ESG Report 2024

Responsible Investing at 3one4 Capital

3ONE4 CAPITAL

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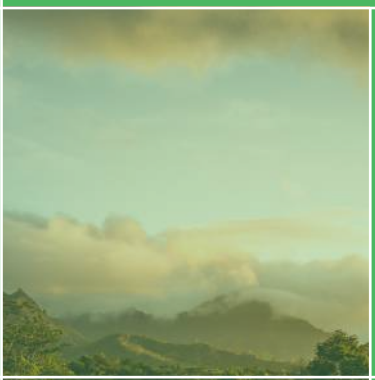

3ONE4 CAPITAL

Foreword

India is poised to be only the third economy after the US and China to transcend the $10 trillion GDP ceiling. Here, at 3one4 Capital, we recognise the nation's potential to deliver on this vision in the coming decade. With favourable tailwinds in demographics, domestic consumption patterns, and its capacity for rapid technology adoption to drive step-function growth, India's heterogeneity and diversity could also inspire a new perspective on emerging markets globally.

The world's fifth-largest economy today finds itself perched at multiple intersecting inflection points. With the rise of the middle class, increasing urbanisation, and deepening smartphone and internet penetration, India is fundamentally re-engineering how it produces, consumes, and engages with the world. With its prompt adoption of global consensus frameworks like SDGs and ESG, India can lead the way in establishing a new paradigm of technological development in line with these forward-looking principles.

As one of India's leading homegrown venture capital firms, 3one4 Capital actively partners with early-stage companies in the country that are mission-oriented and have the potential to set new standards for inclusive value creation and sustainable growth. Through a pragmatic deep-involvement model grounded in consumer behavioural patterns, actionable insights extracted from power-user networks, and by tapping inorganic growth vectors for opportunity capture, we work to unshackle founders from constraints on the path to market leadership. Participating in such a radical rate of transformation requires us to anchor our firm upon indelible principled foundational values which can consistently direct our efforts and practices.

At 3one4 Capital, we act proactively, support early standard-setting, and invest in durable technological assets that will solve for the needs of the future. The firm is the first approved venture capital signatory from India to the UN-supported Principles for Responsible Investment (UN PRI). Additionally, founding partner, Siddarth Pai, is the Indian venture capital industry's first ESG Officer and the youngest professional to hold this position. This lends momentum to our philosophy of building long-term oriented positions in disruptive, category-creating, home-grown startups that will define the new era of India's growth story in ways that are sustainable, inclusive, and resonant with India's unique opportunities and contexts.

ESG considerations are pivotal for us throughout our investment process—from deal sourcing and selection to carrying out due diligence, aligning strategy and growth, and positioning our companies for long-term impact and value creation. ESG is additionally an essential component of our capital development and portfolio monitoring processes for follow-on investments, helping us identify potential risks as well as capturing upside opportunities. These considerations are, therefore, core to our way of working and delivering top-tier performance consistently.

This **ESG Report 2024: Responsible Investing at 3one4 Capital** documents our commitment to implementing ESG principles across the firm's functions, focus areas, and portfolio span. We have found that alignment with ESG parameters from the early stage ensures that we incentivise the promotion of technology that is durable, inclusive, and seminally consequential for scores of Indians.

At 3one4 Capital, we are determined to play our part in helping India establish a nation-first imperative for technological development and socio-economic growth that is sustainable and inclusive. Our obligation includes keeping the long-term interests of our stakeholders in mind through our investing strategy and post-investment monitoring frameworks. The stakeholders involved are not only our limited partners and investee companies but the ecosystem as a whole. For us, ESG is a true force multiplier as we build towards our end objectives.

Early-stage venture capital is predicated on creating outsized outcomes; at 3one4 Capital, we believe we must extend this principle beyond economic results to true value creation and greater societal benefit. At scale, early stage activity can be a catalyst for change via meritocratic and transparent environments where collective action breeds excellence. It is critical for us to reflect the change we want to see and set an example for what is possible when action is intentionally aligned with transformative capital.

Team 3one4 Capital

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INTRODUCTION

The past few years have witnessed a decisive shift in the global investment narrative and investor sentiment towards responsible investing, with a focus on sustainable production; just labour and employee relations and practices; and robust, accountable, and transparent reporting and corporate governance standards. Investors—institutional or otherwise—have gradually come to embrace their newly actualised role as responsible stewards of capital while appreciating the myriad opportunities and risks their conduct and investments carry for the social, economic, and environmental well-being of the larger ecosystems and communities they operate in. Stakeholder capitalism, coupled with intentional and purposeful innovation, has become a deeply entrenched mainstay of the global investment landscape.

Understandably, this shift has marked a transition from an era characterised by low interest rates and an inclination to "move fast and break things" to one dominated by repeated calls for incorporating the real environmental and social (E&S) costs of a product created or service rendered. The disposability and fungibility of products and services created in this earlier era led to a devaluation of the E&S costs of such consumption patterns, with flawed and profligate models successfully attracting capital due to their short-term profit generation potential, often at the cost of widespread unaccountability over their long-term E&S impact.

Environmental, Social, and Governance (ESG) has emerged as a marquee theme in this discussion on the changing responsible investing paradigm, inviting curious forays and praiseworthy commitments in equal measure, with a dash, of course, of criticism and derision from some quarters. At an overall, all-encompassing level, investors, including those at the early-stage, no longer see ESG parameters as just a compliance-driven box-checking exercise, treating them instead as a genuine framework for long-term value creation. Moreover, with businesses facing an increasingly uncertain and complex assortment of challenges across their value chains over multiple timescales, ESG can help them optimise their management of risks—mitigating financial loss and reputational damage.

Regulators and policymakers around the world are tightening the leash on businesses' claims and commitments towards sustainability with new rules and reporting requirements to counter integrity deficits in corporate governance, as well as worrying trends towards misrepresentation of sustainability gains in the form of greenwashing. Businesses which have managed to successfully embed ESG elements in their strategy will thus find it easier to conform to the changing regulatory landscape and enjoy a competitive advantage by leveraging lower compliance costs. In essence, ESG compels us to revisit questions of accountability, recognise investor obligations to the larger ecosystem, underscore the centrality of stakeholder wellbeing, reframe access to innovation as a legitimate right of the populace, and redefine corporate purpose as an enabler for the collective pursuit of a sustainable future for all.

ESG IN THE EARLY STAGE

These aspects become more pertinent at the early stage. Early-stage investing is crucial in laying down a strong framework of sound practices that will eventually define the DNA of a company. Once the DNA of an enterprise has been defined in the early stage, it becomes intractable to engineer any significant change without the organisation undergoing widespread dislocation. This leads to a natural imperative that ESG alignment be instilled, configured, and reiterated during the nascent years of a venture to ensure the consistent creation of responsible companies that will flow into the public markets in the years to come. During an interaction with young start-up founders in January 2022, the Indian Prime Minister, Mr. Narendra Modi, predicted start-ups to emerge as the veritable "backbone of new India"[1]. It is vital that India's new economic backbone is founded on lasting values with an emphasis on integrity, transparency, and a commitment to improve social and environmental outcomes at population scale.

The industry currently suffers from the lack of a cohesive ESG framework for early-stage investing, especially in technology companies. The existing ESG frameworks are best suited for larger corporations or conglomerates, mostly written from the perspective of enterprise transformation, corporate change management, or adoption by established entities, lacking in actionable insights for nascent ventures. This leads to early-stage ventures either experiencing a paralysing knowledge gap or misaligning with—and oftentimes inappropriately emulating—metrics, standards, frameworks, and playbooks intended for larger corporations. At present, this greenfield area is yet to be populated in a manner that lends itself to the trials of new asset creation while balancing the responsibilities of growing into credible ESG fiduciaries.

In addition to this knowledge gap, early-stage companies also face complexities in measuring their direct and indirect E&S impact; in navigating existing reporting requirements and delegating the associated tasks in a small organisation with stretched employee bandwidths; in setting up and managing governance boards and entrenching an appropriate workplace culture with dedicated policy recourse for infractions; and in holistically leveraging ESG credentials to command a premium on their valuations.

Of late, the discursive contours of ESG have come under stress with a spate of fierce diatribes questioning the utility, significance, and underlying premises of the concept as a whole. Valuation expert Aswath Damodaran called ESG a "goodness gravy train" which is enriching consultants, measurement services, and fund managers without generating any tangible positive impact. Damodaran has also been sceptical of the notion that ESG portfolios can consistently outperform non-ESG portfolios since "a constrained optimum can, at best, match an unconstrained one, and most of the time, the constraint will create a cost."

Unfortunately, existing ESG definitions and rankings have failed to bring about consensus on how exactly progress should be measured. Rankings can sometimes come across as arbitrary, especially when they tend to go against commonly accepted views around which companies are creating real-world impact and which are not. There was obvious consternation, for instance, when Tesla was removed from the S&P 500 ESG Index despite pioneering category creation for desirable electric vehicles. The company's 2021 Impact Report highlighted some of these lacunae by arguing that, "current ESG evaluation methodologies are fundamentally flawed. To achieve acutely-needed change, ESG needs to evolve to measure real- world Impact."[2]

Echoing the same train of thought, The Economist, in a recent article, stressed on the need to bolster measurement and address inconsistencies and systemic vulnerabilities to compliance manipulation. Moreover, it argued that on account of ESG lumping together "a dizzying array of objectives, it provides no coherent guide for investors and firms to make the trade-offs that are inevitable in any society."[3] It further states that this is exacerbated by the absence of straight talk on incentives which are often premised on tenuous links between virtue and improved financial performance for companies. The Economist's answer to these woes is to unbundle ESG and focus singularly on emissions.

The Economist's solution, much like those of several others, highlights the nascency of ESG discourse, the prevailing confusion and mistrust, and the inability of existing frameworks to create a convergence in interests and orchestrate institutional buy-in from diverse stakeholders. Notwithstanding the merits of the claims made in the previous paragraphs, ESG, as iterated earlier, is here to stay with support from some of the most celebrated asset

managers in the world. The nitty gritties could be quibbled over, nomenclatures and conceptual boundaries may still need to be redefined, but the grave, global "polycrisis" facing the world's companies—most notably in light of worsening effects of anthropogenic climate change but also the severe dislocation caused by geopolitical tensions, the failure by regulators in certain geographies to protect citizens' money and identities, the capitulation of exciting startups when subjected to rigorous financial or legal scrutiny, and the recurring infringements on employees' social and psychological safety without due institutional recourse—has necessitated a shift towards responsible investing and patient capital. For capital providers, this implies a shoring up of portfolio resilience by jointly managing ESG obligations and investment risk while simultaneously avoiding consensus traps and taking contrarian bets on companies which can generate potentially outsized social and environmental impact.

To this end, the urgency to actualise the necessary shifts cannot be overstated. The time left to act diminishes with each passing day, while early-stage innovation has yet to play the role it needs to in order for humanity to stave off the worst consequences of climate degradation. In the words of the former IPCC Chair Hoesung Lee, *"We are at a crossroads. The decisions we make now can secure a liveable future."*[4] The role that capital plays in this equation cannot be underestimated, as it will take significant and dedicated capital infusions to develop and then democratise solutions which can tangibly move the needle on climate change mitigation or adaptation. Capital must also prioritise the inclusion of all segments of society into the transformation underway. In addition to capital, mindsets need to be aligned to understand the scale of the issue and commit to action across the entire business lifecycle, not just on established companies.

One interesting approach to work on the above mentioned objectives is to adapt the popular "Doughnut Framework" developed by economist Kate Raworth for capital providers in India (see figure 1).[5] The Doughnut consists of multiple concentric rings. The inner circle denotes foundational social and governance frameworks that constitute minimum societal thresholds to ensure that all citizens have equal access to opportunities and civic institutional support to pursue their best lives. The outer ring makes for an ecological ceiling, characterising limits to national, corporate, or individual actions which can cumulatively impact the planet's carrying capacity for life-supporting systems in an adverse manner. Between these two rings lies a doughnut-shaped space that offers avenues for collective prosperity without compromising on prospects of a sustainable future for all.

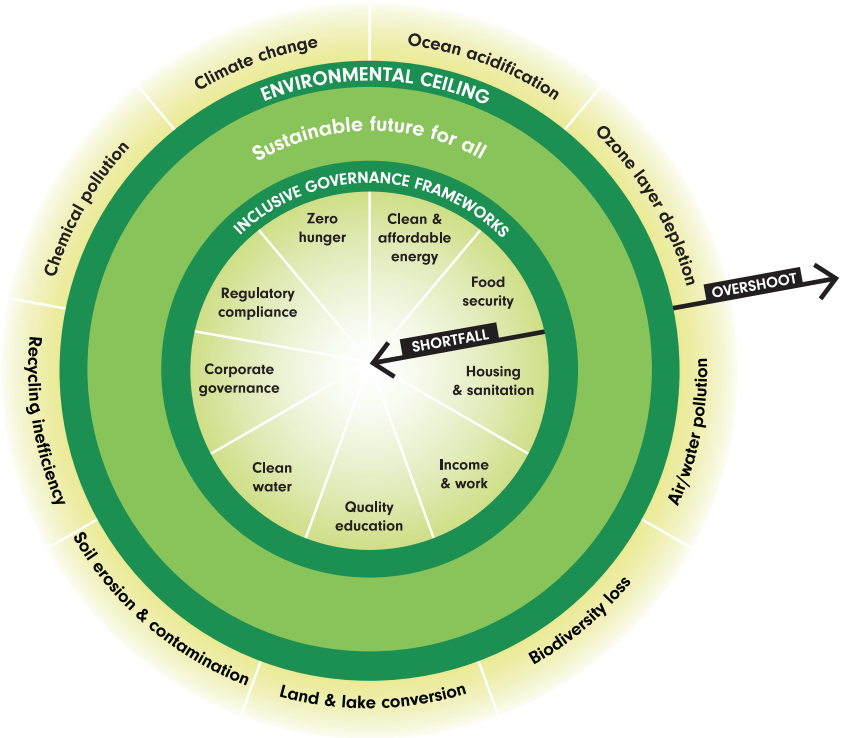


Fig 1: The doughnut for Indian capital providers. Source: Kate Raworth, 3one4 Capital analysis

3one4 Capital is committed to furthering recognition, innovation, and impact for early-stage companies working to expand the size of the intervening space between the boundaries guarding against civic shortfall and ecological excess.

3ONE4 CAPITAL'S THEORY OF CHANGE

At 3one4 Capital, we partner with early-stage companies that are mission-oriented and have the potential to set new standards for inclusive value creation and sustainable growth. Through a pragmatic deep-involvement model grounded in consumer behavioural patterns, actionable insights extracted from power-user networks, and by tapping inorganic growth vectors for opportunity capture, we work to unshackle founders from constraints on the path to market leadership. Participating in such a radical rate of transformation requires us to anchor our firm upon indelible principled foundational values which can consistently direct our efforts and practices. Our Theory Of Change (TOC) is built directly upon the core values and organisational objectives of the Firm.

Transformative Capital that partners with market leaders to drive inclusive value creation, deliver sustainable growth, and set new standards across sectors.

Pre-empting mainstream assumptions on market dynamics builds winners differently

- Proprietary research to map changing contours of markets in India
- Supporting companies that are building narrative disruptions and disproving conventional wisdom on structural assumptions

Radically efficient GTM strategies helps young companies win Market leadership

- Strike strategic partnerships with the mainstream economic fabric to augment existing business practices
- Design and execute upon glide paths with reduced friction, focused alignment, and clear positive-sum dynamics

Foundation-setting to build institutional-grade companies from day 1

- Governance and Business Integrity as the foundation for exponential organisations
- Zero-tolerance approach to regulatory deviations, compliance lapses, and policy exceptions

Intentionally inclusive value creation leads to resilient moats

- Building differentiated products and services for customers efficiently, independent of capital raised
- Courage to defend pro-consumer strategies and build category-transforming economics for the full spectrum of stakeholders

As we deploy these principles into active investment and portfolio management strategies, we are better equipped to support founding teams in delivering grounds-up transformation while aligning on shared purpose and clearer vision statements right from inception.

INCLUSIVE BY DESIGN - 3ONE4 CAPITAL'S ORGANISATIONAL PRINCIPLES

Delivering transformative capital requires a diverse team of investment professionals, technologists, operators, and other specialists who are united by this common purpose and live the firm's values.

To attract and grow independent thinkers who will consistently execute on this commitment, we have intentionally designed the organisation on fundamental principles of:

- **Deliberate Specialization**
- **Goal-driven Cooperation**
- **Biased Towards Action**

In addition to building the capacity to support operating excellence and cultivating a resonant network of specialists, the firm is also committed to setting new standards for the asset class. By participating in ecosystem development, regulatory alignment, and consistently elevating transparency in reporting and disclosures, we are improving the firm's innate resilience every day.

We also recognize that we must lead by example and our organizational design must represent what we truly believe in.

At 3one4, we are directed by a zero-compromise approach towards building an institution while being fully committed to our values. As young professionals ourselves, we are grounded in the reality of the intense competition in the startup ecosystem and the nature of the venture capital industry when it comes to diversity and inclusion across all levels of an organization. It is almost a truism that venture still needs to improve its action taken in including diverse viewpoints and people into all aspects of decision making, globally.

We are deeply impressed by how the founding teams of our portfolio companies have pulled their organisations together to deliver growth despite a challenging environment. We are committed to doubling down on our efforts to support their accelerated shift to new orbits and nurture new value drivers as they grow towards market leadership. With this commitment in mind, we have intentionally designed our organisation on fundamental principles of deliberate specialisation, goal-driven cooperation, and an unyielding bias towards action. A vital aspect of this design is to demonstrate the change that we clearly see emerging across the Indian startup ecosystem–a reflection of the natural diversity in the country's rich demographic tapestry.

Instead of a repeated statement of our principles in every annual report, we decided to remove all biases in our interview and appraisal processes and focus strictly on merit and competence. Our view is that if we are objectively focused on recruiting the very best candidates for the roles in our teams, we will not struggle to achieve a representation of the natural diversity of people and voices in young India today. We are truly biased towards action, and this had to reflect in our own organizational design as well.

We are pleased to report that this model has measurably delivered for 3one4 Capital. As a result, our organization has achieved:

A representation of 50% women across the team of 26 professionals in total

4 out of 6 (67%) of the leadership are women

50% of the management of the firm are women

Team members from every primary region of India – North, West, South, and East – with a wide variety in languages spoken, beliefs, and personal backgrounds

Team members from 14 states that speak 11 languages in total

Team members from diverse streams of training, with degrees in accounting, engineering, business, legal, company secretarial, economics, literature, and the arts

The youngest team in Indian venture capital today, with an average age around 28 years

The first and youngest ESG Officer in the Indian venture capital industry

For us, it is critical to reflect the change we want to see. The firm must set an example for what is possible when action is intentionally designed, and merit is truly prioritised. You will also not see any active bias towards a certain class of universities, prior experience in consulting or investment banking, or necessary tenure in other investment firms. We want to attract and work with the best people, period.

