7) and Water and Sanitation (SDG 6). Though SDG 9 has synergies with SDG 7 and SDG 11, groups of SDGs 6, 7, and 11 have a positive synergy within themselves.

Based upon these dependencies, we construct a *Composite Index* comprising of equally weighted geometric mean of scores of fours SDGs namely Infrastructure (SDG 9), Clean Water and Sanitation (SDG 6), Clean Energy (SDG 7) and Sustainable Cities (SDG 11).

The composite index was created using equally weighted method:

Composite Index (CI) = $\sum_{i=1}^{n} w_i x_i$

where $w_i = 1/n$ and $x_i =$ $scores\ across\ the\ indicators$.

Scores were already normalised to the scale of 0 – 100 by the methodology adopted in the reports, hence separate normalisation for index construction was not conducted. This

[19] Significant relations are reported at 5 percent level of significance. Also, relations spanning in the range between 0.2 and -0.2 are referred as '*unclassified*'.

[20] 41 unclassified pairs are also reported due to lack of sufficient data across SDGs to capture targets.

new index appears to have highest number of synergies with other goals with only two trade-offs. Strikingly, this new index redefining infrastructure, emerges significantly synergetic with Gender (SDG 5). Positive trend between gender and composite index was also noted over three years (refer Figure 10).

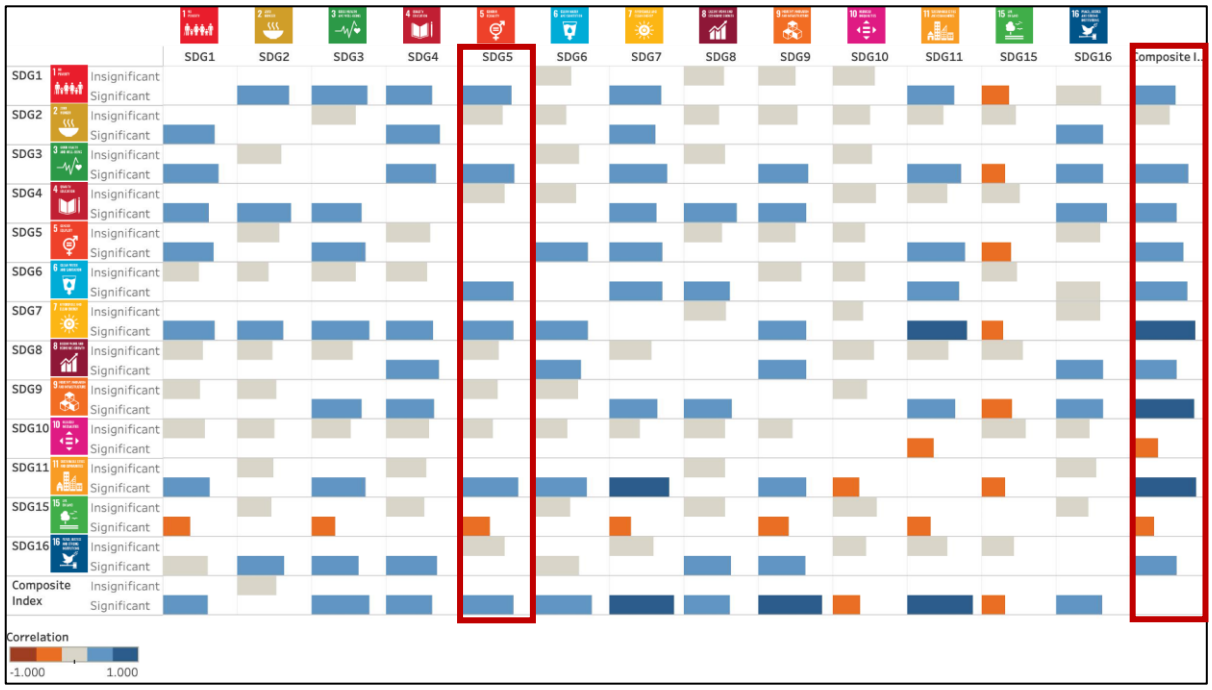

Figure 9 Pairwise Correlation-based synergies across SDGs

Synergies are measured using pairwise correlations across different goals. The direction of correlation determines whether dependencies are positive or negative. Focus is placed on synergies exhibited by goal 5 and the computed composite index.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

