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THE INDIAN SOCIETY OF LABOUR ECONOMICS
C/o Institute for Human Development
256, 2nd Floor, Okhla Industrial Estate, Phase-III, New Delhi-110020, India
Phone: 011-41064679; Mobile: +91-9871177540
Email: mail@isleijle.org; Website: www.isleijle.org

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66th

THE INDIAN SOCIETY OF LABOUR ECONOMICS
ANNUAL CONFERENCE

19-21 January 2026 | Symbiosis School of Economics, Symbiosis International (Deemed) University, Pune, India

Sustainable Technologies for Economic Growth and Skill Development

V.V. GIRI MEMORIAL LECTURE

SACHIN CHATURVEDI
Vice-Chancellor, Nalanda University, Rajgir, Bihar

20 January 2026 | Pune

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The Indian Society of Labour Economics

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PROFESSOR SACHIN CHATURVEDI

Professor Sachin Chaturvedi is currently the Vice Chancellor of Nalanda University. Before joining Nalanda, he was associated with the Research and Information System for Developing Countries (RIS), a New Delhi based think tank, where he worked extensively on issues of development economics, including development finance, SDGs, South–South cooperation and global trade, investment and innovation linkages, with a special focus on the WTO.

A distinguished scholar and institution builder, Professor Chaturvedi has played a pivotal role in launching several major global and national networks such as the Network of Southern Think Tanks (NeST), the Forum for Indian Development Cooperation (FIDC), and the Delhi Process, a key platform for dialogue on South–South and Triangular Cooperation.

He has been closely associated with several initiatives of the Government of India and continues to contribute to shaping evidence-based and integrated economic policymaking. Widely regarded as one of India's foremost voices on external economic engagement and partnerships, Professor Chaturvedi is also admired by peers for his dynamism, mentorship and leadership in the academic and policy community.

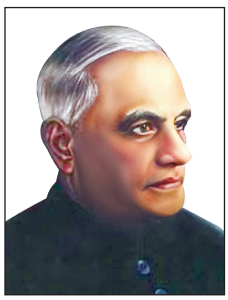
An accomplished author and editor, he has published or edited over 22 books, contributed chapters to numerous edited volumes, and written extensively in reputed journals. His acclaimed book "The Logic of Sharing: Indian Approach to South–South Cooperation" is internationally recognized as a leading work on development cooperation. He also serves on the editorial boards of several journals, including the South Asian Economic Journal and the IDS Bulletin (University of Sussex, UK).

Professor Chaturvedi has held visiting positions at several leading global institutions, including the MacMillan Center for International Affairs at Yale University (as Global Justice Fellow, 2009–10), Jawaharlal Nehru University, the University of Amsterdam, the Institute of Advanced Studies (Shimla), and the German Development Institute. He currently serves as an Independent Director on the Board of the Reserve Bank of India (RBI).

CHAIR: **NAGESH KUMAR**

Nagesh Kumar is the Director of the Institute for Studies in Industrial Development (ISID), New Delhi. He also serves as a member of RBI's Monetary Policy Committee (MPC), and as a non-resident senior fellow of UNU-WIDER and of Boston University- Global Development Policy Center. During 2009-21, he served as Director at UN-ESCAP, Bangkok. During 2002-09, Prof Kumar served as the Director-General of the Research and Information System for Developing Countries (RIS), a think-tank of the Indian Ministry of External Affairs. During 1993-98, he served as an Economist at UNU/MERIT, Maastricht, the Netherlands. Prof Kumar has served on the boards of the EXIM Bank of India, the International Centre for Trade & Sustainable Development (ICTSD), Geneva, and the South Asia Centre for Policy Studies (SACEPS), Kathmandu. A PhD from the Delhi School of Economics, Prof Kumar is the recipient of the Exim Bank's first International Trade Research Award (1990) and a GDN research medal (2000).