We champion diversity because it is essential to our ability to think differently, identify opportunities, and work with the best founding teams across markets.

We are grateful for the opportunity to build an institution that can perform and compete at the highest levels while being mindful, intentionally inclusive, and truly diverse. We hope to consistently be able to meet our high standards and raise the bar on what a next-gen Indian institution can look like.

We are proud to have delivered on our mission to build our leadership grounds-up, and our investment in our human capital is now yielding the fabric that will support our growth into a leading institution from India.

LEADERSHIP IN EXECUTION

3one4 Capital Is India's First Venture Capital Signatory To The PRI & The First Indian VC Firm To Appoint An ESG Officer

The new appointment makes Siddarth the Indian venture capital industry's first ESG Officer and the youngest professional to hold this position

SIDDARTH PAI
Founding Partner, CFO & ESG Officer

Executive Council Member of the Indian Venture Capital Association (IVCA)
Co-Chair of the Regulatory Affairs Committee of the IVCA

" Its a privilege to be the ESG Officer of the first VC signitory to the UNPRI. In this dual role of ESG Officer and CFO, I believe I can better implement sustainable investing across the organization due to the quantitative and qualitative impact it has on operations. The focus will be on raising awareness and embedding it in the chain of commerce to benefit all stakeholders - internal, external and regulatory. It also enables me to work with our portfolio companies and help them become the early adopters and champions of ESG. The value of ESG transcends the balance sheet in the long term, but it's important to translate the short to mid-term impact on the bottom line to create more awareness and add a competitive edge. Hopefully, in time, the role of the ESG Officer must become as critical as any other CXO and finance."

3ONE4 CAPITAL

OFFICIAL SIGNATORY OF

PRI Principles for Responsible Investment

3one4 Capital is the first approved venture capital signatory of the UN Principles for Responsible Investment (PRI) from India and the fifth overall investment firm approved from India. The PRI is a United Nations-supported international network of investors working together to implement sustainable investment by incorporating ESG principles.

We are committed to partnering with the next set of generational innovation engines out of India that will help set new standards for inclusive value creation and sustainable growth. Through this important step, we have reiterated our proactive stance on improving and incorporating the environmental, social, and governance (ESG) factors into investment and ownership decisions.

We have committed to remain meaningfully involved and engaged with the international network of signatories and to be an active participant in policy and ecosystem development of ESG in India.

The firm also announced the appointment of Siddarth Pai as 3one4 Capital's ESG Officer. This appointment makes Siddarth the Indian Venture Capital industry's first ESG Officer and the youngest Indian professional to hold this position.

Siddarth Pai is a Founding Partner and the Chief Financial Officer at 3one4 Capital. As the ESG Officer, he will also lead the firm's intentional work in bringing the foundational principles of ESG into its investment and portfolio management routines. This includes aligning the firm's framework for ESG practices with its existing processes and standards, sharing ESG objectives, policies and practices with the firm's portfolio companies, and actively participating in the development of ESG in the Indian ecosystem. Siddarth is also the youngest ever Executive Council Member of the Indian Venture Capital Association (IVCA), India's apex association representing the country's private equity & venture capital industry. He is also the Co-Chair of the Regulatory Affairs Committee of the IVCA and works extensively in creating a conducive ecosystem for startups and venture capital.

With Siddarth as our ESG Officer, the Firm will aim to fuse the drive for performance and the possibility of positive transformation into a collaborative framework that is tangible and practical for the best founding teams. We will double down on our objective to partner with startups that today have the unique opportunity to truly do good while creating value for the ecosystem.

3one4 Capital's ESG Approach

3one4 Capital's ESG Approach

At 3one4 Capital, ESG is fundamental both internally, at the level of the Firm, as well as externally, in the way we discover, select, onboard, and help scale our portfolio companies. These dual functions, while distinct, form a continuum of an internally cultivated pattern of responsive, responsible, and sustainable stewardship practices rather than a strict binary. Specialist functional teams at the Firm ensure that it resolutely meets its compliance obligations and successfully adheres to prevailing regulatory standards, while going above and beyond to institutionalise ESG compliant practices within the Firm's portfolios.

We view ESG and impact as distinct but not mutually exclusive.

ESG captures the summation of the operational practices that are put in place in partnership with every company the Firm invests in. These practices serve as foundational anchors that help us and the company's stakeholders manage risks, capture opportunities, set boundary conditions, and adapt to changes in the ecosystem. While most of these are essential and non-negotiable, every company does set distinct additional coverage parameters unique to their businesses and markets. The aspects of company building that are covered here include: a) intentional product and pricing design, b) data privacy, security, and consumer rights protections, c) supply chain & vendor management, d) workplace policies and culture, e) environmental protection practices, e) governance and compliance adherence, f) regulatory alignment, and much more.

Impact is the measurement of specific outcomes of our portfolio companies when their businesses lead to positive socio-economic, environmental, and inclusion objectives. We prioritise objective measurement since the standards for impact are set high early on, and we require impact to be demonstrable, quantifiable, intentional, and verifiable. The Sustainable Development Goals (SDGs) have served as a reliable generalised framework here, and impact targets can usually be aligned to this framework directly.

For 3one4 Capital, ESG is a horizontal practice and is essential to our Firm's operations as well as all of our companies, irrespective of the markets they operate in. While not all of our companies will have top-of-mind impact objectives when they are launched, it is clear that most of our companies have a beneficial and measurable impact on their sphere of influence. We help each portfolio company identify its unique purpose and possible impact areas early, and then work consistently with the founding teams to align towards these objectives as we build forward.

The Firm's consistent practice and transparent disclosures have helped it achieve alignment with best-in-class global standards. 3one4 Capital is India's first VC signatory to the United Nations Principles for Responsible Investment (PRI)—a global compact of investors and financial institutions working to implement six aspirational principles to incorporate aspects and practices relating to ESG more deeply into investment processes across asset classes. Recently, the Firm was also recognised by Preqin as the highest-ranked firm in India and South East Asia in terms of ESG transparency KPIs.

FIRM NAME	CITY	COUNTRY	ESG TRANSPARENCY(%)
3one4 Capital Advisors	Bengaluru	India	84
Maybank	Kula Lumpur	Malaysia	84
Templeton Asset Management	Singapore	Singapore	84
Mandiri Capital Indonesia	Jakarta	Indonesia	76
Central Capital Ventura	Jakarta	Indonesia	76
Rabo Equity Advisors	New Delhi	India	73
Antler	Singapore	Singapore	70
True North	Mumbai	India	70
UOB Venture Management	Singapore	Singapore	70
Affirma Capital	Singapore	Singapore	68
Affinity Equity Partners	Singapore	Singapore	68
Dr.Reddy's	Hyderbad	India	65
Shell E4	Bengaluru	India	65
Sunway Group	Petaling Jaya	Malaysia	65
SBI Capital Markets	Mumbai	India	62

Table 1: ESG transparency score of firms in India and South East Asia, as ranked by Preqin in September 2022

Outline of 3one4 Capital's ESG Report 2024

This report reflects the Firm's resolve to lead the tide of change towards the galvanisation of responsible capital for new asset creation. It is structured so as to reflect the alignment of the internal organisational and functional design of the Firm to support the natural execution of Responsible Investing, as well as to demonstrate the deep work done to execute upon our ESG intent via our companies' practical implementations.

Investments and Deal Selection
As one of India's leading homegrown venture capital firms, 3one4 Capital evaluates 7,000+ investment opportunities on an annual basis, with a large number of those aimed at building ESG-compliant and SDG-aligned solutions for an aspirational India. The section on Deal Sourcing provides context on how 3one4 Capital approaches its sectors of interest and how the firm's deal selection workflows apply intelligent combinatorial analysis to selecting for large and inclusive outcomes.

Governance, Business Integrity & Closures (GBIC)
The last two decades were marked by breakneck disruption, characterised by the infamous mantra of "move fast and break things", the consequences of which are being felt now. Regulations have tightened, business model assumptions have come undone, and capital has moved from the forefront onto the fence. The time has emerged for a new paradigm that should serve as a framework for the future. The Governance, Business Integrity & Closures (GBIC) practice at 3one4 Capital focuses on translating signals into actionable insights on how the dynamic between innovation, capital, and policy has evolved, how to span bridges between them, and the standards being crafted for the digital economy. It is the first team of its kind in the Indian venture capital industry. This continuous practice is also elaborated in the report.

Portfolio Management and Finance (PMF)
ESG begins with due diligence on an investment at 3one4 Capital and is continuous until the final negotiation stages of an exit. The Portfolio Management and Finance (PMF) team at the Firm describes its approach in this report. The team's curates each company's reporting requirements based on the scale of a company's operations and its internal capabilities. This team also guides the Firm's zero fault tolerance toward regulatory commitments and other ESG-related commitments.

Growth and Capital Development (GCD)
In addition to its UN PRI signatory status, 3one4 Capital is working on increasing the breadth of resources available to early-stage ventures to help them align to ESG principles and inculcate them into their corporate DNA. The Growth and Capital Development function at 3one4 Capital actively deploys playbooks to cultivate global capital networks with investors with similar ESG alignment and to help early-stage companies align with sound practices from inception. The team has led multiple capstone initiatives with portfolio companies to lead by example in responsible investing, case studies of which are shared in this report.

Case Studies from the 3one4 Capital portfolio
Three ESG case studies from the 3one4 Capital portfolio–Dozee, Licious and Yulu–demonstrate that it is, indeed, possible to effect outsized impact by focusing on tech-led sustainable growth.

Dozee's patented vitals sensing technology is not just improving medical patient outcomes across the country but also driving efficiency across the medical value chain with digitalization, reducing the strenuous workload of medical staff, strengthening partnerships between various stakeholders in the ecosystem, and reducing inequalities by enabling standard of care for all.

Having created the first vertically integrated supply chain in the fresh protein space, Licious is now counted as the category creator and market leader of the segment in India. It has set benchmarks across emerging markets, not just in value creation but also in sustainability, inclusivity, provision of decent work conditions, humane and responsible production practices, and the very highest consumer safety and hygiene standards.

Yulu is building a full-stack MaaS (mobility as a service) solution for millions of urban Indians and is now a market leader in last-mile EV solutions. By providing a feasible, affordable, convenient, and sustainable alternative to existing mobility options, Yulu is spearheading mass

adoption of both micro-mobility and electric vehicles in the country. Its attempt to create and nurture this category in India has already demonstrated an industry-leading impact on inclusivity, income earnings, emissions reduction, and infrastructure augmentation.

3one4 Capital Insights

Our Strategy Research team publishes insights after deep reviews that combine our knowledge base with input from practitioners in the field. This team also supports the Firm's intellectual exercises in iterating on our routines for market studies, thesis development, and framework design. A selection of our work on ESG topics is captured in this report.

The ESG Regulatory Environment & Early Stage ESG Scoring

We summarize the key global policy developments that have required the adoption of a new set of principles to accommodate for the evolution in business responsibility and sustainability, many of which will deterministically affect the early stage venture ecosystem.

The complexity of early stage investing merits a specialized scoring framework that addresses this segment's unique demands. This report also unveils 3one4 Capital's thinking on a proprietary Early Stage ESG Score (ES^2) that incorporates ESG factors into a company's valuation at the pre-investment phase by quantifying ESG parameters, inputting them for various risk metrics and generating an objective and quantifiable score to map an early-stage venture's ESG performance.

Climate Tech Thesis

Multiple portfolio companies of 3one4 Capital have set clear SDG alignment roadmaps and are decisively delivering on their targets. The Firm actively cultivates deep theses around ESG-related paradigms and helps companies align their decisions and activities accordingly. This report details three such core theses and insights. The thesis on climate-tech gives an overview of the venture landscape for the sector in India and details upcoming and noteworthy opportunity areas for the same. Parallelly ongoing cross-cutting shifts to climate conscious consumption, production, and investing constitute once in a generation shifts and thus potentially offer once in a generation social, economic, and environmental returns. India finds itself at the centre of the global transition efforts with Indian climate-tech start-ups, including several of 3one4 Capital's portfolio companies, being uniquely positioned to leverage this seismic change.

Digital Public Goods In India: ONDC & The Next Digital Commerce Evolution

3one4 Capital's insights on ONDC serves to reiterate the above mentioned sentiment and support India's credentials as the locus of global growth over the next few years. The section discusses the effect of commoditization enabled by open networks on corporate profitability and concludes that despite rapid commoditization, corporate profits will be conserved and merely shift to another stage in the value chain. Digital Public Goods (DPGs) have democratised access to sophisticated technological rails and thereby broad-based innovation. As an exemplar of this trend, ONDC will unbundle digital commerce and should lead to a massive net increase in revenue and profit numbers for the industry at large.

3one4 Capital's Contribution To Policy

The Firm utilizes its many networks, strategic relationships, domain specialists, and research advantages to be highly involved in the growth of the Indian startup ecosystem. A critical aspect of the Firm's ecosystem participation is its contribution to the evolution of regulation and standards in the Indian economy. From securities regulations and capital gains taxation to ESG policies and economic reports, the Firm's active involvement in State and National policy is highlighted in this section.

India's Sustainable Growth Story

Finally, from the microscopic to the macroeconomic view, we present our thinking on India's growth trajectory in the coming decade. India is poised to be only the third economy to break through the $10 trillion GDP ceiling, with favourable tailwinds in domestic consumption, demographics, open market economics, and accelerated adoption and development of technology. Sustainability lends an exciting dimension with unique opportunities over this trajectory. The nation has spent the better part of the previous decade focusing on unlocking access to basic amenities for millions of Indians, building sustainable consumption and production value chains, and developing institutional capacity towards a resilient future. It has pioneered the DPG model and built a system of interoperable modules that form the basis for delivering income support and relief to millions while allowing the private sector to innovate on top of it to develop world-class products and services. This unique digital rail network has opened up complex new possibilities, and India continues down the path towards full-stack indigenous technology development. Now, startups are leading the envelope of adoption and expansion from here.

India is now the third-largest startup ecosystem globally, behind only the US and China. It has over 110 unicorns, having surpassed the 100-unicorn mark in JFM 2022. India's growing digital interconnectedness presents a wealth of opportunities for investors. With $146 billion invested, 800 million internet users, 400 million millennials, and $2 trillion in UPI transaction volumes, there is tremendous value creation underway at an unprecedented scale. This is the decade that India will realise its promise of growing into a $10 trillion GDP economy, and tech could contribute at least $2 trillion in market cap to drive this transformation.

The demand on tech entrepreneurs today is not just to build a great product but also to maintain excellence and achieve credibility as they scale their companies. Founders need to become exemplars of unquestionable honesty and integrity in order to inspire the best from their teams. As founders evolve into leaders, they develop strengths in attracting, enabling, empowering, and retaining the best and the brightest talent to achieve the objectives of an institution. At scale, they are catalysts for change in meritocratic and transparent environments where collective action breeds excellence.

Early-stage venture capital is predicated on creating outsized outcomes; at 3one4 Capital, we believe we must extend this principle beyond economic results to true value creation and greater societal benefit. For us, it is critical to reflect the change we want to see and set an example for what is possible when action is intentionally aligned.

3one4 Capital's Portfolio Impact

Impact Statistics from our companies

82 Billion+ Litres
Litres of water saved by portfolio companies' activities

1.6 Cr (16 Million)
Number of blue collars workers assisted in their search for employment

16
Portfolio presence: Number of companies with presence in more than 40 cities across India

40
Safeguarding employment benefits: Number of portfolio companies with provident fund provisions

29 yrs
Building with the young: Average age of employees across surveyed pool of portfolio companies

117
Number of our portfolio companies which are SDG aligned

773
Furthering reach: Cumulative number of districts served by our portfolio

2 K+
Number of Pin Codes serviced by our portfolio companies

400+
Cumulative number of hospitals served by our portfolio companies

3 Cr+ (30 Million)
Enhancing access to healthcare: Number of Indians who accessed healthcare and health services through our portfolio companies

1.75 Lac (175K)+
Number of micro loans facilitated by our portfolio companies

2 K+
Advancing financial inclusion: Number of towns served by our Fintech portfolio

11 %
Women founders as a percentage of total founders

38 %
Women employees as a percentage of total employees across surveyed portfolio companies

20 Million+ kg
CO_2 emissions savings enabled by our portfolio companies

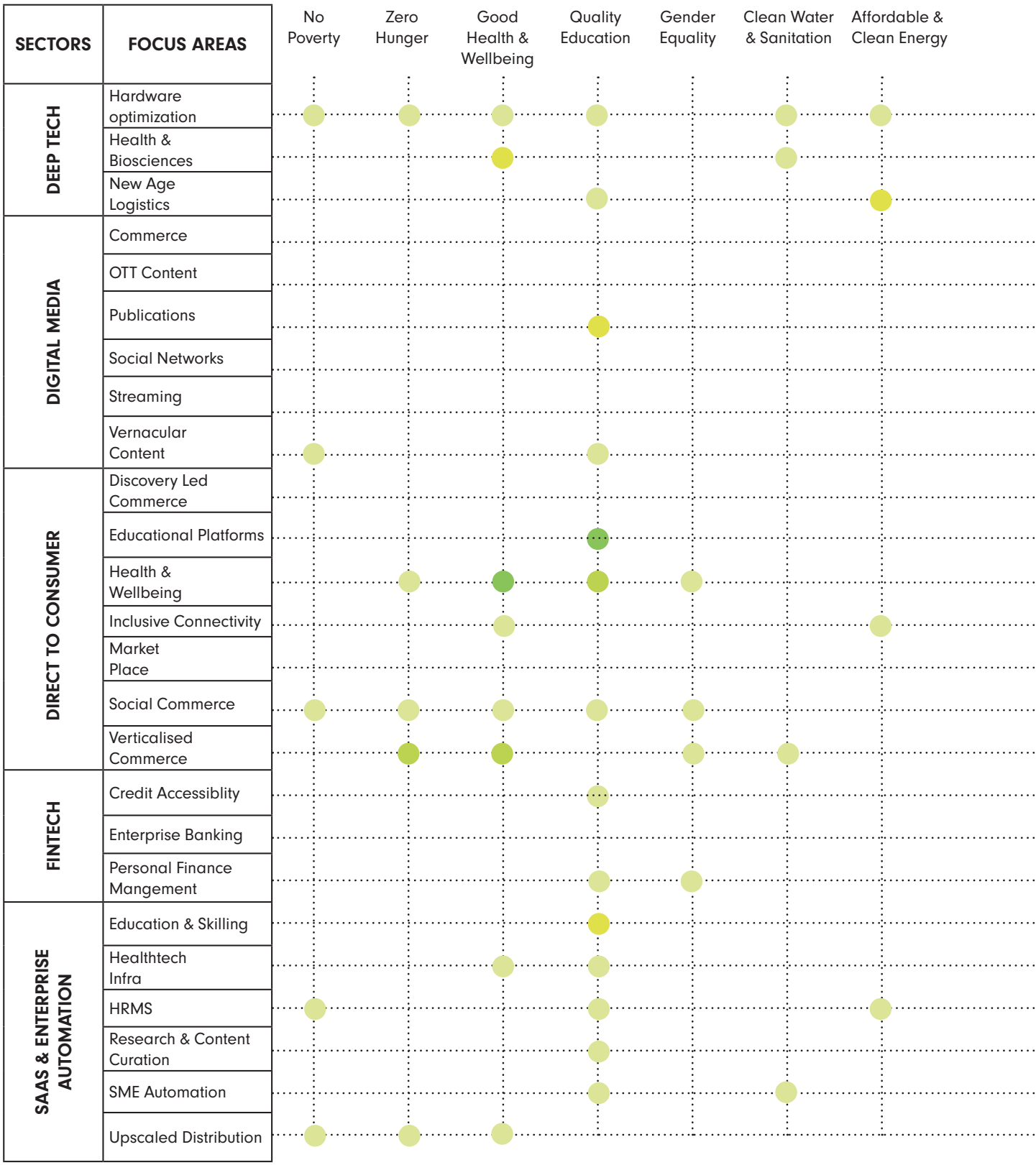
20+
Cumulative number of languages supported by our portfolio