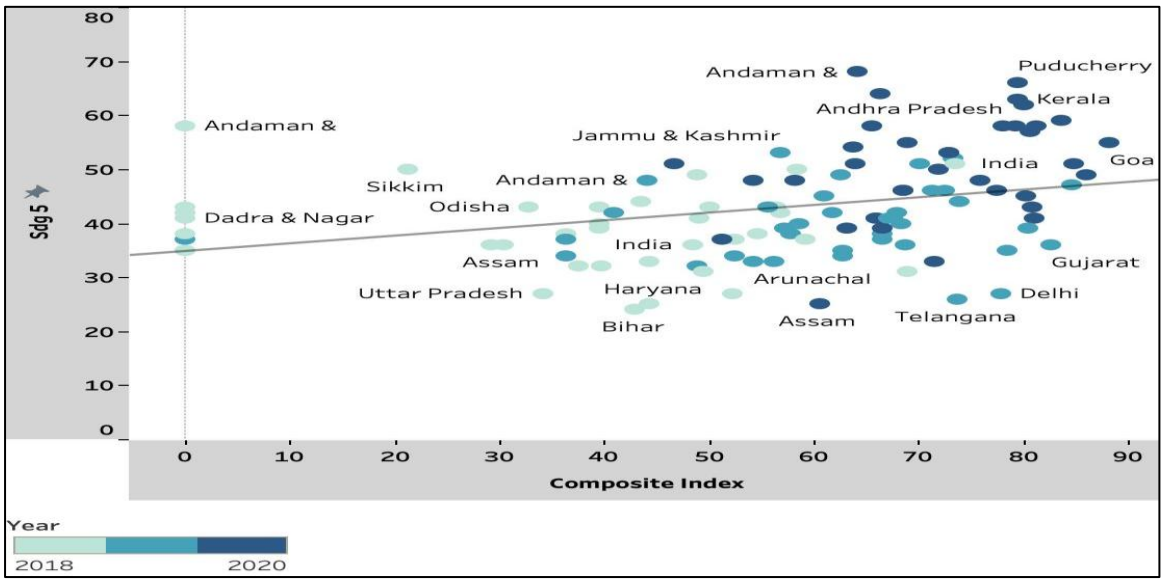

Figure 10 Relationship of SDG 5 with Composite Index across all states over time

SGD 5 and the Composite index display positive relationship across three years.

Source: Authors compilation from reports by NITI Aayog for the years 2018, 2019 and 2020.

Adopting an econometric approach, we use the results obtained from the synergy-trade-off analysis to further investigate the relevance of this approach.

Results based on Empirical Estimation

We formulate a lagged dependent variable-based regression model (refer Equation 1) using a balanced panel data for 36 states/UTs for three years since the baseline report in 2018.

Lag of SDG 5 is significant and positive hinting at feedback effect in regional performance from previous years. Evidence for negative relation between gender and infrastructure is seen as coefficient of SDG 9 emerges significant with a negative sign. Addition of other facets of infrastructure such as water, energy and sustainable cities carry positive association with gender equality. Coefficients of per capita NSDP and its squared term reinforce the feminization-U hypothesis by Kuznets (Baymul & Sen, 2020; Besamusca et al., 2015; Gaddis & Klasen, 2013; Mehrotra & Parida, 2017; Tam, 2011; Tsani et al., 2013). Regional inequalities give rise to U-shape transformation as women in higher per capita states find opportunities to excel by gaining skills and have greater socio-economic representation compared to poorer regions. In a built-up exercise, scores obtained on SDG 5 are regressed across SDG9 and other goals capturing infrastructure, namely SDG 6, 7 & 11 (refer Table 2 columns 1-4].