ABOUT V.V. GIRI



Late Shri V. V. Giri was an important national movement leader and a former trade union leader of India. Educated at the University of Dublin, he had several positions including, Member of Central Legislative Assembly (1927-30); twice the President of the All India Trade Union Congress (1926 and 1942) (also General Secretary and President of the All India Railwaymen's Federation); Minister of Labour in Madras Ministry in 1937 and 1946; Minister of Labour, Union Cabinet (1952-54); Governor of Uttar Pradesh (1957-60); Kerala (1960-1965) and Mysore State (1965-1967); Vice President of during 1967-69. He later became President of India during 1969-74. He took part in the Quit India Movement also and was imprisoned. He was awarded the Bharat Ratna in 1975. Shri Giri was a prolific writer. His books, 'Industrial Relations' and 'Labour Problems in Indian Industry' were pioneering ones. He also wrote several articles as President of labour and trade union movement in India. In 1957, Shri Giri headed a team of prominent public personalities and academicians to establish the Indian Society of Labour Economics (ISLE). He nurtured and strengthened the Society and was its Life President.

Sustainable Technologies for Economic Growth and Skill Development

Sachin Chaturvedi[1]

The Context

The evolution of growth theory from purely economic to sustainability-oriented paradigm marks a significant shift in how development is conceptualized. Solow's (1974) early intervention established that economic expansion cannot remain viable if it depletes natural capital faster than it regenerates. This recognition laid the groundwork for linking technological innovation to environmental stewardship, redefining productivity in ecological as well as economic terms (Raven 2012).

Sustainable technology aims to efficiently utilize the natural resources for fulfilment of societal needs and economic growth, while minimizing the environmental impacts. It ensures the balance between the economic growth, long terms resource availability and minimum degradation of the environment and society (United Nations, 2015). While the recent internet revolution, digital infrastructure and resources development have significantly improved the production and consumption of goods and services, they have also transformed the global value chains (Chaturvedi 2024; Pandey and Chaturvedi 2019). Their development and diffusion depend on interactions among multiple actors connected through institutional, economic, and knowledge-based linkages (Geels, 2002; RIS 2023, 2024).

Empirical frameworks from the OECD (2011) and the World Bank (2020) provide policy confirmation: nations adopting green growth strategies via renewable energy, circular production, and ICT-led efficiency display stronger resilience and productivity than resource-dependent economies. The UNDP's (2015) work extends this argument by emphasizing human

1 Nalanda University, Rajgir, Bihar

capability and skill formation as the necessary precondition for technological diffusion. Without equitable access to education, inclusion, and skill development, sustainable technologies remain underutilized, widening rather than narrowing development gaps. A study conducted by Arrow et al. (2012) further argued while proposing that the capital of countries reside in renewable and intangible forms of assets that includes innovation, knowledge and ecological veracity. These studies emphasized on the notions that technological sustainability is no longer a peripheral concern but the structural basis of modern economic systems. Finally, the critical voices including Stiglitz, Sen, and Fitoussi (2009) and Raworth (2018) argue that sustainable growth facilitated by technology must be assessed considering the larger domains of human wellbeing and planetary boundaries. They suggest that growth achieves acceptability only when it encourages comprehensive prosperity, mental wellbeing, and environmental balance: the "triple dividend" of sustainable development.

There are multiple studies that have focused on examining the relationship between clean energy, technology innovation, and economic growth. Wang and Li (2022) conducted a study that highlighted enhancing economic growth facilitated by clean energy technology innovation leading to sustainable development. Similarly Cai et al. (2020) revealed that venturing in clean energy may show the positive effects on economic growth, specifically in the long run. Few studies, on the contrary, highlight that the transition to clean energy may have short-term costs that could potentially offset long-term benefits. A study by Green and Stern (2017) contended that the shift to clean energy may primarily entail substantial investments that could have negative effects on economic growth.

In terms of the researches that go beyond analysing investment in infrastructure, capital formation and related factors support economic growth, a study conducted by Mohanty and Bhanumurthy (2019) highlighted some interesting facts; the authors utilised the annual time series economic data and employed ARDL techniques and the results highlighted that the Physical Infrastructure Index advances GDP by approximate of 5 - 7.5% per unit increase as compared to 3.9% for financial development suggesting increased growth elasticity of infrastructure. A study conducted by Singh et al. (2023), employed nonlinear ARDL model on the Indian data from 1976-2020. The results highlighted that technological development has displayed positive and

significant effect on growth. The results further showed that India is yet to reach the threshold where deepening of the financial sector supports GDP expansion; however, the acceptance and adopting of technology and trade openness act as robust drivers of growth. This reinforces the idea that real-economy capabilities tied to technological advancement are more growth-enhancing than finance alone in the Indian context.