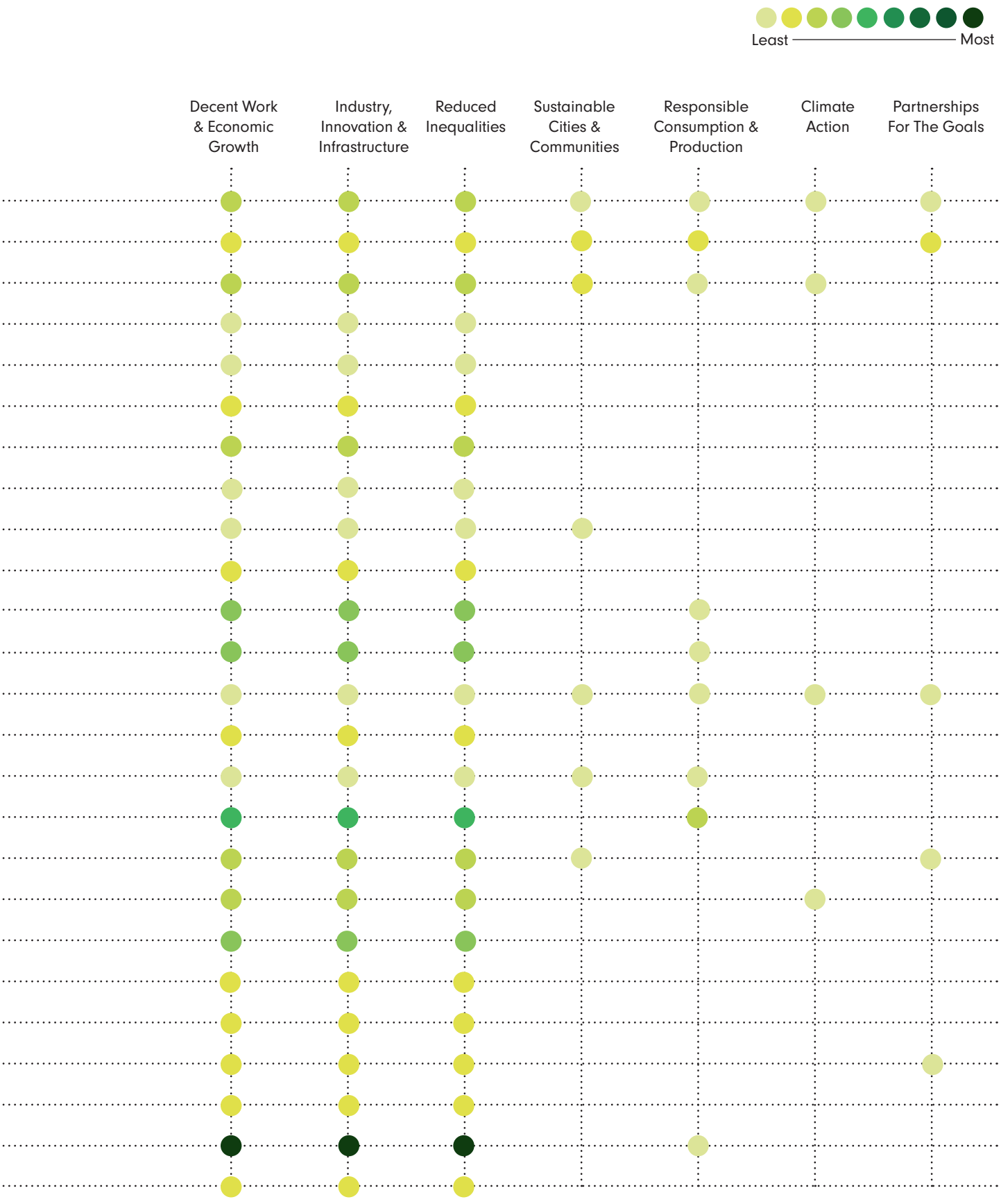
425 Million+
Green kilometres powered by our portfolio companies

12,500+
Hospital beds serviced by portfolio companies

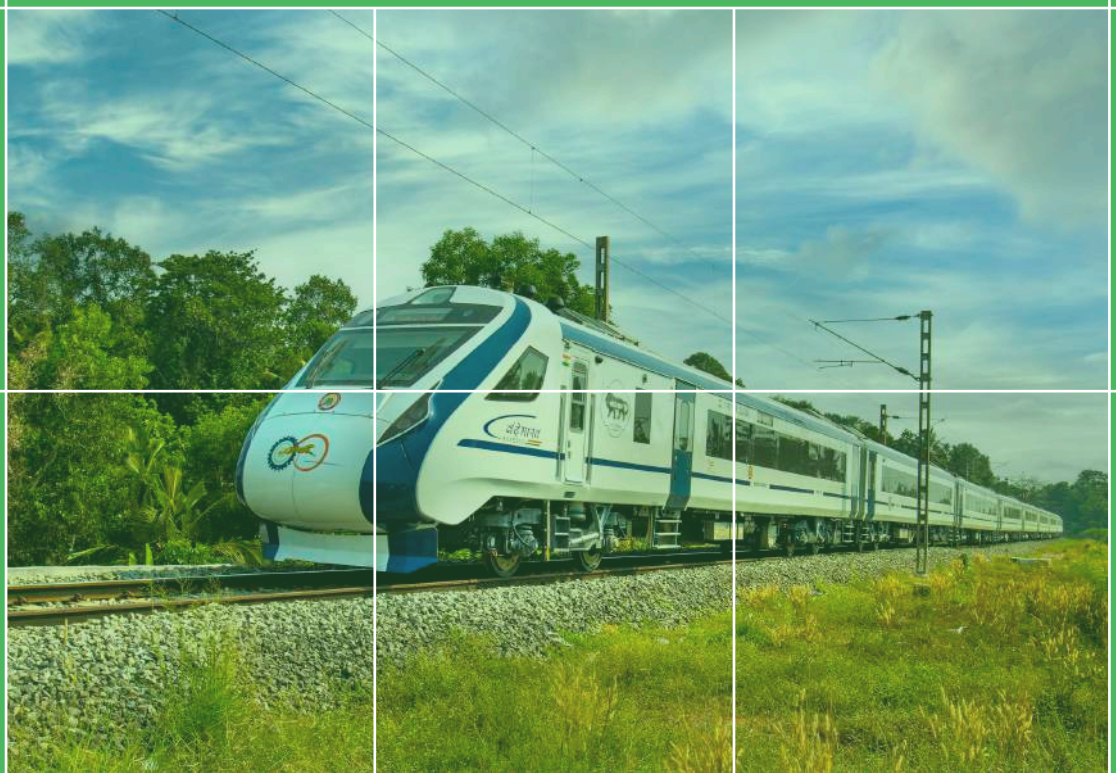
Portfolio SDG Alignment Grid

Impact Statistics from our companies




Least
Most
Decent Work & Economic Growth
Industry, Innovation & Infrastructure
Reduced Inequalities
Sustainable Cities & Communities
Responsible Consumption & Production
Climate Action
Partnerships For The Goals

Investments within ESG Focus Areas at 3one4 Capital



Investments in ESG

3one4 Capital's investments are biased towards companies exploiting technology to create, grow, or dominate large markets in India. The firm also invests a portion of its capital in US-focused companies that have feedforward effects into the themes being pursued in India. The firm works in select market categories and at the intersection of adjacencies that are large, growing, and ready for unique products and services. The themes pursued are SAAS, Enterprise and SMB Automation, Fintech, Consumer Internet, and Digital Health.

The firm sees 600+ investment opportunities on a monthly basis across various channels. Over 50% these opportunities are inbound through various channels including entrepreneurs reaching out to the firm directly — 3one4 Capital and its team members have established themselves as extremely approachable to entrepreneurs as well as referrers that are looking to introduce us to quality teams building innovative products.

3one4 Capital's responsible investing focused mandate meshes well with the firm's ability to find sector agnostic investment opportunities. Sustainability and social responsibility towards all stakeholders is of paramount importance, and these Environmental, Social, and Governance (ESG) principles are mainstream components in our investment screening and portfolio monitoring processes.

It is interesting to note that the founders of most of the teams that we consider are not thinking about their business in sustainable development goal terms. They identify a large problem and a novel solution, and are able to make a compelling case regarding the timing and their unique ability to build the concerned business. However, by virtue of using technology to offset difficult labor, create scale, generate reach, and enhance incomes, companies are able to create tremendous impact that goes beyond economic value. Numerous examples of this exist within the portfolio, ranging from WeRize in financial services to BetterPlace in human-resource development, and Exponent Energy in EV charging infrastructure to Rozana in P2P rural commerce. Therefore, a major part of the scope of work at 3one4 Capital is to help companies effectively see beyond the commercial value that their business is able to create.

Within our broader investing scope, we have a number of sub themes that we are keen on investing in:

- **Climate Action -** climate is one of the foremost issues that humanity is contending with in the 21st century. A number of entrepreneurs are chipping away at this problem by inventing new IP and incentivizing better behaviour.

- **Better Health Outcomes -** India's health statistics leave a lot to be desired. Healthcare productivity challenges and the rise of non-communicable diseases in particular are areas where startups will be able to deliver rapid outcomes.

- **Responsible Production and Consumption -** sourcing of raw materials and consumables must change in keeping with the climate action theme. Food, textiles, and packaging supply-chains are a handful of examples that are being reimagined by entrepreneurs looking for more sustainable forms of resources.

- **Urban Workforce Enablement -** Income prospects have resulted in domestic migration and urbanisation in India. This blue, grey, and entry level white collar segment of workers and their families are a large and growing addressable market for specialised services and products that target their basic needs as well as their discretionary and aspirational spends.

- **Quality Education -** quality education creates massive leverage in society and though it does not come with a short term pay-off, studies have shown that the benefits are always worthwhile. Startups have a role to play in creating, curating and delivering education to various demographic segments, usually as a supplement but increasingly as an alternative to traditional sources of education and certification.

- **Reduced Inequalities -** alternative sources of credit, education, and employment that startups provide dovetail nicely with government intervention and are critical in the objective of reducing inequality.

- **Sustainable Cities -** housing, energy and mobility are essentials of all cities and require novel solutions to complement public policy and services.

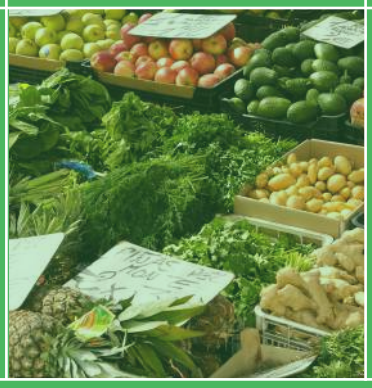
Deal Sourcing within ESG Focus Areas

3one4 Capital has evaluated a significant number of ESG relevant and SDG aligned companies. The following metrics give an indication of the same over the period FY17-18 to FY21-22

	Electric mobility	712		Financial inclusion	2,720
	Education	2,472		Healthcare	3,196
	Regional language Content	399		Renewable Energy	209
	SME Wealth Creation	331		Blue collar enablement	151
	Women focused	561		Agriculture and Agri-tech	815
	Low carbon industry and transport	148		Climate monitoring	123
	Emissions reduction	104		Water management	79

It is still early days for 3one4 Capital's investments and our processes continue to evolve to create a much more meaningful impact towards the firm's mission of supporting generational growth engines to create outsized economic and social returns. As India's first VC signatory to the UN PRI as well as the highest ranked VC firm in India and South East Asia in terms of ESG transparency KPIs according to Preqin, 3one4 Capital is deeply committed to responsible investing. Going forward, the firm is eager to explore opportunities in sectors and thematic areas with untapped potential to further ESG impact. As alluded to earlier, many innovative startups in India today are creating large-scale positive impact without necessarily fashioning or identifying themselves as ESG focused or SDG aligned ventures. 3one4 Capital will continue to add several such companies to its portfolio and subsequently help them maximise their impact.

The firm has doubled down in its belief that intentional technological innovation can act as a force multiplier for enabling inclusion, access, and growth at population scale. Investments at 3one4 Capital act as the primary conduit to catalyse and further the firm's responsible investing footprint. Through its efforts, the firm hopes to play its due part in galvanising the early stage investment ecosystem towards building more ESG-driven and SDG -aligned portfolios.



Governance, Business Integrity & Closures Practice at 3one4 Capital

Introduction

GLOBAL PERSPECTIVE

The pandemic has accelerated digital adoption and transformed the way businesses operate. Issues regarding the adverse impact on climate change, human rights, the widening digital divide, data integrity and privacy, diversity and inclusion, and governance have come to the forefront. Addressing these concerns by all relevant stakeholders globally in a timely manner is crucial for a sustainable future.

According to "The Global Risks Report 2022 – Insight report" published by World Economic Forum, the top risks as per the respondents fall broadly under environmental and social risks, which in the earlier times was restricted to economic benefits.[1] With the growing dependencies on technology, assessment and management of technological risks is becoming increasingly important in the global context.

In recent years, "ESG" has become mainstream among venture capital investors and has become a paramount consideration for investment. While all stakeholders in unison are contributing to provide innovative solutions, the venture capital industry is taking strides in the right direction to seize the opportunity and drive rapid ESG adoption to address concerning global risks and issues for each company. Awareness and implementation of ESG across the transaction chain has sensitised the stakeholders towards its adoption bearing in mind the relevance, sector, and business models.

Global venture capital AUM reached US$1.24 Trillion in the first half of 2020,[3] while AUM in India has reached USD 650 Million for FY 2021.[4] In the last decade, venture capital firms globally, have invested in startups that solve problems through innovation and had the foresight to back disruptive technologies, which have now given us new calibre of business leaders who will bear the mantle to contribute and solve global issues.

Fig 1: Most important risks according to the WEF Global Risks Perception Survey 2021-22. Source: World Economic Forum[2]

INDIA PERSPECTIVE

Indian start-ups have contributed to the colossal growth in economic activity and job creation with ripple effects on standardisation of processes and markets. It is interesting to note that Indian start-ups have grown remarkably over the last seven years. The number of new recognised startups have increased to over 112,000 in 2023-24 from only 733 in 2016 -17. As a result, India has become the third largest startup ecosystem in the world after the US and China.[5]

2021 for India has been a record year for VC/start-up investments, recording an all-time high of US$28.5 billion which is almost four times the value recorded in 2020 (US$7.3 billion) and is almost equal to the total value of VC/start-up investments in the previous three years combined. Start-ups have emerged as the largest deal segment in 2021 accounting for 37% of total PE/VC investments.[6]

While ESG adoption is in nascent stages in India, it is quickly gaining momentum among venture capital investors and founders. Venture Capital investors are riding this wave being fully cognizant of delivering value for the asset class whilst also ensuring a holistic approach to environmental, social, and governance considerations. The founders see extensive value in adoption of ESG owing to brand reputation, reduction of attrition and economies of price across the value chain.

Parallelly, the COP26 climate change conference in November 2021 saw Prime Minister Narendra Modi committing India to achieving "Net Zero" emissions by 2070. On the policy front, the Indian regulators such as SEBI and RBI have stepped up and provided guidelines and frameworks for commitments made on a global level.

Introduction to the GBIC function at 3one4 Capital

Given the notable transformation of the ecosystem in the adoption and implementation of best practices for managing businesses, the GBIC (Governance, Business Integrity and Closures) team at 3one4 Capital plays a crucial role of maintaining portfolio oversight in these three aforementioned areas. This function predates 3one4 Capital's investment into a portfolio company and extends up to and beyond the Firm's exit from the company, touching upon every single link in the entire transaction chain. Through this function, 3one4 Capital is able to operationalise its ESG framework across its engagement with the portfolio company and other stakeholders, leading to an effective inculcation of responsible practices into the company's operations. The team also lends itself to thought leadership in navigating corporate and regulatory compliances, governance standards, and the creation of business integrity frameworks basis the stage and sector of the company.

Sector Specific Broad Considerations and Stakeholder management

The pandemic has reinforced the importance of a nimble yet comprehensive approach for startups to adopt and maintain a competitive edge. There is a paradigm shift in startup strategies to include ESG as one of the core themes for business operations leading to sustainable growth instead of a mere vanity metric. Venture capital investors backing the startups and founders understand that the outcomes may be short term, medium term or long term, and the enormous effect it may have will be visible only in the long term.

All stakeholders are cognizant of the direct correlation between the implementation efforts and outcome effects for ESG. There is a clear need for the startups to inculcate the ESG framework in the company's culture early on to set the right direction from the start.

According to "The Next Big Leap – Towards ESG maturity in Tech sector'" published by BCG x Nasscom, the image below reflects the ESG considerations prioritised based on importance across stakeholders. This diagram gives a bird's eye view of stakeholders and important ESG considerations view of stakeholders and their significant ESG considerations. The most important stakeholders are customers, investors and regulators.

Some considerations will always be imperative for the company irrespective of the sector they operate in. They are employee health and wellness, corporate governance, diversity and inclusion, community wellness, and standard policy implementation. While some become relevant depending on the industry that the company operates in, stage of the company and the expectation of the relevant stakeholders involved.

Few important considerations for startups to assess ESG related risks in the following sectors per our view are included below. For ease of reference, we have added the criticality against each of them. Risk assessment for each section clarifies the questions that we believe are necessary to be discussed with the company to assess the company's vision, plan and mitigate steps either prior to or after investment based on the sector's criticality.