Table 2 Estimation results with infrastructure and per capita NSDP as determinants

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SDG5_{-1}$	0.626***	0.520***	0.446***	0.357***	0.582***	0.488***	0.484***	0.339***
	(0.110)	(0.118)	(0.128)	(0.122)	(0.133)	(0.138)	(0.136)	(0.139)
SDG9	-0.032	-0.061*	-0.090**	-0.120***	-0.055	-0.069	-0.065	-0.133**
	(0.040)	(0.034)	(0.040)	(0.040)	(0.056)	(0.052)	(0.054)	(0.052)
SDG6		0.392***	0.389***	0.298***		0.362***	0.358***	0.270***
		(0.069)	(0.071)	(0.070)		(0.080)	(0.085)	(0.082)
SDG7			0.162***	0.015			0.172***	-0.016
			(0.046)	(0.049)			(0.063)	(0.061)
SDG11				0.237***				0.297***
				(0.049)				(0.053)
$LnPC\_NSDP_{-1}$					-38.081	-29.725	-50.613**	-45.683
					(30.780)	(23.970)	(22.255)	(38.721)
$(LnPC\_NSDP_{-1})^2$					1.740	1.377	2.176**	2.010
					(1.291)	(0.996)	(0.934)	(1.690)

Source: Authors Computation.
*Robust Standard errors reported in parentheses. Dependent Variable: Score of SDG5. Constant eliminated. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*

Further investigation (refer Table 3 columns 9-12) shows that inclusion of water, energy and sustainable dwellings and waste management facilities create a positive and significant scope for gender improvement. Every increase in score of Composite 6-7-11 creates a scope of changing gender score by around 50 percent in the positive direction. Thus, role of quality infrastructure such as connectivity through roads and transport, access to electricity and cleaner fuel, availability of sanitation and water along with proper waste disposal is holistically indispensable for empowering women folk and alleviating their status in the society.

Table 3 Estimation results with composite index (excluding SDG 9), inflation and tax revenue

	(9)	(10)	(11)	(12)
$SDG5_{-1}$	0.360***	0.371***	0.339***	0.427***
	(0.117)	(0.123)	(0.123)	(0.133)
SDG9	-0.125***	-0.107**	-0.103*	-0.066
	(0.045)	(0.053)	(0.056)	(0.066)
$LnPC\_NSDP_{-1}$		-69.802*	-65.393**	-73.237**
		(36.867)	(33.022)	(31.894)
$(LnPC\_NSDP_{-1})^2$		2.987*	2.814*	3.125**
		(1.618)	(1.450)	(1.405)
Composite 6-7-11	0.399***	0.522***	0.503***	0.497***
	(0.078)	(0.078)	(0.075)	(0.086)
Inflation			0.677	0.573
			(0.736)	(0.805)
$LnTax\_Revenue_{-1}$				-0.492
				(0.627)

Source: Authors Computation.
Robust Standard errors reported in parentheses. Dependent Variable: Score of SDG5. Constant eliminated. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

The variable of interest; namely composite index explains the variability in SDG 5 (Gender) well (refer Table 4 columns 13-16). With a positive and strongly significant relationship (at p value < 1 percent), the wider and more inclusive definition of infrastructure lends higher support for improving gender score. These additions also increase the magnitude of lagged dependent variable in affecting gender score. Whereas taxing the household gross income has greater incidence on labour force participation compared to individual income resulting in withdrawals from labour force and reduce female labour supply (Blundell, 1995; Burtless & Hausman, 1978; Vlasblom & Schippers, 2004), inflation, although insignificant, forces reduction in real in-hand wage and purchasing power which leads to greater active work participation. Inter-state tax competitions and corporate taxes prove more onerous for women than men (Braunstein & Grown, 2011).

Table 4 Estimation results with Composite index (including SDG 9) and control variables

	(13)	(14)	(15)	(16)
$SDG5_{-1}$	0.586***	0.640***	0.610***	0.623***
	(0.097)	(0.114)	(0.112)	(0.121)
$LnPC\_NSDP_{-1}$		-78.007***	-76.444***	-95.103***
		(23.971)	(24.765)	(26.330)
$(LnPC\_NSDP_{-1})^2$		3.289***	3.238***	3.958***
		(1.054)	(1.066)	(1.171)
Inflation			1.330*	0.627
			(0.780)	(0.802)
$LnTax\_Revenue_{-1}$				-1.480**
				(0.617)
Composite Index	0.200***	0.317***	0.321***	0.476***
	(0.057)	(0.068)	(0.077)	(0.090)

Source: Authors Computation.