Further, in this debate, the International Energy Agency report (2024) highlighted some interesting facts: the GDP in the United States grew by a robust 2.5% in 2023 and clean energy was an important contributor, considering the manufacturing of clean energy technologies as one of the important categories. Similarly, one fifth of China's 5.2% GDP growth in 2023 was reported to be associated to clean energy and the largest increase coming from investment in clean power capacity, followed by clean equipment sales, particularly EVs. Expansion in clean energy manufacturing accounted for around 5% of China's GDP growth in 2023. In European Union one-third of GDP growth in 2023 was accounted to be from clean energy. India was reported to be the fastest growing large economy in 2023, with GDP increasing by around 7.7%. and clean energy contributed slightly less than 5% of GDP growth in 2023, predominantly from investment in new solar power capacity. Considering the foregoing discussions, a clear trajectory is evolving that growth no longer remains a measure of accumulation but of adaptation and sustainable technologies remain the facilitators of this adaptive economy, whereas skills and environmental judiciousness serve as its navigating apparatuses.

Economic growth in the contemporary era is increasingly dependent on sustainable technologies that enhance productivity while preserving environmental balance (Mezentseva et al. 2024). However, the effective deployment of such technologies fundamentally depends on the availability and quality of human skills, which serve as the foundation for technological adaptation, innovation, and diffusion. These skills, in turn, are closely linked to the level of human development, often measured through the Human Development Index (HDI). Yet, in many contexts, the development of skills remains constrained due to barriers of accessibility, equity, and inclusion, resulting in uneven participation in technological and economic progress (Chaturvedi et al. 2015). The lack of equitable access to quality education, training infrastructure, and digital resources

widens the skill gap, thereby limiting the capacity of societies to fully harness the potential of sustainable technologies for inclusive and resilient growth (Chaturvedi 2024a).

Skills and Sustainable Technology

Skills form the bridge between human potential and technological adoption. Yet, the availability and quality of these skills are shaped by accessibility, inclusivity, and educational equity factors deeply tied to human development outcomes. Pavlova (2012) argues that green and digital skills are central to achieving sustainable development goals (Aparicio-Gómez et al. 2024), and despite several efforts by the national and international organizations, the key constraints in the skill development are Accessibility, Equity, Inclusivity, Quality and Relevance (Chaturvedi 2024).

Bhaduri et al. (2025) stressed that the innovation needs to move beyond the centrality of growth and northern dominated models require inclusivity, context specific approaches and sustainability. The authors put an emphasis on frugal and community-based innovations and highlighted its potential in balancing environmental, social and economic goals. The authors further advocate for having a contemplative governance and triangular cooperation in order to strengthen the local capacities and embed sustainability as the ethical and operational foundation of innovation policy linking technological progress directly to human development and wellbeing.

The wider dimensions of technology and its deeper socioeconomic impact are becoming more complicated as new technologies are revolutionizing the inter-balancing of factors of production, particularly, labour and capital, leading to widening income inequalities across globe (Chaturvedi 2024; Chaturvedi and Srinivas 2015). The disruptive and negative change in the nature of work has been reported in last few decades primarily due to technological interventions (Autor 2009). According to the World Economic Forum's (WEF) Future of Jobs report, 2023, in the next five years, 23 per cent of the jobs are expected to change globally. This change is likely to consist of growth in 10.2 per cent of the jobs and decline in 12.3 per cent of the jobs. Employers anticipate 69 million new jobs to be created and 83 million eliminated - a net decrease of 14 million jobs, or 2 per cent of current employment. Along with the decline in the job market, the technological

advancement has also led a growing demand of tech-savvy processionals and exacerbated the need for adaptation and skill development of the human resources to be employable in the changed scenario. All these aspects are reflecting a greater challenge and revisited attention to the fundamental queries that include: how utilization of technologies and strategies for skill development are adapted for inclusive economic growth and wellbeing. According to the World Bank, to succeed in the 21st century labor market, one needs a comprehensive skill sets which include:

– Foundational and higher order skills
– Socio-emotional skills
– Specialized skills
– Digital skills

The order of skills changes with change in time and at professional level more specialized skills are required. In recent past due to the rapid improvement in IT, the digital skills are essential and required at every stage.

Human Development Index: New Context and New Realities

The Human Development Index, though groundbreaking in its multidimensional approach, remains quantitatively reductive. Scholars have criticised the HDI for overlooking the mental and emotional health as indicators of human flourishing (Baysal and Sutton 2024; Alkire 2002); social inclusion and equity, which determine the accessibility of education and employment opportunities (Anand and Sen 1994); life satisfaction and subjective wellbeing, essential markers of real human progress (Diener et al., 2018).