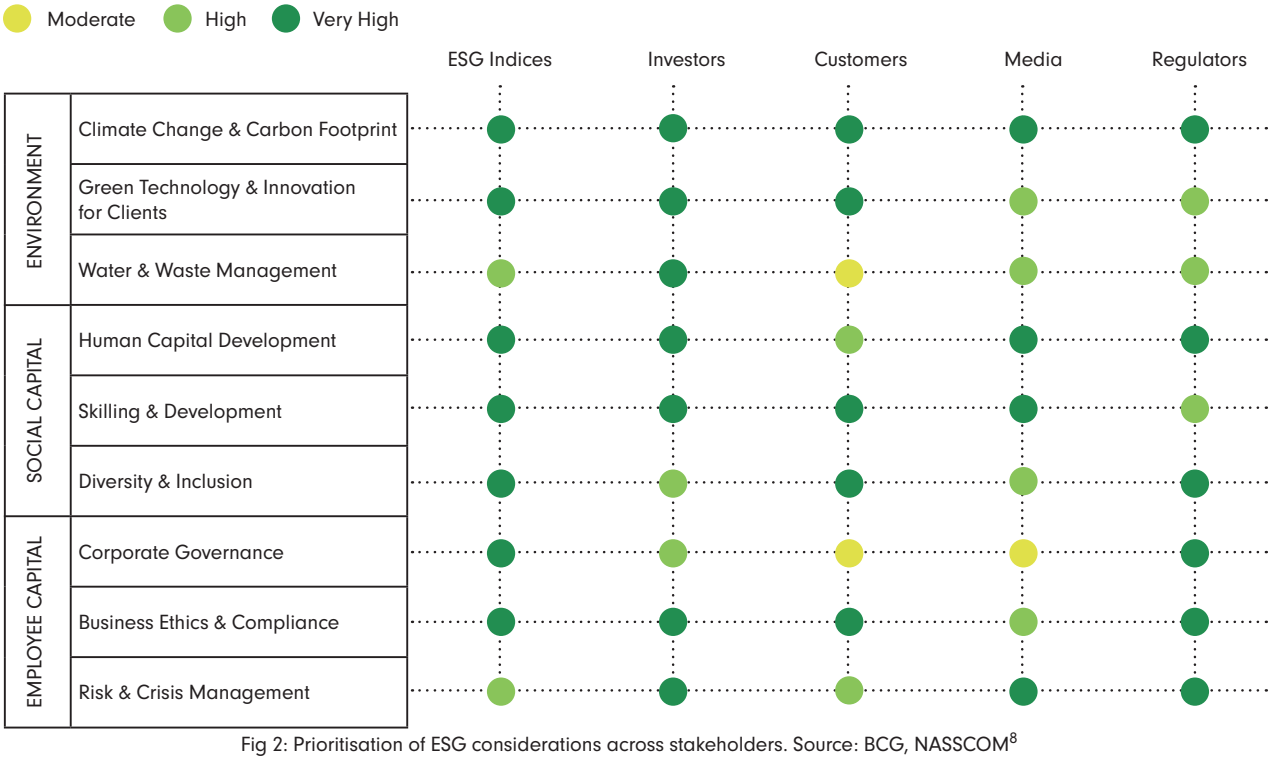


Fig 2: Prioritisation of ESG considerations across stakeholders. Source: BCG, NASSCOM[8]

KEY CONSIDERATIONS FOR STARTUPS TO ASSESS ESG RELATED RISK ACROSS SELECT SECTORS

LOW MEDIUM HIGH NA

1. Environmental: Emissions and energy efficiency

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For all sectors:

- **Greenhouse emissions:** Companies are increasingly becoming aware that they will be held accountable for emissions and measures undertaken to minimise the greenhouse emissions (both direct and indirect i.e., Scope 1, Scope 2 or Scope 3 emissions)

- **Carbon footprint:** The company's vision and evaluation of their direct and indirect emissions across the entire supply or value chain is critical to shoulder tactical actions. The company could be "net zero", "carbon neutral" or "carbon negative" depending on which path the company may choose to walk on. This evolving process will need all stakeholders of the company to come together and devise an action plan.

For Deep Tech and SAAS & Enterprise Automation:

- **Product development optimization:** Few companies are also looking at energy efficiency at the stages of development through optimization of hardware and software to bring about efficiency not only as an afterthought but to make it an integral part of the product.

- **Use of renewable energy:** Another alternative would be to look at use of renewable energy for specific businesses in their production process. This also helps in cost and effort optimization.

B) RISK ASSESSMENT:

- Does the company operate in an energy or water intensive sector?

- In the company's view, is there an impact on soil/water/air owing to the production/manufacturing process?

- Does the company monitor emissions (whether directly or indirectly)?

- Whether the company is considering adoption of renewable resources in the future?

- Do any of the products offered by the company have energy labelling/certifications?

- Is there usage of harmful/hazardous substances in the production process? Are suitable approvals by the regulators procured for operations?

2. Environmental: Management of data centres

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For all sectors:

• **Cooling mechanism:** Large quantities of energy are necessary to run the IT infrastructure. This is crucial as data loads are only growing with the increased dependency on technology. As a result, large quantities of water are required for cooling which indirectly affects the environment. Companies are gearing towards bringing in optimal cooling, lower consumption of energy or using renewable energy to manage carbon footprint.

B) RISK ASSESSMENT:

• Is there any cooling system/procedures in place at the data centre?

• What is the target water efficiency in data centre cooling?

• Does the company use/plan to use renewable resources to manage data centres to minimise impact on carbon emission?

3. Environmental: Waste management and packaging

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For all sectors:

• **Circular economies:** Focus is also shifting to build and support circular economies and e-waste management due to digital transformation across the globe.

For Direct to Consumer:

• **Ethical consumerism:** Ethical consumerism is becoming increasingly relevant today. For most companies operating in the D2C sector, packaging is vital for product positioning and brand recollection. Some of them are choosing to reduce the components that were used traditionally, while some others are adopting sustainable and eco-friendly options for packaging to reduce environmental impact.

• **Circular economy:** Circular economies and waste management also hold relevance for a D2C company in relation to sustainability.

B) RISK ASSESSMENT:

• Does the production/manufacturing process result in waste?

• Does the process result in generation of hazardous substances? What are the risk mitigation steps undertaken by the company?

• Nature of waste and the waste management practices adopted by the company.

• Are there alternative uses for the waste/byproducts generated?

• Does the company undertake an assessment of wastage ratio across the production cycle?

• Is the company required to adhere to applicable law for labelling/packaging? Specify the relevant applicable laws being followed?

• Does the company have policies on effective e-waste management?

LOW MEDIUM HIGH NA

4. Environmental and Social: Innovative green instruments

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For Fintech:

• **Assets backed:** Green finance means raising finance for projects that focus on the environment.

• **Financial inclusion:** New and innovative instruments are being conceptualised and created to cater to capture new users, thereby creating financial inclusion.

B) RISK ASSESSMENT:

• What is the process by the company for assessment and selection of assets?

• How does the company use proceeds and monitor deployment of proceeds?

5. Social: Sourcing and supply chain management

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For Deep Tech and Direct to consumer:

• **Deep analysis of supply chain:** Companies are also going deeper to check if the suppliers, distributors, and manufacturers follow fair employment practices and have zero tolerance on human rights violations.

• **Sourcing strategy:** Souring from certain geographies can provide an indication of the general industry practices. Companies are exploring local sourcing of materials for optimization of costs, quicker availability of material and reduction of emissions in the field of logistics, warehouse and storage. Not only does local sourcing help in lower turnaround time for rolling out products expeditiously but also contributes to supporting local communities.

B) RISK ASSESSMENT:

• How does the company identify the vendors/suppliers/distributors/manufacturers? Is there a screening (including reference checks) undertaken prior to onboarding by the company?

• Does the company undertake a due diligence/on-site visits for the vendors/suppliers/distributors/manufacturers prior to engagement?

• Are there policies against child labor and unfair employment adopted by vendors/suppliers/distributors/manufacturers?

• Are there any measures undertaken by the company to reduce the carbon emissions across the supply chain?

• Have there been any restrictions on the sourcing country for the goods/services the company requires in the past? Are there any geographical restrictions imposed by any regulator?

6. Social: Algorithmic bias

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For all sectors:

- **Data quality and output examination:** Deep learning algorithms are based on neural networks developed on emphasised attributes of the data feed. Hence, the algorithms may develop a bias based on the neural network they are built on. These may tend to hamper inclusivity of the end consumer in some cases. Due care must be taken to check how the AI has been developed and if any periodical assessment of output in relation to the objective would help surface any biases/anomalies for the company to fix.

B) RISK ASSESSMENT:

- Does the company share data with sensitive information to any employees?

- Does the company have a data access list of the employees who are privy to the information collected by the system?

- Are there any manual interventions possible? Is it documented to capture in which cases these could be triggered?

- Does the company perform periodic/random deep dive analysis of the algorithmic output?

7. Social and Governance: Data privacy, Data security, and cyber security

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For all sectors:

- **Data protection:** In this time and age, the most valuable asset of any company is personal data, financial data and business data. Cyber security breach/data security breach results in data loss, negative media coverage and reputational risk. This enterprise risk will need to be mitigated with proactive and periodic risk assessment to test vulnerabilities and firming up network access controls.

- **Adoption of incident response plan**: It is also imperative that the company has an incident response plan to provide a direction for the company and its executives to handle the situation upon occurrence.

B) RISK ASSESSMENT:

- Nature of information/data being collected.

- Which geographical regions does the company cater to? Are relevant laws adhered to in relation to data privacy and security based on geographic presence?

- For the data being collected by the company, are consents procured along with communication of intent of collection/access the said data?

- Is access to personally identifiable and/or sensitive data accountable to specific individuals to maintain control over access and preserve accountability for misuse?

- Do any of the third parties have access to the data? If yes, what is the purpose of providing the same.

LOW MEDIUM HIGH NA

• What are the authentication protocols in place to ensure the data access is provided to the right personnel?

• Does the company have cyber-attack insurance in place?

• Does the company have an incident response plan in place?

• Are there policies and trainings in place for educating the relevant personnel of the company?

8. Social and Governance: Trials, studies, relevant certifications or licences

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For Deep Tech:

• **Affiliations with accredited institutions:** Depending on the sector the company operates in, they will need to procure relevant certifications or undergo trials from accredited institutions. Adherence to these minimum standards is important for operations as it gives comfort to all stakeholders in relation to product safety.

For Direct to consumer:

• **Awareness of applicability of standards**: Awareness of relevance and adherence to minimum standards pursuant to the industry in which the company operates is important. This is crucial for the food and beverage industry.

• **Labelling:** Labelling as per regulatory standards need to be adhered to where applicable so the consumers can take an informed decision of the product.

For Fintech:

• **Licences/registrations:** Fintech companies need to procure registrations licensing/sub-licensing or such other arrangements for operations.

B) RISK ASSESSMENT:

• Has the company applied for or intends to apply for any certification/licences in relation to its business?

• Is the application process to procure certifications/ licences transparent?

• In case of affiliations with third parties/institutes for conducting any tests, list for the same. Are they accredited third parties/institutes?

9. Governance: Grievance redressal

Deep Tech | Direct to Consumer | SAAS & Enterprise Automation | FinTech | Digital Media

3one4 Capital commentary and risk assessment

A) COMMENTARY:

For all sectors:

• The Companies will need to have mechanisms for complaint management by the stakeholders (whether consumers, suppliers or any other third party). Identified personnel who are given responsibility for managing this will need to be stated on the websites of the company.

For Direct to consumer:

• Since the companies have an opportunity to directly communicate with the end consumer without any middlemen – whether it is via its website, an app or through a marketplace, the existence of a redressal mechanism is important for customers to raise complaints in order to receive resolutions for the goods/services procured from the company. Consumer redressal mechanisms are important to the brand's reputation and serve as a feedback system for the company.

For Fintech:

• Repeated patterns of exceptions/failures are an indication of process inefficiency. The redressal mechanism serves as a feedback channel for the company to assess in case of algorithmic bias and have an open platform to sort queries.

For Digital Media:

• Digital Media companies need to have a robust grievance redressal mechanism which is socialised with all users. The social media platforms can receive queries/ complaints to take remedial action as per relevant regulations in relation to content. Management of content is of utmost importance since it helps in minimising the effects of hate speech, self-harm, defamatory content etc.

B) RISK ASSESSMENT:

• Does the company have a grievance redressal process in place?

• Are there policies adopted stipulating management of stakeholder grievances?

• Is there any complaints committee set up to manage complaints received from stakeholders? Are the members qualified to manage the nature of complaints?

• Does the company's website clearly explain the process for grievance redressal and contact details of relevant personnel?

• Does the grievance redressal process provide skip level escalation in case of mismanagement or non-responsiveness from the current level?

GBIC Across the Transaction Chain

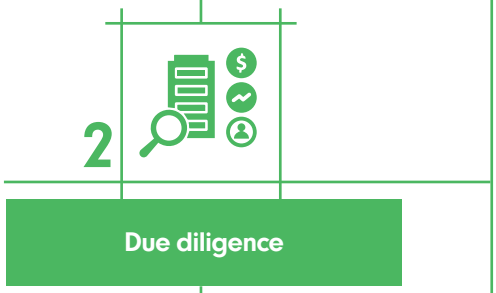
The GBIC team at 3one4 Capital works with the portfolio companies right from the time of inception to transition. The team helps portfolio companies adopt, maintain and operationalise systems, policies and practices on matters related to to ESG, governance and business integrity. This varies from instituting committees, adoption of standards, compliance to agreements, and intimation on the change in regulatory landscape. Depending on the stage of the business and the resources available, a phased approach is taken in relation to ESG. At 3one4 Capital we encourage the founders, board, key employees and the investors to have active discussions to align on the pertinent ESG goals among all stakeholders of the company.

The founders and thereby the employees are the most important stakeholders working to ensure the company is meeting its ESG goals. It is of utmost importance that the culture and importance of ESG alignment is a top-down approach. The culture of the company must be to foster innovative and sustainable methods to improve efficiencies across the chain.

GBIC TEAM AND ESG FOCUS

The GBIC team along with the other teams at 3one4 Capital work with the founders/company across the transaction chain in relation to ESG and due diligence in the following manner:

- Assess if the company's business is in-line with the fund's ESG investment policy.
- Ensure the company's business does not fall in the fund's investment exclusion list.
- Run a public search on the company and founders for negative media coverage.
- High level understanding of the sector and geographical presence of the company.



- Understand the legal group structure (including parent, subsidiary and joint ventures) along with geographical location.
- Check applicability and adherence to labour regulations.
- Understand business model and business plan of the company.
- Assess intellectual property ownership.
- Assess supply chain risks/opportunities and vendor engagement terms.
- Undertake forensics/integrity check.
- Procure details of fines/complaints on the company/ founders.
- Details of incidents relating to accidents, fraud, whistle-blower complaints and resolutions etc.

- Include ESG considerations as a part of the investment manager/investment committee discussions.
- Include the ESG due diligence considerations as a part of the investment memorandum.

- Seek commitment from the founders and the company by incorporating ESG clauses and obligations in the transaction documents.
- Providing templates of ESG policies for adoption.

- Discuss with the founders to set ESG milestones and KPIs.
- Based on relevance and prioritisation (whether short term/long term) collaborate with the founders to create an ESG plan/roadmap (based on the stage of the company).
- Encourage the company board to assess ESG metrics on a periodic basis.
- Collect ESG metrics/developments from the company on a periodic basis.
- Monitor ESG developments internally, liaise with the founders in case additional information is needed.
- Agree on the format and frequency of reporting ESG metrics.
- Undertake ESG audit if necessary.

GBIC FUNCTION'S DETAILED WORKFLOW

Pre-Investment

1. Diligence and Business Integrity Work: The GBIC team is instrumental in performing and overseeing portfolio diligence on matters related to business integrity, governance, and business practices. This helps 3one4 Capital create a multi-dimensional view of the company that spans beyond the traditional view of business models and towards business practices. The table below provides the key matters reviewed at the due diligence stage at a compliance level. These checks are crucial even at the early stages of startup lifecycle as it gives the founders and investors time to assess and discuss the relevance and applicability to each company depending on the sector it operates in. Active discussions can be held to align on the short term and long term ESG goals that the stakeholders agree upon.

2. Legal and Regulatory Checks: The team is also tasked with conducting legal diligence as well as background information on the regulatory frameworks that apply to the company, basis their current business model and any areas they plan to expand into. Until the startups business and revenue lines mature, the founders and company will test and modify business lines according to market requirements and company's vision. Adherence to the

law and staying abreast with the regulatory changes may be cumbersome. Since 3one4 Capital is actively involved with the founders on the business model, we can bring relevant amendments to their attention. This helps in assessing the impact of such amendment to decide on the next steps by the company.

3. Creation of ESG Playbook: GBIC works on creating the ESG Playbook for the Fund that encompasses adherence to general practices as well as matters specific to the industry the company operates in. Depending on the nature, stage and the resources available at the company, 3one4 Capital works closely with the founders to put together an ESG playbook which includes policy templates and an ESG plan for specific time periods.

General outline of the ESG playbook may be as follows:

Within 30 or 60 days

- Key stakeholders hold discussion and have a common understanding on the "ESG" applicability to the company
- Based on the ESG issues identified by the key stakeholders, prioritise the ESG issues based on long term/short term objectives.
- Build a mission and vision statement in relation to ESG amongst key stakeholders.
- Determine KPI and targets to track ESG development based on short/long term objectives.
- Seek relevant registrations (if pending) pursuant to the due diligence observations.

Within 60 or 90 days

- Active participation by the investor director/ investor observers on the board to help the founders/ management navigate and monitor ESG topics and/or ESG issues.
- Adopt a framework and incident response plan for critical matters of business.
- Appoint personnel to manage grievance redressal, communicate on company website regarding the same (such as whistle-blower, sexual harassment etc)
- Monitor ESG KPIs to assess if the base data collection method/assessment methodology needs to be modified.
- Include ESG reporting/discussions as part of board meetings
- Set up compensation committee/council.
- Adopt policies such as anti-corruption, anti-bribery etc.
- Procure necessary insurance such as D&O insurance, cyber-attack insurance etc.

Within 100 or 180 days

- Hold meetings/ communicate on the grievance redressal process to all stakeholders.
- Assess data collection and data localisation and its adherence to applicable law.
- Review and publish data and privacy policy, make suitable changes to the website and appoint a personnel to manage the same.
- Review vendor policy and screening process.
- Assess feedback provided by the stakeholders, deliberate and include as part of the system.
- Undertake training sessions for stakeholders to evaluate understanding.
- Assess business model to tweak ESG metrics, if necessary.

The ESG playbook will have additional points based on the nature of the business.

4. Stakeholder Management for Equitable Rights: Venture Capital rounds have the reputation of having rights that favour certain parties over others. The team works across all the transaction participants - founders, employees, board members or other investors - to ensure that the terms in the investment documents are fair and equitable to all concerned. As part of the transaction documents - process to be followed in case of deadlocks, matters that need investors' attention are taken care of to reduce friction later.

Portfolio Oversight

5. Continuous Monitoring: The team works across the portfolio to perform the function of continuous monitoring - be it the adherence to the ESG Playbook or E&S practices proposed by 3one4 Capital, of the investment documents, applicable regulations, or any other policies adopted by the company that involves the role of an investor. This function informs 3one4 Capital of any changes in the business or the environment in which the company operates, so that 3one4 Capital can take appropriate measures as required.