*Robust Standard errors reported in parentheses. Dependent Variable: Score of SDG5. Constant eliminated. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*

Conclusion

We study the relationship between gender and infrastructure in light of the sustainable development. Targets to achieve gender equality and infrastructure varies regionally showcasing a disharmonious performance. Some states/UTs perform consistently over time to achieve greater scores, whereas others lag consistently behind on both goals. We also find inconsistencies in target selection not only for capturing individual goals but a lack of synergistic approach in achieving sustainability at national level. Paucity of data at disaggregated level was visible as methodology was constantly changed to compute aggregate scores for SDG 5 and SDG 9. We develop a correlation-based synergy-trade-off analysis to answer some potent questions: does infrastructure matter for gender? How well defined is infrastructure and whether synergies across SDGs could be utilised to channelise the efforts in right direction?

Based upon NITI Aayog's reports on SDG in India, a negative relationship is reported empirically between SDG 5 (Gender) and SDG 9 (Infrastructure) which is refuted through literature. The comparison across SDG 5 and SDG 9 also points to the fact that India's attempts of infrastructure improvement has remained de-coupled from empowering the women in the country. Studies not only support the synergistic relationships between gender equality and resilient infrastructure but also elaborate the positive synergies between facets of infrastructure services such as transport, water, sanitation, electricity and waste management.

It is imperative for researchers to realise the implications of interactions across diverse disciplines and provide solutions based upon these synergies. Difficult to understand at a micro or individual level though, it is with the help of the transdisciplinary interactions that could

enable efforts toward achieving the agenda of sustainable development for the society at large. Framework presented here and across other researches citied in the study lay the path for researchers and policy makers to create collaborate initiatives across several disciplines and to harness the interactions in realising the goals through common purposes. Decision to empower is not limited upon an individual self or a group-based approach, but rather relies upon a wider approach including system of networks and flows such as infrastructure of which the former is a part of, as shown in our study. Planning for construction of a road or rail network is not limited to provision of connectivity or to facilitate transportation but lends long term perspective to understand how different lives are affected differently. Sensitivity to such ideas with both vertical and horizontal integration of facets to development require the decision makers to operate outside the compartmentalised approaches to tackle issues of poverty, undernourishment, inequality and empowerment. Abstractions of gender and infrastructure dependence could seem to carry trade-offs which can be thus mitigated through exploration of synergies across goals beyond their explicit definition (Fuso Nerini et al., 2017; Pradhan et al., 2017; Thacker et al., 2019a).

In this direction, an encompassing approach is adopted through developing a composite index. The redefined infrastructure index emerges positively correlated with gender goal displaying significant synergies. The random effects-based estimates show that a unitary change in composite index results in increasing the SDG 5 score significantly by half a unit. These results strengthen the belief in adopting a multi-dimensional approach to sustainable development.

There is also a need to strike a balance between centre-led and state-led interventions in Indian context in order to evaluate the needs of citizens. Improvement of country-level scores requires harmonised performance by states in achieving regional scores on different sub-indices. Functioning as a welfare structure, States and Union Territories need to push for implementing schemes by engaging all stakeholders. Programmes such as *Ujjwala Yojgna, Swachh Bharat Mission, Ayushman Bharat, PM Awas Yojna* are credible steps which corroborate the plurality of across sustainable development goals. Constant evaluation of such programmes must also be undertaken to map the progress of such efforts in right direction and achieving the desired outcomes[21]. We laud the efforts and commitments of NITI Aayog and hope future studies at a greater scale could be undertaken in this direction.

Limitations

The present study suffers from its own share of limitations including the data as NITI Aayog published for only three years. The lack of continuous data renders it difficult to check the persistent level of disparity across the SDGs. Another limitation includes the misalignment of parameters and sub-indicators across the SDGs chosen by NITI

[21] In a reply to parliamentary question on Gender Budgeting and its implementation, the cabinet minister for Women and Child Development reported that although funds by 43 Central ministries/Departments/UTs were allocated for development schemes concerning women and children, no study was put in place to assess the impact of these efforts either at state or national level. With 27 states/UTs adopting Gender Budgeting by the year 2020, 9 states were yet to adopt and data of only 12 states and UTs for separate budgetary allocation for gender purposes was available in public domain.

Aayog vis-à-vis the United Nations to assess SDG 5 such as *cases of Child marriage or unionisation, under-age mutilation, recognition to time spent on unpaid domestic care and work, state-level laws for women rights pertaining to health and education and gender-wise access to communication technology.* The inclusion of these wider dimensions would provide a much clearer approach to addressing gender related issues and would prove vital for drawing comparisons in an international context.

Declaration

The authors declare no conflict of interest.

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