In 1990 the United Nations Development Programme produced Human Development Index (HDI) and since then it has been in the existence (Anand and Sen, 1995). The UNDP in its annual Human Development Reports (HDRs) provides rankings across the countries based on the HDI for comprehensive comparisons of their performance in the rankings with what they see as their peers. The Human Development Report in 1991 prompted a diverse literature on multiple alternatives of wellbeing and various methodological criteria guided by analytical rigour and index constructions that subsequently led to both praise and critique (Hirai, 2017). In 1990s major

three features on the new index was singled out by Mahbub ul Haq, the first coordinator of the report. HDI would measure indicators of wellbeing other than income; covering both social and economic dimensions jointly through a designed composite measure and flexibility in the coverage and methodology of HDI (estimations). This led to development of literature that explored the substitute measurements and specifications of a measure of multi-dimensional wellbeing (Burchi et al. 2016).

A study by Sagar and Najam (1998) critically reviews the HDI and highlighted that HD vision and HDI in tandem failed to capture the spirit of the world it pursued to describe. Additionally, the authors argue that HDI focuses almost exclusively on national rankings and performance, and limited or no attention has been paid towards development from a global perspective. Halisçelik and Soytas (2018) highlighted that HDI had constraints in covering the poorest part of the society hence Gender Development Index, followed by Multidimensional Poverty Index and Gender Inequality Index were developed to supplement the HDI for larger dimensionality covering gender disparity, living standards, life expectancy among others.

A strand of literature post millennium development goals implementation started pouring in highlighting the limitations of HDI. A study conducted by Ranis et al. (2006) argues that while HDI is exhaustive but certain limitations concerning vital dimensions of human wellbeing require adjustments. The authors tested 11 categories and 39 indicators of human wellbeing and suggested that a broader set of indicators is required to evaluate the multi-dimensional wellbeing including health, political freedom, community wellbeing among others. Similarly, Ranis and Stewart (2012) argued that human development has witnessed success and failures during 1970 to 2007. The authors highlighted performance concerning a range of dimensions of Human Development that included societal stability, gender empowerment, and environmental sustainability and the results show that all the indicators have revealed a weak association with performance on the Human Development Index (HDI). An important study by Prabhu (2003) attempted recollection of historical genesis of the HD concept with an endeavour of enunciating sustainability and equity discourses. The study further stressed upon the issues ascending from the application of the HD approach in global frameworks including Millennium Development Goals and Sustainable Development Goals.

Further during the phase of sustainable development goals implementations, the HDI measurements and dimensions witnessed a change: Chabban et al. (2016) went beyond the conventional human development dimensions; the authors introduced the composite global wellbeing index using the subjective and objective wellbeing data over ten dimensions. The results highlighted strong correlation with HDI with less dependency on income and better reflecting social, human and environmental aspects of progress, thus making a comprehensive and holistic measure of wellbeing.

Anand (2016) further progressed with introducing holistic approach of moving beyond the HDI; the author argues that broader human development will be captured by integrating subjective measures of wellbeing. The traditional HDI dimensions including income, education and health in tandem with happiness, sense of purpose and life satisfaction will provide comprehensive and holistic understanding of human development and overall progress. The author further argues that subjective data/dimensions aid in providing critical insights for policy efficiency, service quality and other multiple social dimensions.

Lior et al. (2017) introduced a multilayered novel approach for the first time to analyse sustainable development, by adopting GDP, beyond GDP and SDG approach. Composite indicators method was adopted for analysis on group of 20 indicators. The study concluded that the indicators with the maximum impact on the level of SD included public debt, FDI energy imports, total natural resources rents, and the Corruption Index. The study emphasised that the ranking order derived from the SDG-based approach can be utilised to determine the prioritisation of developmental efforts and financing that countries should allocate and receive to achieve the SDGs. The study also highlighted that measurements beyond GDP provide a substantial assessment of growth and development, aligning with SDGs for inclusive devolvement.