6. Sound Governance Practices: In early-stage companies, it is critical to instil sound governance practices at the inception to ensure Business Integrity as a default anchor of operations. This involves codes of conduct for board meetings, board members, and intensive founder coaching on such matters. The team leads this function in conjunction with 3one4 Capital's representatives per company. This helps set cadence and imbibe good governance practices with the management from the inception.

7. Policy Adoption Implementation: The team assists portfolio companies in the adoption of E&S policies, the ESG playbook, and other policies that are essential in ensuring sound business practices at a portfolio level. From compensation and ESOP policies to vendor management, standards are enforced across the portfolio by the GBIC team. Since the portfolio companies are in the nascent stages of the business life cycle, 3one4 Capital works with them to review policies prior to adoption to give a perspective of industry practices or recommendations to further improve the policy in relation to the objectives set out.

8. Enforcement of Rights: The team assists 3one4 Capital in the enforcement of the rights of the Fund as per the investment documents, such that the Fund's position can be secured during corporate and cap table changes. With rights being potentially diluted over every equity round, it is vital for the Fund to continuously monitor these changes.

Portfolio Transition

9. Structuring Transitions: The team works on structuring 3one4 Capital's transition from the portfolio company in an efficacious manner. This involves studying the various transition models as per legal frameworks and adopting one that best meets the needs of the Fund and the company. The option is finalised based on discussions with all parties and ensuring that the stakeholder objectives are met.

10. Transition Diligence: The team works with the Company on transition diligence to ensure that the Fund's exit is in accordance with the same frameworks that underpinned capital raises at the company and that incoming investors are also aligned to similar frameworks.

11. Thought Leadership: The team works extensively on researching and refining the playbooks and frameworks that 3one4 Capital develops and adopts across its own functions as well as those of the portfolio company. Owing to the change in the regulations and varied experience of the team, 3one4 Capital can work closely with the founders and professionals to provide playbooks and frameworks in adherence to law.

GBIC FUNCTION – ESG KEY CONSIDERATIONS

While the GBIC team has various touchpoints with the portfolio company across the transaction cycle, the key considerations across the process for ESG checks/considerations are as follows:

DUE DILIGENCE	
ENVIRONMENTAL	1. Compliance with environmental guidelines and laws 2. Any licences or permits obtained from EAA in relation to the operation of the business of the company 3. Any notices received from any governmental authority in relation to violation of environmental laws
SOCIAL	1. Any incidents such as fraud, accidents, harassment complaints from employees/third party vendors 2. Geopolitical factors that may impact sourcing of core products in the supply chain 3. Assess employee and vendor background 4. Compliance with labour legislations 5. Review of data and security breaches
GOVERNANCE	1.Forensic/integrity check 2. Assess risks involved based on geographic presence 3. Directorship assessment in other companies (competitive business assessment, PEP status, etc) 4. Assess litigation status on the Company 5. Assessment of corporate structure 6. Assessment outstanding liabilities/penalties to any statutory authorities and quantum

INVESTMENT AGREEMENTS	
ENVIRONMENTAL	1. Policies for employee health and safety compliance 2. Periodic assessment of any environmental risk
SOCIAL	1. Implementation of: • Equal employment opportunity policy • Gender neutral for prevention of sexual harassment policy • Whistle blower policy • Privacy policy • Anti-money laundering, anti-corruption and anti-bribery policy
GOVERNANCE	1. Specific representations/covenants on anti-corruption and restricted list on investment into companies 2. Zero tolerance on fraud, embezzlement etc. by founders or company 3. Board representation and competence – governance committee for oversight 4. Application for relevant certifications to bolster trust and transparency in the company

MONITORING	
ENVIRONMENTAL	1. Changes in the business which may alter its pollution output 2. Assess any additional compliance requirements pursuant to any revised environmental laws 3. Assessment on reducing environmental impact
SOCIAL	1. Vendor/supply chain management and training by adherence to company's policies in relation to fraud, child labour etc 2. Encourage security testing on a periodic basis through a third party to assess vulnerabilities
GOVERNANCE	1. Work with the founders on governance practices to run board meetings etc 2. Regulatory and compliance oversight (PSA's) 3. Sufficiency of adequate internal controls based on the company's operations 4. Random checks for process implementation through third parties

Way Forward

Adoption of good governance practices and integrity checks from the nascent stages of the company fosters ESG development from all stakeholders at a faster pace. While the ESG metrics/KPIs are evolving depending on the nature and the stage of operations, the approach is finessed as the company grows. It is imperative that these are considered in the formative years such that it becomes an integral part of the culture of the company. Now more than ever, the importance of these matters from the stakeholders are to be understood to contribute to an fair and balanced ecosystem bolstering growth of companies built on right principles.

ESG Resonant Portfolio Management & Finance at 3one4 Capital

Introduction

Identify, measure, and monitor. These are the principles that the PMF (Portfolio Management and Finance) team emphasises on its portfolio companies through their journey with the firm. Be it at the time of initial screening or the final negotiation stages of an exit, a zero fault tolerance to these principles is pressed upon the portfolio company. Exponential value creation is the ultimate goal of any Fund, and the PMF team ensures this through the consistent and unrelenting adherence to these principles. The team enables 3one4 Capital to monitor and manage its portfolio companies by providing insights into business operations, validating business and operational models, and forecasting the impact of both macro and micro events on a portfolio company's financial health. The team's expertise spans the entire transaction chain for the Fund, being involved from the point of portfolio discovery to the point of portfolio transition. The team's work feeds into the Fund's management systems and allows the Fund to create strategic portfolio interventions when required to ensure that the companies possess the necessary resources to scale. The team is also at the vanguard of monitoring the financial and economic outcomes of ESG adherence and detecting areas that require deeper interventions into portfolio operations.

Pre Investment

DUE DILIGENCE

1. Scope of diligence

Traditional due diligence involves an assessment of the financial, regulatory, and operational health of a company to provide a holistic picture of the position of a business at a particular point in time to a prospective investor. The scope for such diligence has been well defined and formalised as a standard operating procedure to be applied every time a company is screened for investment.

Traditional diligence elements, however, often aren't applicable at the early stage due to the lack of any substantial operating history. Such elements fail when applied forcefully to such companies, leading to an overstatement of risk due to uncertainty. ESG, in particular, suffers in the early stage as most literature on the matter is centred around the growth stage or created with established companies in mind, not early-stage ventures.

In order to gain a more well-informed opinion across all these parameters, we at 3one4 Capital, have broadened our due diligence focus to include not only an analysis of the risks and threats that are faced by the prospective investee company but to additionally undertake a comprehensive overview of the environmental and social impact across the wider society.

We believe we are obligated to keep our fiduciaries' best long-term interests in mind through our investing strategy and post-investment monitoring framework. The fiduciaries involve not only our limited partners and investee companies but the broader ecosystem as well which is impacted by our portfolio.

The importance of sustainability and social responsibility to all stakeholders is a primary focus for 3one4 Capital,

and we have incorporated these principles into our screening and due diligence review in the pre-onboarding phase and in our continuous monitoring process post the onboarding of the company. ESG parameters have now become mainstream components in the process of investment screening and portfolio monitoring, existing as a horizontal factor across aspects of fund investment and operations.

The value of integrating ESG parameters into diligence and monitoring at the early stage cannot be underestimated. These practices are harder to integrate later in the lifecycle of a business. The consequences of ignoring these will impair capital raises and even exits for such enterprises. Our practice, therefore, has been to lay the framework of such practices at the early stage and help the companies scale it up as they progress in their journey.

2. Screening

The PMF team gets involved at the point of portfolio discovery to assess the long-term viability of the critical assumptions underpinning the company's business model. It simulates the growth and scaling potential of the business and the wider impact it can generate not only in economic terms but in terms of sustainability and non-financial value creation.

At 3one4 Capital, we have developed a tailored approach to our due diligence and business model evaluation curated on the basis of pre-assessed sectoral risks and the company's dependencies across the ecosystem.
The ultimate aim of the DD is for the firm to get a holistic view of the company being assessed and the sector in which it operates across not only financial and operational parameters but also the inclusion of Environmental, Social, and Governance considerations, to make a fully informed investment decision. To arrive at this informed decision, it is imperative we analyse the company on the following parameters in addition to traditional diligence considerations:

• The significance or materiality of ESG risks and their impact (adverse or otherwise) on the business.

• The adequacy of and implementation status of the company's management system (if already implemented).

• The company's commitment, capacity, and track record regarding ESG matters.

• The magnitude of the ESG considerations or issues identified and the resources needed to address them.

• Identification of the areas that require prioritised focus.

• Collaborative areas where the management, as well as the investor, can add value to existing ESG practices and processes or helm their creation.

• Reassessment of the viability of the business plan after taking the observed ESG and BI risks and opportunities into consideration.

• Creation of a cadence with the management of the prospective investment to have oversight and intervention on ESG matters going forward.[1]

RECOMMENDATIONS ON ADJUSTMENTS TO THE VALUATION

In a recent global survey of private equity general partners, over half (54 percent) reduced a bid price after ESG due diligence and one-third (32 percent) had increased it.[2]

Accurate determination of a company's valuation is an important step in the investment screening process. At the early stage, company valuations are mostly considered subjective due to the lack of historical financial or operational data points. There are, however, numerous validated methodologies to ascertain the true value of a company despite this lack of information. Depending on the valuation methodology adopted, these data points will include the following, among others:

- Revenue (Projected/Historical)
- Profits/Losses (Projected/Historical)
- Working capital requirements
- Market risks premium
- Risk-free rates
- The weighted average cost of capital (WACC)
- Company-specific growth rates (Projected/Historical)
- Revenue/ EBITDA multiples (Current or forward)

Valuation involves collecting and analyzing these and other ranges of metrics as well as the risks and opportunities a business faces. The goal is to arrive at a company's estimated intrinsic value at the time of screening and enable entrepreneurs and investors to make informed investment decisions.

Today, ESG has also become a significant parameter to take into consideration in the assessment of the valuation of a business.

Quantification of ESG initiatives and strategies for financial returns or value appreciation is a significant challenge today, especially so at the early stage. There is no widely recognized framework to incorporate a company's ESG performance into its valuation. Investors today are using varied and unstructured methods to incorporate ESG considerations to determine a company's valuation.

While select ESG metrics may provide an insight into the impact it may have on the financial materiality of a business, it does not enable investors to quantify the impact (adverse or otherwise) of ESG performance. To address this, 3one4 Capital has created its own ESG valuation framework in-house while using other Global standards to validate metrics selection. We have incorporated ESG risks and opportunities into our investment decision making and this, in turn, will impact the company's determined valuation.

The premium good governance commands have only recently become apparent, with sectors and countries still suffering the effects of badly run companies.

Extant ESG frameworks being mainly catered to large corporations/ public traded companies and their investors, we believe that the creation and/ or curation of ESG standards and the adoption of an early-stage ESG valuation methodology should be established for companies that do not fit the existing standardized company classification to help safeguard stakeholders' value and enhance positive long term outlooks.

One of the most widely accepted valuation methodologies is the discounted cash flow (DCF) methodology. This methodology allows an investor to value a company basis its prospective cash flows and discount these cashflows at prevailing market rates. It effectively depicts the valuation of a company today basis the expected valuation of the company in the near future. As mentioned earlier, since early-stage companies lack historical performance indicators, tying the company's valuation to its prospective cash flows is usually considered the ideal methodology to value the business.

With the adoption of ESG considerations into our valuation frameworks, the Fund can effectively implement the considerations into our DCF modelling to have a bearing on the valuation of the company.

An example of how the Fund incorporates ESG factors into a firm's valuation is to quantify ESG into risk metrics and adjust the discount rate used in the DCF valuation modelling. Hence, companies that show poor performance on ESG metrics will be considered to have a higher risk profile, and one could argue for using a higher rate of discount to accommodate the impact of these perceived risks in the DCF. The reverse holds true for companies that score well when it comes to ESG metrics.

Though quantifying the ESG risks is possible, it has its own challenges. One of the difficulties is the magnitude of adjustment basis the impact of the ESG risk. There is no standard way to ascertain with clarity the magnitude by which the discount rate is affected. The decision on the degree of quantification of the discount rate is left to the diligence professional.

Another way of integrating ESG factors in the DCF is by adjusting the future cash flows of a company. Hefty sanctions and penalties placed on a firm due to its negative environmental impact, affecting profitability, or a manpower shortage due to ill-treatment of its workforce could drive labour costs higher are examples of such factors. Another example could be the resultant higher capital costs due to the non-applicability of ESG-linked schemes to a firm which is yet to implement ESG frameworks. These are all examples of how the future cash flows of a firm could be affected and would need to be accounted for as part of the process to ascertain the valuation of the firm.

The current standards present an assessment of a company's direct impact on the environment, community, society, and its shareholders. However, they overlook a broad set of data points such as the impact of a company's technology or business model innovation, which is often even more significant for early-stage companies. These nuances must be considered while evaluating a company's holistic ESG impact.

The impact of good governance in terms of corporate culture is especially nuanced as its impact is often felt in its breach as opposed to adherence. It plays a fundamental role in value creation and value erosion. The lack of translation of these nuances into financial terms has been a practical hurdle to widespread acceptance of ESG factors in the interplay of ESG in valuation and finance.

The above considerations depict the need for a broader, more standardized quantification of ESG measures and translation of these measures into financial considerations on the firm's valuation.

INVESTMENT DECISION

At the end of the DD phase, the fund has aligned with the company on the assessed ESG risks and the way forward in this respect. It includes an implementation plan focused on improving current ESG practices or creating an action plan in the absence of such practices and the likely costs and benefits of implementing these. Post this screening, the investment proposal is prepared and presented to the Firm to make a fully informed decision which will include assessing the significance and nature of ESG impact, as well as the risks, opportunities, and likely costs to be incurred in relation to the proposed investment. The company's ability to manage and address these risks and opportunities effectively is also evaluated.

Through this approach, we ensure the following benefits to both the Fund as well as the investee company:

- Informed decision-making for the Fund through an understanding of the various risks/opportunities assessed at the time of diligence.

- Holistic understanding and formulation of the ESG framework required for the company basis its diligence findings.

- Establishment of reporting mechanisms for seamless flow and timely reporting of relevant information so as to take corrective actions as and when needed.

- Identification of ESG schemes and programmes or benefits the company could leverage to boost growth prospects and value addition to the business.

- Risk control on the reputational front and minimisation of legal exposure.

Portfolio Oversight

PREPARATION OF THE REPORTING AND TRANSPARENCY SYSTEMS

Post the completion of the investment screening, and once the investment decision has been made to move forward with the prospective investment, an open discussion between the management of the company and the Fund to outline the ESG action plan and responsibilities of the business with regard to key guidelines to be adhered to as well as the reporting requirements to be relayed on a regular cadence to the Fund is undertaken.

Utmost care is taken during this activity to ensure an open and trusting partnership between the fund manager and the management of the company. This is imperative in building value in the company because it encourages fruitful discussions and enables a company to benefit from the fund's experience.

This discussion encompasses/ achieves the following[3]:

- Establishment of governance mechanisms for ESG: At the early stage, ESG reporting mechanisms and sustainability governance are nearly non-existent. Hence, the establishment of governance mechanisms necessitates the creation of a framework from the ground up, in coordination with the management of the company, and not just an adjustment to existing governance structures.

There is no single structure for successful sustainable governance. The discovery of a curated governance structure by a company will depend on the stage the company is in with regards to its life cycle, the sectoral or societal impact areas that the company is likely to interact with, the capital allocation, and, finally, the growth prospects of the company.

In addition to the above points, the strategic influence of the leadership of the company and their commitment to the adoption of the governance structure form a significant part of the success or failure of the structure.

- Revisit ESG Due Diligence findings : As mentioned earlier, various considerations are taken into account during the investment screening process. These considerations/ risks are then quantified into the valuation of the company and act as inputs for the investor and the company to focus on the curation of the ESG framework that would be required to be adhered to and revisited on a periodic basis. Once risks are understood, and considerations have been addressed, value creation opportunities must then be modelled and prioritized.

- Alignment and implementation of the monitoring parameters and key performance indicators with the company : It is important to consult with the company and agree on the KPIs that will be used to monitor key ESG factors across the lifecycle of the investment. These metrics can help streamline the focus of the management and the employees on material business issues and help build commitment as well as track and chart improved performance. The KPIs may need to be revisited at regular intervals as the company, and its business will likely evolve over a period of time.

- Set up a regular cadence for reporting key performance indicators and benchmarking against defined ESG action plans : The periodicity, content, and format of such ESG monitoring reports will depend on the prevailing scale of operations. On the basis of discussions with management and the relevance of the impact of the ESG factors on the particular field that the business operates in, a schedule with regard to reporting can be fixed and formalised.

MONITORING FINANCIAL, OPERATIONAL, AND ESG ADHERENCE

Regular reporting is a very helpful tool for monitoring a company's ESG improvements and setbacks. Companies (especially early-stage start-ups) may not have the reporting framework in place to provide an elaborate report or updates on pre-discussed ESG parameters. Depending on the scale of operations and the company's internal capabilities, we curate reporting requirements and timelines to ensure regular reporting.

Reports provide us with a summary of the company's ESG performance, including progress against the ESG action plan and KPIs. The frequency and depth of the reports are adjusted according to the level of ESG risks and the company's ESG management capabilities. This will grow over the period of our investment, such that formal reporting becomes less cumbersome to the company over its life cycle and cover wider long-term targets.

A review of the reports provided takes place on an ongoing basis throughout the life of the investment. The PMF team works closely with the company to better understand the progress made against each of the KPIs and deep dives into the headwinds and/or tailwinds that impact the company. The team will leverage this information to realign the initially curated ESG action plan and rebalance the company KPIs on a consistent basis. The main objective of this is to build a regular cadence of ESG reporting, a self-evaluation, and understanding by the company of its impact on the ecosystem and a consistent track record of improvement across various aspects of the company's ESG focus.

ENSURING SCALABLE EXPANSIONS

ESG and the changing investment thesis around ESG are forcing a rethink on prevailing business models. The proof that business models built on the principles of environmental consciousness, societal consideration, and financial priorities can realistically translate into positive financial returns are compelling founders to transform their existing models.

As per a McKinsey Global survey, 83 percent of C-suite leaders and investment professionals say they expect ESG programs to contribute more shareholder value in five years than today. They also indicate that they would be willing to pay about a 10 percent median premium to acquire a company with a positive record for ESG issues over one with a negative record.[4]

This is no longer about perceived value creation; quantification of these ESG principles is now clearly visible.

Through the constant adherence and systematic review of the agreed-upon ESG paradigms, the company can create exponential value for all stakeholders involved on the following fronts:

- Revenue acceleration
- Effective cost reduction
- Reduced regulatory hurdles
- Transition alignment

Portfolio Transition

INFORMING TRANSITION DECISIONS

Due to ever-changing consumer preferences, regulatory and compliance frameworks, and the perception of what constitutes a sustainable business model, Private Equity and Strategic Acquirers have altered their investment thesis to fit this dynamically changing environment.