Measuring Human Development progress through Wellbeing

Measuring human development through wellbeing moves beyond economic and social indicators to capture how people actually live, feel, and flourish. It reflects a shift from assessing progress by output to evaluating the quality and sustainability of human life. The evaluations of wellbeing beyond GDP have been analysed by Barrington-Leigh and Escande (2018); the authors analysed

comprehensive set of 80 human development indicators since 1970 onward and highlighted four approaches including subjective wellbeing metrics, composite indices, dashboards and monetary measures. The authors utilised SWL regression method to derive weights for aggregation of 11 domains for the 34 OECD member countries. Further, ordinary least squares was used to estimate the value of one domain, life satisfaction, using the equation 1:

$$SWL_i = a + bX_i + \varepsilon_i \quad (1)$$

where X_i=vector of the values of other dominants for country i, a is constant, and ε_i is the country modelling error.

The results emphasized that progress measurement must clearly distinguish human wellbeing from sustainability goals, using transparent, empirically based indicators to guide policy and ensure that development truly reflects quality of life, not just economic growth.

A study conducted by Sajith and Malathi (2020) includes an important aspect of methodological and analytical rigour; GDP per capita and HDI has been evaluated for Indian states employing panel data from 1990-2016. Recalculations of HDI has been carried out by removing the income component to avoid the bias. The equations 2 and 3 developed by the authors were utilised for the calculations; the authors created the composite matrix multiplying three dimensions (inequality adjusted life expectancy, inequality adjusted education index and inequality adjusted GDP per capita index) and taking nth root of the product and calculation ensured equal weights for all the three dimensions. The authors observed deficiency in previously used statistical analysis i.e., the HDI composite index is regressed with the GDP or GDP per capita index; the authors noted that in such causality study, both (regressor and regressed) have income factor and felt that it will give an incorrect approximation. To remove this ambiguity re-computation of UNDP's HDI index was carried out by removing the income component from the original HDI matrix; followed by multiplication of the inequality adjusted life expectancy and inequality adjusted education index. The nth root of the product was taken and the computation gave equal weightage to life expectancy and education proportions in the composite matrix.

$$HDI = \sqrt[3]{LEI * EI * II} \quad (2)$$

$$HDI = \sqrt[2]{LEI * EI} \quad (3)$$

Further, the authors used fixed effect regression models augmented by Ducker-Fuller test were used. HDI computation was performed using UNDP formula in combination (life expectancy, education, and income indices). The results highlighted that income strongly correlates with HDI, though the HDI lacks qualitative wellbeing dimensions like happiness and sustainability. The study concluded that from India's perspective, growth in income itself will take care of the HDI evolution; it does not require a separate tracking or the policy re-orientation based on the HDI. The authors finally argue regarding the strong correlation between the HDI and Happiness Index of 132 countries, whereas the data of Indian HDI and Happiness Index is moving in opposite directions, highlighting that HDI cannot be used as a common matrix across countries for cross-country comparison to measure human welfare (Sajith and Malathi, 2020).

Although HDI has proved to be an influential model of calculating the economic growth, it also witnessed modifications, addition of dimensions and criticism as well. Researchers from Flinders University in 2018 came up with a novel statistical measurement models connecting wellbeing with Human Development in low-income nations including India (Assam state) and Timor-Leste (Saikia et al. 2018). The youth component was added to HDI and creation of Human wellbeing Index as a complementary dimension to HDI. The study further advanced in integrating objectives of HDI with subjective wellbeing making a move towards comprehensive, holistic and inclusive procedures of human progress reflecting the actual development beyond economic outcomes. A study by Suryanarayana et al. (2016) adopted the novel HDR 2010 methodology for computing HDI and IHDI in India. Multiple data points from NSS were tested using a rigorous statistical tool with reference to goalposts mentioned in the HDR 2010. The results highlighted inequalities in education and health sector. The study provided a framework to promote HD by addressing disparities across dimensions and emphasized that policies encouraging economic growth require integration with the distributional dimensions of health and education. Additionally, a study by Volkovitckaia et al. (2020) argues that HDI has a limited dimensionality and scope in terms of capturing creative and social parameters of life quality. The authors further stressed upon inclusion of innovation, trust and creativity as the indicators of wellbeing implying that nations intellectual and social strength lies in patens and startup growth. Additionally, the study concludes

that integration of social trust, labour sustainability and human potential reflects the significant progress a nation needs.

Further the literature has moved beyond traditional HDI measures to propose novel indicators and statistical innovations that more accurately reflect the multidimensionality of human development and wellbeing. Chaaban et al., (2016) developed Composite Global Wellbeing Index where integration of psychological, social, economic and environmental dimensions has been developed. The authors utilised multiple methods to normalise, weight, aggregate the data points in a scale of 0-1. The equation 4 was used for indicators normalization and equation 5 was used when the measures of indicators were having as negative component of wellbeing i.e., unemployment or homicide rates and equation 6 was used when Indicators within dimensions and dimensions were aggregated by using the following formula:

$$z_i = \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad (4)$$

= variable to be converted for country i, = minimum value for the variable across all countries, = maximum values for the variable across all countries, = normalised variable

$$z_i = 1 - \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad (5)$$

Each wellbeing dimension is measured using one to five indicators. Within each dimension, indicators are averaged using equal weights. Dimensions are then aggregated by calculating the arithmetic mean of the dimension values using equal weighting as well. Indicators within dimensions were aggregated by using the following

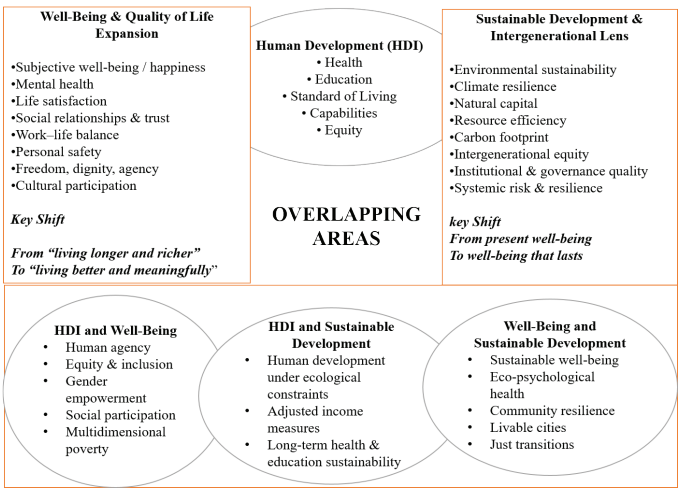
$$A = \frac{1}{n} * \sum_{i=1}^{n} \quad vi \quad (6)$$

where, A= average, n= the number of the terms, vi= the values of each individual item in the list of the numbers being averaged.

The results highlighted that CGWBI depicted high correlation with the Human Development Index (HDI); nevertheless, CGWBI is less sensitive to income effects than the HDI. The authors stressed that CGWBI provides an improvement over the HDI, by considering added wellbeing proportions and minimizing the impact of per capita income on overall human development rankings. This indicates that there is a need for a fundamental shift from the conventional thought process of viewing development as a basic purpose (health, education and income) towards multidimensional comprehension that incorporates multiplicity of dimensions in terms of individual,

environmental, and intergenerational human progress (Figure 1).

Figure 1
Interconnection between HD, WB and Sustainability



Towards Comprehensive Wellbeing

In the debate of wellbeing beyond the conventional literature components on HDI, a contemporary contemplation has evolved; Chaturvedi (2025 a, b) has added a unique dimension in human development i.e., Life Style for Environment (*LiFE*), a pioneering pathway that recognizes the fundamental role of communities and individuals in pursuing human development and encouraging behavioural changes important for nature's conservation and restoration. Chaturvedi et al. (2025) argued that Wellbeing and HD are intertwined and multidimensional that moves beyond the GDP based growth; environmental sustainability, ethics, social inclusivity, equity and quality of life should be in tandem with individual and collective lifestyles playing a decisive role in shaping present and intergenerational outcomes. The authors call for development model that has wellbeing embedded with it and take progress forward through responsible behaviour, sustainable consumption with measurement frameworks that align to long term planetary wellbeing. A study by Prabhu and Iyer (2024) proposed sustainability and equity as an alternative approach, aligning with the LiFE. Further Ferreira and Nunes Junior, (2024) proposed the construction of a simplified HDI to measuring non-urban Indigenous communities progress, taking characteristics and contribution of community into consideration for carbon capture. The

authors argue that global forums like G20 should guide global economic policies that are inclusive and sustainable thus helping in resolving the climate crisis and encouraging social impartiality.