A previously niche scope of diligence has now been converted to a mainstream focus. With this clear shift in focus to sustainable investing, these market players now view companies under a differentiated diligence lens. The PMF team focuses on aligning our portfolio companies to fit this scope of diligence.

Through constant monitoring and adherence to preset objectives, the PMF team prepares the companies to be ESG due diligence ready at the time of its transition. Our deep involvement strategy with the portfolio enables us to guide the company and systematically provide course correction measures, if necessary, during the monitoring phase.

The team understands the sectoral nuances of each company and leverages their experience to provide guidance on a granular level to help showcase the value creation that can be brought about by aggressively pursuing ESG objectives.

ESG-aligned Growth and Capital Development at 3one4 Capital

Introduction

Growth and Capital Development (GCD) at 3one4 Capital is a unique function that closely partners with portfolio companies to drive revenue, business model and geographic expansion, and navigate capital raise or exit processes most efficiently with the best priced and structured outcomes. GCD manages 3one4 Capital's global network of experts, investors, bankers, and academic partners that it actively leverages on behalf of the portfolio. The team identifies and creates unique market linkages across sectors, connecting portfolio companies with appropriate, vetted strategic partners from within this network. The GCD team also works to continuously surface market intelligence across the 3one4 Capital ecosystem to enable the portfolio companies to anticipate emerging market opportunities, map the competitive landscape, support strategic decision-making, and manage processes and pricing during capital raises or M&A.

At 3one4 Capital, sustainable investing goes above and beyond capital deployment. At scale, the 3one4 Capital-portfolio products and services could have an outsized impact on society, often in ways that are unforeseeable during its formative years. GCD strives to enable the early and growth stage portfolio companies to become the next generation of enduring and sustainable global champions. The team views ESG as central to its work in delivering more substantial returns across the portfolio and believes that enabling deep alignment and adoption of ESG principles across growth and capital development life cycles is crucial in developing resilient companies.

Global Market Data on ESG Investing and Partnerships

The GCD team actively leverages information from deep market research and thousands of interactions with partners to identify shifts and emerging trends in global sentiments across public and private markets. This, in turn, continuously informs the team's tactical interventions with the founders to ensure a competitive advantage for their respective companies.

Over the past few years, the team has found that the internal responsibility and commitment of 3one4 Capital towards ESG leadership across the portfolio finds deep resonance in the market data from the GCD global investor and partner network.

ALLOCATIONS INTO ESG-COMPLIANT COMPANIES ARE ACCELERATING IN INTENT & QUANTUM

Across the globe, stakeholders in public and private markets are witnessing an increase in investment allocations, valuation premiums, and preference in M&A for ESG-compliant companies. A global survey of 500 asset managers and institutional investors indicates that ESG assets are on track to comprise 21.5% of total global AUM in less than 5 years.[1] Additionally, BNP Paribas highlights that close to 75% of the surveyed asset owners and 62% of the surveyed asset managers allocated more than a quarter of their funds towards ESG in 2019.[2]

While the recent trends in private market investments have been harder to capture quantitatively, the GCD team, has seen a marked acceleration in intent and allocation by large global private investors toward ESG-focused startups. Companies that are ESG focused from an early stage enjoy greater interest from growth and late-stage investors. These funds are beginning to rely on aligned early-stage funds to lay the groundwork of sound practises, thereby allowing them to build upon a strong foundation. Additionally, given the long-term nature of private market investments, investors see ESG stability as an increasingly critical factor alongside financial metrics to optimise the risk-return profile of their respective portfolios.

ALIGNMENT OF GROWTH WITH ESG

ESG factors reflect the long-term prospects of a company including its financial performance, resilience, and ability to sustain itself during adverse situations. Here's a close look at how global indices have performed relative to indices that were screened for ESG values as shown in Figure 1.

"The Morningstar U.S. Sustainability Leaders Index—representing the 50 U.S. companies with the best ESG scores—made returns of 33.3% over the year, beating the broader U.S. market by more than 8%. Six out of the ten U.S. sustainability indexes beat their benchmarks over the trailing three-year performance period, as did seven over the five-year period."[3]

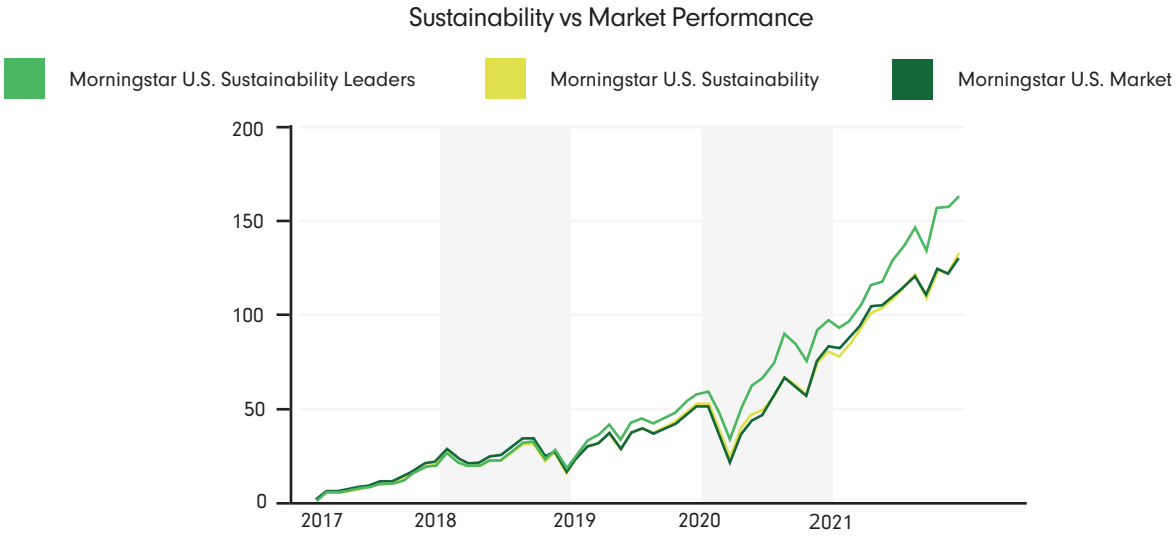


Fig 1: Morningstar Direct & Morningstar Indexes benchmarking market performance and sustainability.[4]

MSCI ACWI	MSCI ACWI ESG Screened	MSCI ACWI ESG Universal	MSCI ACWI ESG Leaders	MSCI ACWI ESG Focus	MSCI ACWI SRI	Time Period
19.0	19.2	20.5	21.3	18.8	24.5	1 yr
21.0	21.7	22.3	21.8	22.0	25.0	3 yr
15.0	15.4	15.8	15.5	15.8	18.0	5 yr

Fig 2: MSCI ACWI Index vs related ESG indices[5]

"Researchers from MSCI examined the performance of the MSCI All Country World Index, which included more than 2,900 large- and mid-cap stocks, and compared the performance with five ESG versions of the index."[6] All but one of the ESG indices outperformed MSCI's flagship global equity index (ACWI) in 2021.

In addition to its positive effects on the environment and society, sustainability is very much rooted in risk management and healthy investment returns. Lower expected returns, inability to scale and lack of significant value-add through ESG integration are myths that ESG-aligned companies have challenged, globally. This is further corroborated by studies that suggest there is a positive correlation between ESG adoption and improved performance on conventional benchmarks:

• **Market penetration and expansion-** Adhering to ESG protects companies from adverse regulations. In addition, they are more likely to receive support from the government and, as a result, rapidly expand in the existing market and tap into new markets.

• **Consumer trust-** Consumers are now keen to see companies solidify their ESG efforts. As shown in figure 3, a study of 6,500 consumers and employees across 4 countries and 15 global companies found a correlation of 0.87 between trust and perceived ESG performance; this indicates a positive link between the two variables.[7]

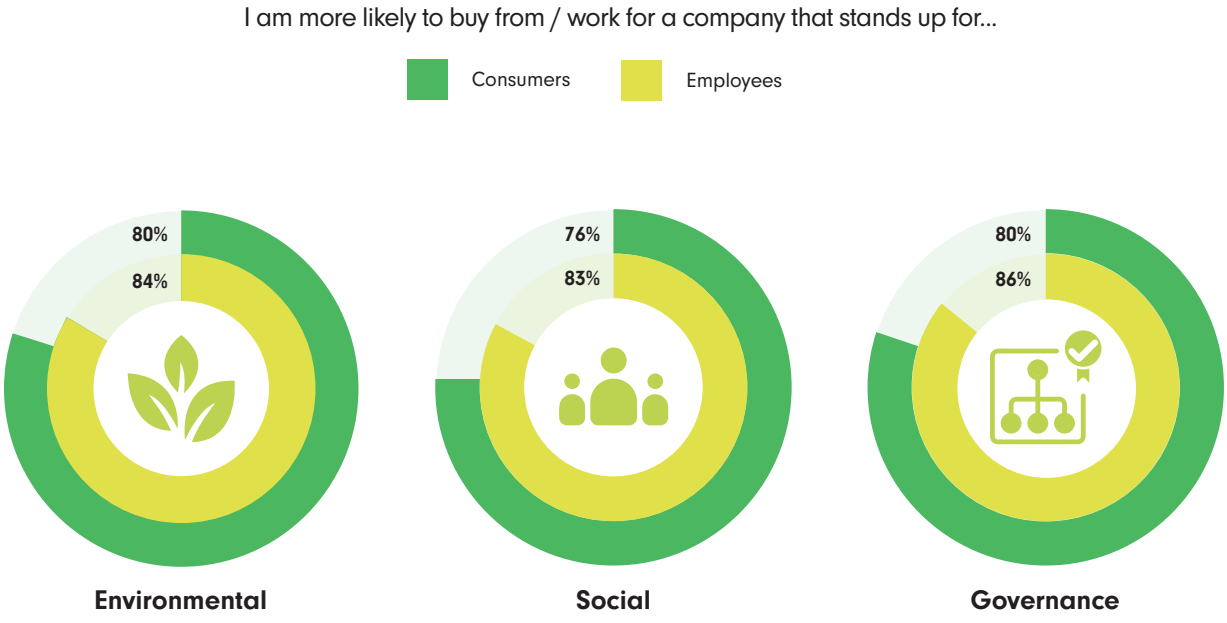


Fig 3: A survey conducted by PWC reveals that ESG commitments are driving consumer purchases and employee engagement. [8]

• **Pricing flexibility-** Due to the rising consumer affinity towards sustainability, consumers are willing to pay a premium for products and services of ESG-compliant companies. Research highlights the influence of ESG on consumers' buying decision and their willingness to pay; consumers were surveyed on purchases made across industries like automotive, electronics, and packaged categories, where 70% were willing to pay an extra premium of 5% for a "green" product that met their performance standards.[9]

• **Resource efficiency -** Across sectors, there is a strong correlation between resource efficiency (like energy and water consumption, and waste reduction) and financial performance. Research indicates that operating expenses such as raw material costs and the true cost of water or carbon can affect up to 60% of operating profits.[10] Integrating ESG can result in resource efficiency for businesses over the short, medium, and long terms, such as reduced operational costs, improved readiness for resource shortages and regulatory changes, and enhanced brand reputation.

IPO READINESS WITH ESG

Over the past decade, the role of ESG has become a critical factor for stakeholders at the IPO-readiness stage. In Q3 2021, ESG was referenced in 17% of all Form S-1s submitted during the quarter, a ninefold jump in just 18 months.[11] Companies with strong ESG practices are increasingly seen as enablers for improved financial returns, stronger brands, and wider competitive moats and can access a broader pool of investors post-IPO. Additionally, they can seek the following beyond investor interest:

1. Consumer trust: Millennials and Gen Z comprise a significant chunk of the consumer base, and they value a company's efforts toward the overall betterment of the environment and society. More than 70% of millennials and Gen Z value sustainability over brand name while making a purchase.[12]

2. Better market reputation: By incorporating ESG, a company is transparent in its communication and disclosures. This, in turn, fosters a positive market sentiment.[13]

3. Increased employee retention: In addition to the consumer base, both millennials and Gen Z form a large section of the workforce. This workforce is scouting for jobs at companies that have a strong commitment towards corporate governance.[14]

Early-stage businesses that are aiming for an IPO must integrate ESG strategies around their main business model and thereby contribute to a more sustainable economy and generate long-lasting positive impacts.

CRITICALITY OF ESG IN M&A

In a recent global survey of M&A executives, while only 11% claimed to extensively assess ESG during an M&A process in 2022, 65% of the respondents expected an increased focus over the next three years.[15] More than half of the respondents witness ESG leadership as justifying higher valuations or are expecting this to be the case in the near future. A Fortune study reveals that ESG has gained heightened relevance during M&A transactions for the following reasons:[16]

1. Selection of potential targets: While assessing a potential company for M&A, the acquirer seeks companies that would improve their own ESG capabilities/score.

2. Due diligence: Acquirers evaluate new opportunities and quantify various risks and opportunities through a social, environmental, and government lens, along with financial indicators.

3. Post-merger integration: ESG adoption can have a positive impact during the post-merger integration stage of the M&A process. Corporate culture and governance play an outsized role while realizing synergies between the two firms.

Private companies' M&A transactions are increasingly using ESG-linked performance indicators in management's compensation and earn-outs for exiting shareholders as effective tools to help promote stakeholder alignment.[17]

ESG-FORWARD VALUATION FRAMEWORKS

In light of the tightening regulatory environment and rapidly evolving standards regime across the globe, as discussed in previous sections of this report, companies working at the forefront of responsible inclusion, championing environmentally sustainable solutions, and instituting transparent and responsive governance structures stand to gain a distinct advantage in the coming years.

As per the EY survey, the International Valuation Standards Council (IVSC) recognizes ESG as 'pre-financial' information rather than 'non-financial' information.[18] This is influenced by the strong interconnectedness between sustainability and the financial market. The financial scores on investments are now integrated into an overall ESG score that directly impacts the valuation of each company. The target price increases for a company with a high overall ESG score. This remains unchanged for a company with an average overall score and is mostly reduced if a company has a weak overall ESG score.

Higher ESG scores lower a company's cost of capital by increasing the premium they command in the capital markets. This creates an indelible financial link for a historically non-financial metric, depicting the changing market sentiment that is buoying responsible investing. Top ESG performers earn valuation multiples that are between 3% to 19% greater than those of the median performers in those areas.[19] In comparison to their low-scoring peers, companies with an effective ESG strategy are more than twice as likely to perform in the top two quartiles of ten-year total shareholder return performance. C-suite leaders have indicated that they would be willing to pay about a 10 % median premium to acquire a company with a positive record for ESG issues over one with a negative record.[20]

Premiums applied to exemplary companies are not as significant as discounts applied to companies with poor sustainability risk profiles.

IHS Markit's research suggests that the downside risk is greater for target companies than the upside potential and that a negative ESG assessment is likely to have a significantly adverse impact on the business valuation.[21]

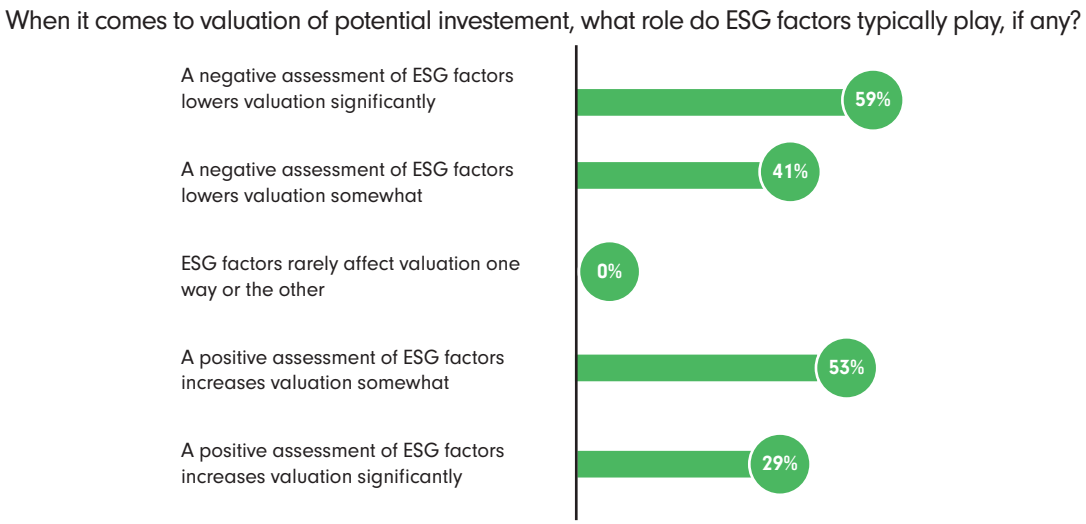


Fig 4: A survey conducted by IHS Markit on the correlation between ESG factors and a company's valuation[22]

Research and representations from a number of firms, including Carlyle and KKR, have increasingly observed valuation premiums for business models that reflect ESG best practices. Credit rating agencies S&P Global Ratings (S&P), Moody's, and Fitch Ratings have integrated ESG considerations into their models, and financial data providers like MSCI, Bloomberg, and Refinitiv have also established their ESG scoring systems—as discussed in the regulatory overview section— which serve as robust indicators and references in performing market comparison for public companies.

GCD across the Business Lifecycle

The GCD team has consistently unearthed data from numerous markets and stakeholders that strongly indicates that ESG will underpin the future of sustainable innovation. GCD has taken a lead in contextualizing this across the lifecycle of the portfolio and works closely alongside 3one4 Capital's upstream network of founders to recalibrate companies' business models, define growth strategies, and open up strategic networks.

PRE - INVESTMENT

GCD facilitates a virtuous feedback loop to the sourcing and investing process by placing a potential portfolio company in the wider context of the market, i.e., investor mindset and trends across business models and sectors. The team analyzes the critical indicators that would lend companies credibility across the consumer and investor spread, and lays out a detailed roadmap right from the company's evaluation to 3one4 Capital's investment to exit via IPO or acquisition.

With deep roots in continuous macro-economic and thematic research, especially across emerging markets, the team is aware of the evaluation matrices undertaken by various investment firms and how they are embracing an ESG lens during their diligence processes. Further, GCD conducts extensive investor-ecosystem mapping and broadens the pool of capital for an ESG-focused company. For example, while carrying out the due diligence for Rozana, a peer-enabled social commerce platform, the team identified a larger set of impact investors due to Rozana's commitment towards democratizing e-commerce to address the needs of rural India and the company's diverse organization structure, i.e., a woman-led founding team and a peer network that predominantly comprises of women.

As a result, GCD has an integral role in helping 3one4 Capital adopt a 360-degree view of a potential investment opportunity which further prepares the Firm to align and build a long-term relationship with the company.

ALIGNMENT OF GROWTH AND ESG

One of the key roles that GCD plays is in supporting companies in realizing their long-term vision while balancing steep short-term growth goals. At 3one4 Capital, we strongly encourage that the company's vision must focus on value creation for all its stakeholders rather than just its shareholders.