The Indian perspectives on human development go beyond the conventional dimensions and try capturing the spirituality traditions of human wellbeing. Salagame (2017) argues the universal wellbeing is reflected by widely recited prayers (*sarve bhavantu sukhinah*) cutting across religions. Further, the authors highlighted that interconnectedness of Vedic, Buddhist and Jain traditions shape the worldview of flourishing and happiness as collective, *dharmic* and spiritual. Ekman et al. (2005) move beyond the existing Positive Psychology models; the studies have argued that wellbeing leads to positivity (Seligman, 2015) and adversity and pain as integral to prosperity (Wong et al. 2021). The authors emphasised on integration of Indian spirituality in the prevailing positive psychology models.

Across the literature, human development is clearly shown to be much broader than income or GDP. Starting with Anand and Sen, development is defined as expanding people's real freedoms and capabilities, not just economic growth. This conceptual shortfall illustrates a paradox: human development drives skill formation, but HDI cannot fully explain why skill disparities persist. Therefore, HDI must evolve toward a capabilities-based, wellbeing-centered approach, as advocated by Sen (1999) and Nussbaum (2000).

Considering the existing strand of literature on HDI and wellbeing, a clear gap emerges in terms of the inclusion of technology and the limited coverage of sustainability within the HDI framework. This gap highlights the need for further examination and conceptual development of studies that incorporate broader dimensions of technology, skills, and sustainability in order to develop more robust and holistic HDI and wellbeing measures.

In context of above an integrated model (figure 2) is proposed, the model reflects a holistic framework for understanding of sustainable human centric growth. The model accentuates that the traditional approaches of development had focused majorly on productivity and income and has remained limited in capturing the complex convergence between skills, technology and wellbeing. While sustainable economic growth today is largely driven by sustainable technologies, these technologies are effective only when supported by a skilled and adaptable workforce. The creation, diffusion, and utilization of such skills depend on the level of human development, which the conventional HDI captures only in part and misses in capturing the qualitative dimensions that include inclusion, equity, relevance, accessibility

and larger aspect of wellbeing that shape real human potential.

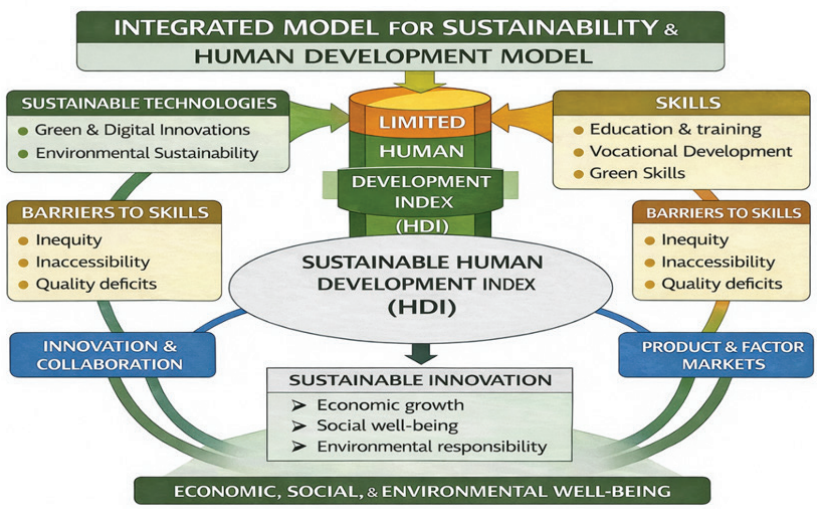
The model also highlights the central role of product and factor markets in sustaining this relationship. Product markets determine how innovation translates into viable goods and services, while factor markets comprising labor, capital, and knowledge create the conditions for skill deployment and technological advancement. When these markets function inclusively, they strengthen the link between human development and innovation.

Equally important are collaboration, partnerships, and communication, which enable the flow of knowledge, resources, and innovation across institutions, industries, and communities. These collaborative mechanisms help overcome the barriers to skill development such as inequity, exclusion, and quality deficits by promoting coordinated policy actions and shared responsibility among stakeholders.

At its core, the model integrates these economic, social, and institutional dimensions into a unified process of sustainable performance, where economic viability, social impact, and environmental responsibility reinforce each other. It places comprehensive wellbeing including mental, social, and environmental wellness as the ultimate indicator of true human progress. In doing so, it reframes development as a continuous cycle in which human development fuels skills and innovation, innovation enhances market performance, and inclusive markets, in turn, sustain human wellbeing and long-term resilience.

Figure 2

Depiction of an integrated model for understanding of sustainable growth



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