Post 3one4 Capital investment, the team mobilises internal resources to preemptively integrate ESG into the portfolio's business plan and help the company realise its ESG impact within its current operational environment. For example, the team identified metrics that capture a company's commitment to social inclusion like the number of female users for SALT (a financial planning and investment management platform for women), first-time digital transacting users for KuKuFM (an audio streaming & sharing platform for regional content) and the number of borrowers beyond tier 1 cities for WeRize (a financial super app for families/individuals of small Indian cities).

Larger businesses often impose strict ESG regulations on their suppliers and stakeholders to strengthen their own stance towards sustainability. Therefore, adhering to ESG has a significant impact on securing partnerships with these businesses in order to drive top and bottom-line growth. The team collaborates directly with the companies to help bring their business models closer to ESG compliance resulting in revenue generation, cost-optimization, and risk mitigation at the same time. A strong environmental, social, and governance (ESG) proposition links to value creation in multiple ways:

Value Creation (FY 2023)	GCD Initiative towards ESG	Number of companies impacted
Revenue growth	Attract B2B & B2C customers with more sustainable products. Achieve better access to resources through stronger community and industry relations	**40**
Cost optimization	Lower energy consumption and minimised carbon footprint. Offer curated technology partners resulting in cost reduction.	**22**
Uplift	Attract talent through social credibility and differentiated branding. Better outcomes driven by collaboration tools	**18**
Access to sustainable capital	Strategically aligning companies and follow-on investors, ensuring greater ESG synergy	**35**

Table 1: GCD's ESG-driven initiatives towards the growth 3one4 Capital's portfolio companies. Source: 3one4 Capital Research

Project Capra

GCD is working closely alongside Licious to help them optimally leverage their existing network of Farmer Producer Organizations (FPO) in order to build a capital-efficient supply chain that would enable the company to catapult its growth and social impact.

Licious had seen its revenue grow at 9% MoM from Mar' 17 with an accelerated growth of 21% MoM through the initial period of COVID-19. However, post- COVID, the company was able to meet only 65% of its consumer demand.

At this juncture, GCD proposed an initial pilot of a blended model where Licious leverages government and PSU relationships to support an Aggregation and Holding/Fattening model via a partner FPO. This project is aligned to nudge the company to become a Sustainable Development Goals (SDG) champion by taking into consideration 7 specific goals that the company could focus its attention through Project Capra and beyond.

Licious is well poised to deeply impact the SDGs and deliver a playbook for sustainable development and scale through multi-stakeholder partnerships.

This project will enable Licious to realize the following:

• Assured, consistent supply for a bulk of the mutton demand; ability to control pricing and supply volatility.

• Increased quality of lamb/mutton protein and lower rejection rates through implementation of better rearing practices, higher quality feed at lower negotiated prices etc.

• Enhanced ability to negotiate lower costs (~10%) and credit periods for the meat supply.

• An established negative working capital structure in partnership with PSUs that can provide for the working capital that the FPO needs to service an account like Licious'.

• Capex light model to scale supply - make FPO attractive/more credit-worthy to institutional capital by underwriting via assured demand and enable the FPO to invest into scaling up supply instead of Licious directly bearing the costs.

• Deep relationships with state and local governments. Leverage FPO relationships to build trust in the local ecosystem with farmers and intermediaries.

• Internal intelligence and sustainable playbooks for scale across the country and across SKUs potentially through new FPOs that the company directly seeds/ helps create.

In addition, Project Capra has a strong value proposition for FPOs. At a higher level, the model is designed around Licious partnering with local FPOs with whom it had a prior relationship. Through this collaboration, FPOs will be assured a 40% increase in their demand aggregate supply and support on marketing and capital access. This will also help FPOs leverage and attract government support efficiently.

With the successful implementation of this project, Licious will be able to secure a sustainable model of partnership with FPOs, helping the company further consolidate its market leadership.

Fig 5: 7 specific goals that Licious can focus its attention on leading, through Project Capra and beyond.[23]

RESILIENCE OF ESG COMPLIANT COMPANIES

Additionally, ESG-compliant ventures have proven to survive boom-bust cycles better. COVID-19 brought to the forefront the need for resilient and sustainable business models. The team's emphasis on sound governance practices, a mix of socially-forward hiring and retention frameworks, and fostering a mission-led culture helped the portfolio weather pandemic-related dislocations without compromising on the delivery of services. A few examples of this resilience include:

YULU

Through a timely enhancement in its business model, Yulu transformed into a B2B clean mobility platform along with its existing B2C offering. The company became the partner of choice for businesses like Licious and BigBasket for delivering essentials during the pandemic. Their processes scaled with demand, and the effective allocation of resources helped fulfil the need for sustainable delivery with a low-carbon footprint. This pivot has led to the creation of a critical part of the future strategy of the company: intentionally servicing gig workers across the country to access inclusive, seamless and cost-efficient modes of last-mile logistics.

Fig 6: Representation of initiatives undertaken by Yulu during the pandemic. Source: Yulu

KOO

As Koo witnessed a meteoric rise in users over the pandemic, it also served as a means for contextual news and information for the country's citizens in their own local languages. This enablement that was activated during the pandemic has had a lasting effect, establishing Koo as one of the leading sources of trusted, crowd-sourced, local information across India.

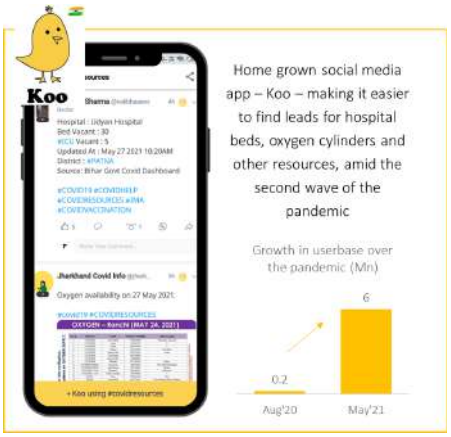


Fig 7: Koo's platform enabled the discovery of essential resources during the COVID-19 crisis. Source: Koo

BETTERPLACE

During the pandemic, BetterPlace, in collaboration with the Government of India, built an AI-based skill management portal—bridging the demand-supply gap in the skilled workforce post the migration of workers to their villages. This helped in providing employment opportunities to millions of people who had lost their jobs. Post the pandemic, this venture has enabled blue-collar workers to continue to upskill and manage active job migration decisions via the platform.

Fig 8: A sample dashboard of the Aatmanirbhar Skilled Employee Employer Mapping (ASEEM) portal developed by BetterPlace and the Government of India amidst the pandemic (left) and the utilization metrics of ASEEM (right). Source: BetterPlace

PORTFOLIO AS A LINCHPIN DRIVING AN ESG-DRIVEN ECOSYSTEM

The team constantly identifies intersectional opportunities within the portfolio base to create value both in terms of commercial and non-commercial growth. ESG leaders within the portfolio are driving deeper ESG adoption across their vendors and partners creating a compounding effect for the entire ecosystem. The team has closely observed and measured the impact of this within the portfolio. For example, while 50% of Yulu's revenue is derived from marquee B2B institutions such as Zomato, Swiggy, etc. thereby enabling wider EV adoption, Licious, one of 3one4 Capital's growth-stage companies, is leveraging Yulu's electric bikes for their delivery fulfilment.

GCD is also driving closer synergies across the platform in the form of feedforward mentorship connections. As mature ESG-compliant portfolio companies continue to establish new market standards, their mentorship to early-stage and smaller portfolio companies becomes invaluable. They share best practices which accelerate the ESG journeys of the latter.

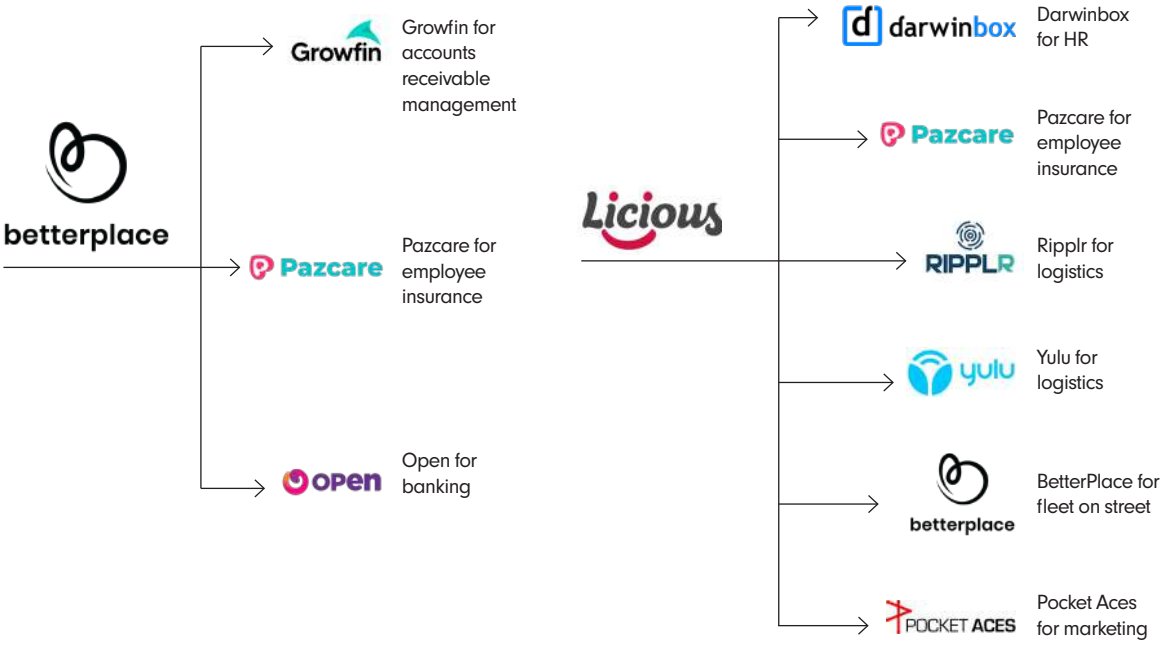


Fig 9: Representation of 3one4 Capital's portfolio synergy. Source: 3one4 Capital Research

Sustainable Capital Development

The GCD team's main objective is to accelerate the growth of portfolio companies, a core part of which includes securing companies' access to long-term quality global capital that underwrites their sustainable growth. Onboarding strategically aligned investors looking to achieve goals beyond monetary return has a monumental impact on the portfolio. With the right partners, founders can build resilient companies and gain credibility from stakeholders including potential customers, growth investors, suppliers, and strategic business partners to realise dramatically better business outcomes.

ESG ACROSS CAPITAL PARTNER NETWORKS

GCD plays a pivotal role in evangelizing ESG among the investor community and the startup ecosystem. For follow-on rounds, the team works actively to connect the portfolio companies to high-value investors that provide them with a sustainable pool of capital and are aligned with the company's vision and principles. Further, these discussions have promoted the adoption of non-commercial KPIs, tracking misuse of platforms, and building policies around ethical pricing during the decision-making process for investors during the next round of funding.

In addition, the team promotes informed credit and insurance underwriting decisions and also educates the ecosystem on how companies with good governance, strong work culture, and social awareness have a sustainable competitive advantage over others. This has led 3one4 Capital's partners in the financial sector to plan and deploy special budgets for sustainable finance as well as encourage portfolio companies to commit to sustainability by setting clear performance goals related to ESG.

Companies with business models that are more aligned with societal needs and progress are better positioned to thrive in the market, and these are the companies in which sustainable investors seek to invest. As their strategic partners, GCD helps portfolio companies articulate a compelling, data-led ESG story - a strategic narrative that incorporates audacious goals, concrete steps, and transparent progress. This enables businesses to establish a strong competitive positioning across financial partners and helps them win a higher wallet share with key investors.

While approaching potential investors for the portfolio's follow-on rounds, GCD actively articulates the relationship between sustainability and conventional factors such as quality and low volatility. The team by its involvement in exploring synergies among investors, bankers and startups is also playing a crucial role in spreading awareness about ESG amongst a much broader community.

Partnering with companies who share 3one4 Capital's dedication toward ESG excellence

AXIS BANK

Axis Bank, one of India's largest lenders, has embedded ESG across its core functions and initiatives, which enables not only sustainable growth for the bank itself but also ensures true value-creation for all its stakeholders in the ecosystem.

Given Axis' ESG-driven strategy, in 2021, they partnered with 'The Private Infrastructure Development Group (PIDG)' guarantee arm, GuarantCo with a goal to catalyze EV adoption in India through a program size of USD 300 million.[24]

All the qualified loans to the borrowers by Axis bank are to be partially credit-guaranteed for up to a maximum of 10 years. Within this agreement, the loan proceeds will be utilized for greenfield CapEx in EV infrastructure under the following categories:[25]

1. Manufacturing and distribution of EVs, batteries, components, and charging infrastructure

2. Services that are based on EV usage or/and services that are for the EV-sector

3. Finance companies that are providing financing for the purchase of EVs by consumers

To expedite Axis Bank's efforts, GCD helped Axis and Exponent, 3one4 Capital's portfolio company, explore synergies to further foster the EV ecosystem in India. Exponent is on the path of making EV adoption mainstream in India through its proprietary charging infrastructure, pack construction, and charger electronics. GuarantCo and Axis are striving towards sustainable goal achievement by bridging the funding gaps for EV infrastructure in India's sunrise sector of e-mobility. GCD is constantly searching for these partnerships and initiatives where both the portfolio and partner can mutually create value while reducing the overall carbon footprint.

KukuFM

Primary Objective: Engagement with investors and DEI (diversity, equity and inclusion)-integrated narrative curation

Background: Since 2018, Kuku FM's mission has been to leverage the power of audio and the human need for companionship to create deep and engaging relationships in an increasingly fragmented and isolating world.

Most often, audio content and podcasts are used interchangeably. However, podcast as a form factor is a very small segment of the audio industry. Podcasts are simply capsular content in audio, comprising mostly talk shows. Every episode is complete, it has a sense of finality to the content. Audio in its truest form is very vast. One can listen to audiobooks, educational courses, children's stories, live audio, short/long-form content, and even daily soaps that can seemingly go on forever.

It was crucial to highlight this key difference since Kuku FM's target market was consumers of audio content which, in turn, proved to be a substantially large TAM, comprising tier 2 and 3 India.

GCD helped with the positioning of Kuku FM (beyond a podcast or an audio FM) and built a narrative around the deep value addition provided by Kuku FM's platform, which addresses the rising content consumption needs of the aspirational audience beyond tier 1 India. The company currently offers regional-language content under multiple categories including fiction, educational courses, spiritual content, etc and plans on further diversifying across the board.

In addition, the company is supporting budding content creators to meet their true potential; with Kuku FM's proprietary technology, smartphone owners can create content without investing in hardware/tools and establish additional sources of income. Using their platform, users can create diverse content that resonates with audiences across India and brings communities together.

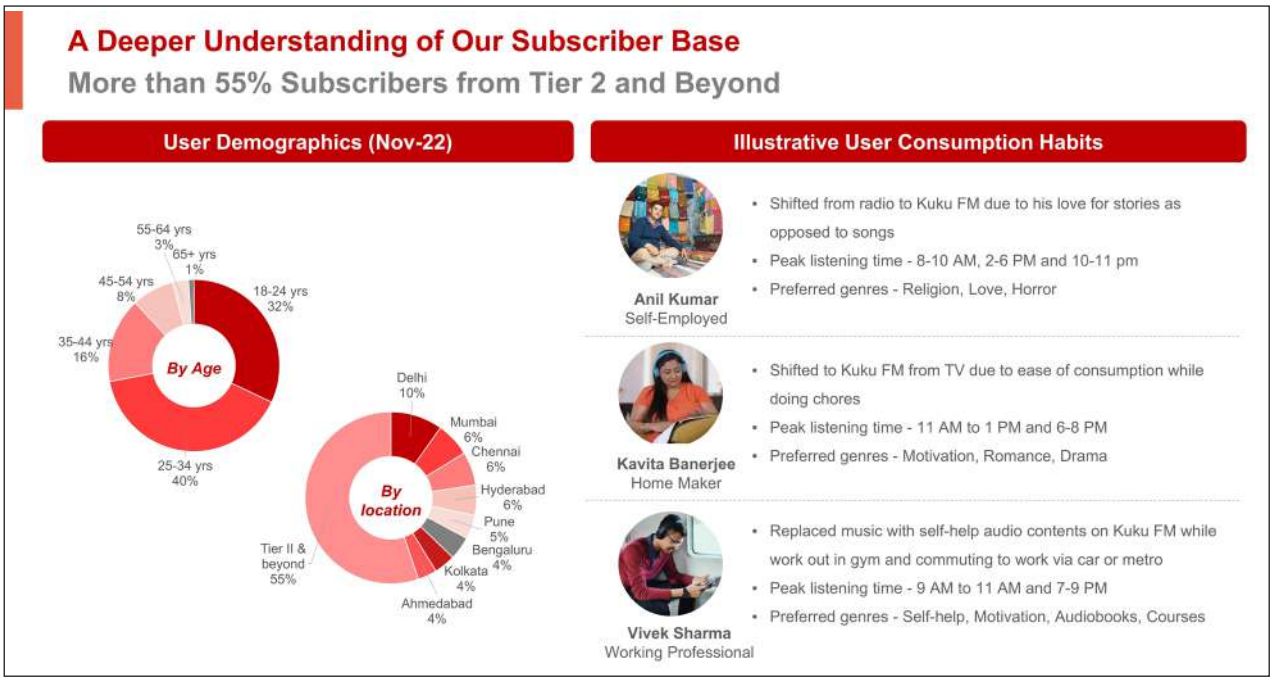


Fig 10: Kuku FM's current user base across demography and consumption behaviour | Source: Kuku FM

Outcome: The company's well-defined vision towards becoming India's leading digital audio platform for regional content has helped them secure investments from marquee institutions like Fundamentum Partnership, Google, and Krafton. In addition, the company has witnessed exponential growth; as of Oct '22, Kuku FM has 2M+ paid subscribers and is realizing an average listening time of 65 minutes per user per day.

Current Status: The company will continue to work towards this objective with ongoing support from GCD and the board.

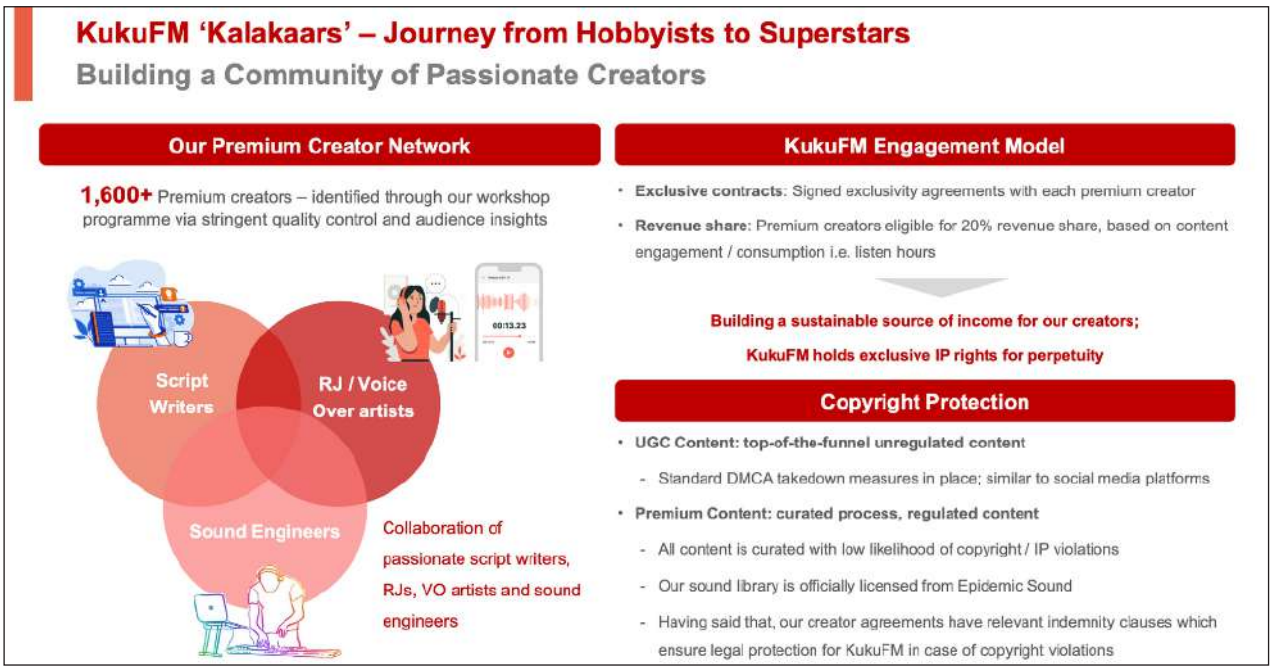


Fig 11: Kuku FM's creator programme. Source: Kuku FM

FASAL

Primary Objective: Enhancing crop yields & access to agriculture credit within the Small & Medium farmers (SMF) segment

Background: India is the second largest producer of fruits and vegetables in the world.[26]

India's agriculture technology advancement if utilized correctly presents an excellent opportunity for sustainable & equitable growth alongside improved livelihoods for farmers.

Fasal has developed an IoT-powered AI platform to provide farm-level, crop-specific, and crop-stage-specific actionable intelligence for fruits, vegetables, spices, and plantation crops. It captures real-time data on conditions from on-farm sensors to deliver actionable recommendations to farmers via mobile phones in regional languages through the Fasal App available on iOS, Android, tablet, and the web. Fasal has currently deployed this technology on more than 75,000 acres of farmland across India in crops such as Grapes, Pomegranate, Chilli, Capsicum, Tomato, etc. By deploying the services provided by Fasal, farmers are able to generate a 22% increase in the yield per/acre (MT) than non-Fasal farmers. This eventually translates into an additional 4.5 MT of total farm yield at the conclusion of the harvest season. A Fasal farmer on average receives an incremental income yield of INR 15 per/kg of the produce sold at the agri-markets, resulting in a net 20% increase in the gross revenue generated.

After years of actively collaborating with farmers across the country, Fasal is now on a mission to address the wide financing opportunity in Indian agriculture, wherein only 30% of all Indian farmer households borrow from formal sources, while~50% of SMF are unable to borrow from any source.[27] Priority Sector Lending (PSL) is a major policy initiative instituted by the RBI to ensure an adequate flow of credit to sectors of national priority, especially

employment-intensive sectors like agriculture.[28] Despite the presence of numerous such schemes for over two decades, farmers have still faced low degrees of access to formal banking services. [29]

GCD is actively liaising with Fasal to develop an extensive framework that will serve to empower and support farmers across the credit cycle. This will entail an assessment of the harvested crops, the sale of the crop produce in the markets, and procurement of credit lines from the banks for agricultural purposes. This model will focus on the SMF segment, members of which often find it difficult to qualify for the traditional due diligence processes of banks, which requires stringent documentation and collateralization.

In collaboration with GCD, Fasal will thus help farmers meet their needs in terms of short-term and long-term credit/financing requirements, manage their post-harvest expenses, meet the consumption requirements of their households, streamline working capital maintenance, and procure credit requirements for agriculture and allied activities.

Outcome: By deploying Fasal's services, farmers now receive a surplus of 45%+ in net sales proceeds generated at comparatively lesser costs. The program being developed by GCD & Fasal will enable farmer access to structured credit proceeds that will allow them to mitigate the financial shortcomings they traditionally face during the harvest cycle.

The economic growth of farmers will thus serve as an inflection point within the Indian agriculture ecosystem which will further augment Fasal's long-term goals, viz making precision agriculture accessible to all farmers in India and across the globe.

Current Status: Fasal is actively collaborating with stakeholders involved in order to amplify crop productivity & agri-credit accessibility within the Indian landscape.

Fig 12: Fasal's sustainable development goals. Source: Fasal

BUGWORKS

Primary Objective: Unlocking a broader pool of impact-driven investors

Background: Bacterial infections are growing increasingly resilient to antibiotics, thereby posing a global public health hazard in the form of increasing mortality and morbidity, and prolonged hospital stays, eventually leading to ballooning healthcare costs. Globally, approximately 700,000 people die due to AMR every year, and estimates suggest that the death toll could reach ~10 million by 2050.[30] Additionally, the pandemic has fuelled the surge in antibiotic-resistant "superbug" infections that has deferred the progress made in combating Antimicrobial Resistance (AMR) by years.[31] Emergence of such infections has made newborn sepsis highly dangerous. In India, sepsis accounts for 20% of the country's 1 million neonatal deaths, of which 58,000 deaths are due to AMR.[32] The proposed SDG (Sustainable Development Goals) target set by the UN aims to end child mortality by 2030.[33] Hence, addressing

AMR would be crucial for India to strengthen its efforts to reduce neonatal mortality and uplift its SDG ranking.

Since 1960, no new novel broad-spectrum antibiotic molecule with high efficacy has been developed and launched, with most antibiotics being variations of existing antibiotics drug classes. The big pharmaceutical players have typically looked away from this market due to the limited lifespan of drugs (given the rapid emergence of resistance), increased cost of R&D, and the low cost of antibiotics. Hence, they have developed an affinity towards high-priced therapeutics-driven R&D while shying away from AMR-related R&D.

Bugworks has developed a highly differentiated, dual-targeting, broad-spectrum novel chemical entity (NCE) that exhibits potent killing of pan-resistant superbugs. The company has advanced in its clinical development path and has entered the Phase 1 studies of clinical trials. Additionally, Bugworks is actively engaging with the AMR ecosystem to explore Phase 2/3 development opportunities. In line with their AMR research, the company is well-positioned to create new benchmarks for modern medicine and diversify across the medical-infra value chain.

The founders' commitment towards tackling the global AMR crisis while democratizing access to proprietary medicines for low and middle-income countries, lowering the DALY (Disability Adjusted Life Years) burden from bacterial diseases, and contributing to the overall sustainability of health and public infrastructure of cities helped Lightrock (a marquee global impact-driven private equity firm) to build conviction that Bugworks is uniquely capable of delivering this outcome. Investing in Bugworks reflects Lightrock's prudent foresight and its focus on embracing long-term gains over short-term wins.

Outcome: GCD led the closure of one of the largest growth equity deals in the drug-discovery space in India by identifying and mapping the investor ecosystem for Bugworks. In addition, the team played a pivotal role in building Bugworks' reputation across the investor spread which further helped them secure funding from Lightrock. The team constantly strives to identify partnerships where investors and founders are strategically aligned and can mutually work towards meeting impact outcomes while scaling globally.

Current Status: A partnership with Lightrock has enabled Bugworks to gain global exposure, and the company will continue to strengthen its commitment to balancing financial and impact goals.

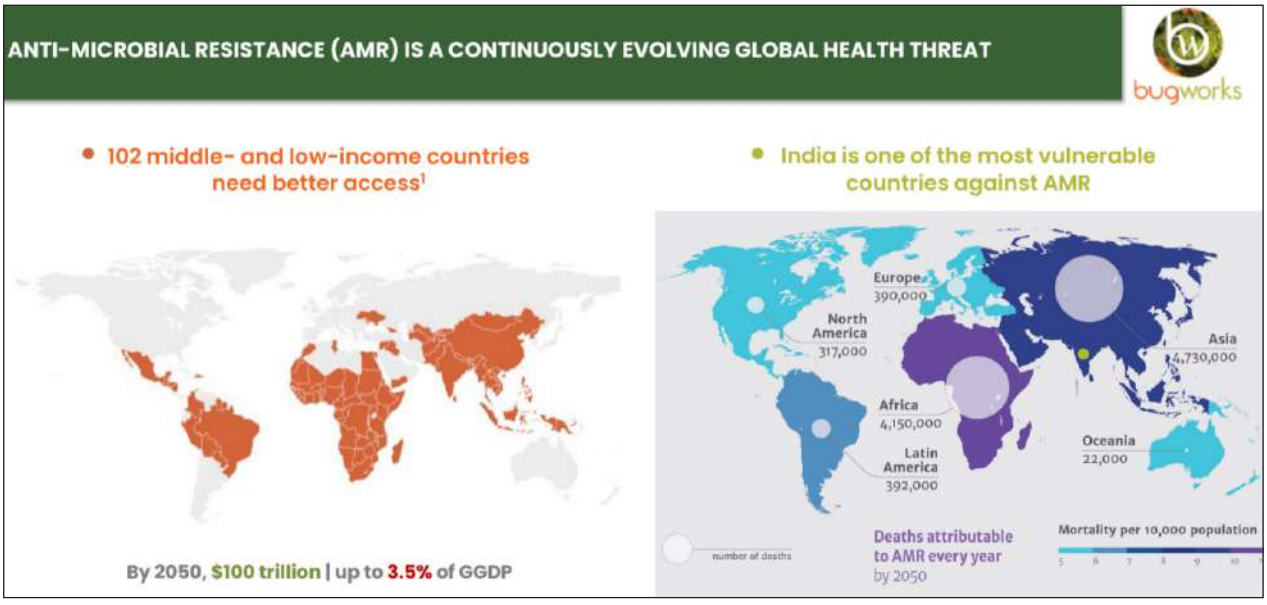


Fig 13: Illustration of the threat that AMR imposes globally. Source: Bugworks

BETTERPLACE

Primary Objective: Value creation and growth beyond compliance and reporting

Background: Informal employment is a significant part of emerging economies and represents a huge market in India. An informal labour market presents an opportunity to uplift the blue-collar workforce by establishing professional credibility, initiating upskilling programs, and creating inclusive financial environments for frontline workers.

BetterPlace captures rich data of the blue and grey-collared workforce across job cycles and provides a full-stack solution that includes hiring and onboarding, lifecycle management, and engagement functions for enterprise clients. By taking a horizontal approach, BetterPlace is integrating the fragmented value chain and is rapidly formalizing every blue-collar intensive industry segment.

In FY 2021-22, BetterPlace impacted ~4.5 M frontline workers and enabled the growth of 200+ large organizations. To strengthen its commitment towards ESG, BetterPlace intends to:

Impact people's earning potential: With BetterPlace, workers now have access to shift-based jobs across enterprises which increases their earning potential.

Enable access to opportunity: The company is providing social security to the frontline workforce through access to loans, on-call doctors and credit. It aims to uplift the lives of 35 million frontline workers by FY23.

Upskill via digital university and women empowerment: Offering continuous training and skilling programs for workers. In addition, BetterPlace is facilitating women to participate in work activities through its platform. With the company's microlearning offering, Oust Labs, BetterPlace aims at arming women with desired skill sets that will accelerate more gig opportunities for women and decrease the gender gap.

Insurance coverage: BetterPlace offers 3 types of insurance: life, accidental and medical in order to provide comprehensive coverage for blue-collar employees and their families.

Outcome: At 3one4 Capital, the team believes that long-term sustainability requires companies to consciously align profits with progress. BetterPlace is an example of a company gaining a competitive advantage by intentionally providing frontline employees with better working conditions and opportunities. GCD helped the company raise its Series C round from the likes of British International Investment (BII) and CX Partners— highly reputable global long-term ESG-centric investors. GCD prioritizes such partnerships between the founding team and follow-on investors, where the visions of both stakeholders are aligned.

Current Status: The investor coalition and active engagement with BII and CX Partners resulted in the company improving its ESG benchmarks which will further help them in achieving their non-financial objectives.

Fig 14: BetterPlace's value proposition across stakeholders. Source: BetterPlace

BetterPlace has partnered with British International Investment (BII) to increase the participation of women in the workforce.

BetterPlace will bring together a network of partners to upskill and employ 100,000 women workers by 2024. The initiative also aims to increase the participating women workers' earnings per hour by more than 10%.

In November 2022, BetterPlace entered into a partnership with British International Investment (BII), the UK's Development Finance Institution (DFI), 3one4 Capital's LP, and one of the world's foremost impact investors. The partnership will work to increase the participation of women in the workforce and increase their earnings.

According to The Frontline Index Report by BetterPlace,[34] women make up just 3% of the total frontline workforce. Furthermore, BetterPlace's data suggests that even though women constitute 23% of the users on its Rocket platform, an end-to-end recruitment platform that provides a pre-skilled pool of workers to enterprises, only 3% of them actually work in a company. Most earnings are somewhere between INR 16,000-17,000 per month.[35]

BetterPlace endeavours to bridge this gender gap in economic participation by bringing together a network of partners to upskill women workers and simultaneously mobilise and sensitise employer organisations working towards building an equitable frontline workforce. The partnership aims to upskill and employ 100,000 women workers by 2024. In order to boost their disposable incomes, BetterPlace will further strive to increase their earnings per hour by more than 10%.

BII's decision to extend support to BetterPlace reaffirms the company's vision to empower frontline workers in their quest to access a better life. Having already onboarded more than 1,000 clients on its platform, upskilled over 2.5 million workers, and verified more than 20 million candidates, BII's support in the form of flexible and patient capital should give a fillip to BetterPlace's ambitions to further scale its positive people impact.

"The impact as a result of ensuring gender equality in the workforce is massive. According to a McKinsey Study, a whopping $12 trillion could be added to the global economy by advancing gender equality. We are honoured to be partnering with British International Investment and working towards bridging the gender gap in our frontline workforce. I strongly believe that with the right intent and a robust tech platform, we can create an ecosystem which is conducive to women workforce participation. I hope that this initiative is one of many that would create a future workforce which is equitable, productive, and geared towards creating immense value to the Indian economy."

— Pravin Agarwala (Co-founder and Group CEO at BetterPlace)

"BII is pleased to partner with BetterPlace on this pilot project which aims to accelerate women's entry into India's workforce. Increasing inclusive economic opportunities remains a critical precondition for productive and inclusive development within any country, and I am thrilled that BII's flexible capital will back a tech-enabled programme designed to provide employability support and skills development for women—increasing their participation in the economy and improving their livelihoods. Through successful implementation of this model, we see strong potential for this programme to serve as a blueprint for transforming the workforce and uplifting women's economic empowerment both in India and across the world."

—Manav Bansal (Managing Director and Head of India, British International Investment)

BII, being among 3one4 Capital's most prominent investors, aligns closely with the Firm's thesis to unlock access, equality of opportunity, and income alleviating pathways for millions of aspirational Indians. BII's resolve to bolster inclusive economic growth and improve development outcomes for women resonates exceptionally well with 3one4 Capital's intent to galvanise stakeholders across its networks to collectively drive transformational impact at population scale. We are thrilled to have been able to bring BII and BetterPlace together. We are confident that BetterPlace will successfully leverage its category-leading tech stack to improve the experience of thousands of frontline women workers.

BetterPlace has impacted 4.5M frontline workers in FY22

150,000+

Frontline workers added every month

500k+

Background checks every month

200+

Large organizations impacted in FY22

INR 388 Cr

Insurance coverage for frontline workers in FY22

2.5 Million

Workers up-skilled annually

40 Million Minutes

Of digital training provided in FY2

Fig 15: BetterPlace's impact metrics in FY 2021-22. Source: BetterPlace

Way Forward

The asset and wealth management space is in the midst of a substantial shift with ESG-related AUM projected to grow at a CAGR of 12.9% to reach USD 33.9 Tn by 2026, up from USD 18.4 Tn in 2021.[36] Emerging national regulations and increasing capital commitments towards the connection between long-term value creation and returns has made ESG maturity a primary factor in driving valuation outcomes. A company's competitive self-interest, therefore, lies in pursuing a dynamic ESG strategy as capital, partners, and talent are rapidly moving from ESG laggards to leaders.

GCD understands the strong correlation between commercial and societal profitability and strives to create awareness for the same while working alongside the portfolio on ESG—not as a vertical silo but as an overarching thesis. At 3one4 Capital, the team's commitment to integrating ESG with growth benchmarks will continue to unlock outsized gains for its portfolio companies. This includes access to lower-cost capital from a large and diverse investor pool, improved credit ratings with ESG-driven decreases in enterprise risk, revenue growth through business line diversification, and superior exit outcomes.

While significant progress has been made thus far, GCD intends to expand the team's work on ESG frameworks, articulation, and tactical programs beyond the 3one4 Capital portfolio and into the larger network of investors, banks, and strategic partners. The team aims to leverage their expertise to drive a wider understanding and active adoption of ESG compliance across the ecosystem, particularly across private markets. In its role as a linchpin and connector for different stakeholders of the innovation ecosystem, GCD hopes to lead the industry's shift towards a deep bias for outsized impact and inclusive growth alongside capital returns.


DELIVERY

ESG Case Studies from the 3one4 Capital Portfolio

dozee

Dozee


dozee
john
Sleep
Vitals
Your Vitals
Trends
Average Resting Oxygen Level
Live
dozee

Dozee: Revolutionising Indian healthcare, one hospital bed at a time.

Dozee is an exciting addition to our portfolio. It has pioneered contactless, continuous remote patient monitoring (RPM) in hospitals and at home, delivering unparalleled patient safety and maximising utilisation of ICU beds. Employing Ballistocardiography (BCG)- a non-invasive technique that measures micro-vibrations to capture cardiac contractions, respiration metrics, body movements, as well as other events such as snoring, seizures, and tremors- to monitor vitals, Dozee's offering works to analyse, forewarn, and thereby improve its users' cardiac, respiratory and sleep health. Their solution has medical grade accuracy, is simple to deploy and maintain, and is incredibly cost effective.

At a time characterised by increased health consciousness on account of the pandemic and a deepening consumer and business focus on India's shifting disease profile, rising healthcare costs, inadequacy of public healthcare etc., Dozee has the potential to revolutionise Indian healthcare, one hospital bed at a time.

THE PROBLEM AT HAND

India's healthcare infrastructure is in serious need of an upgrade-

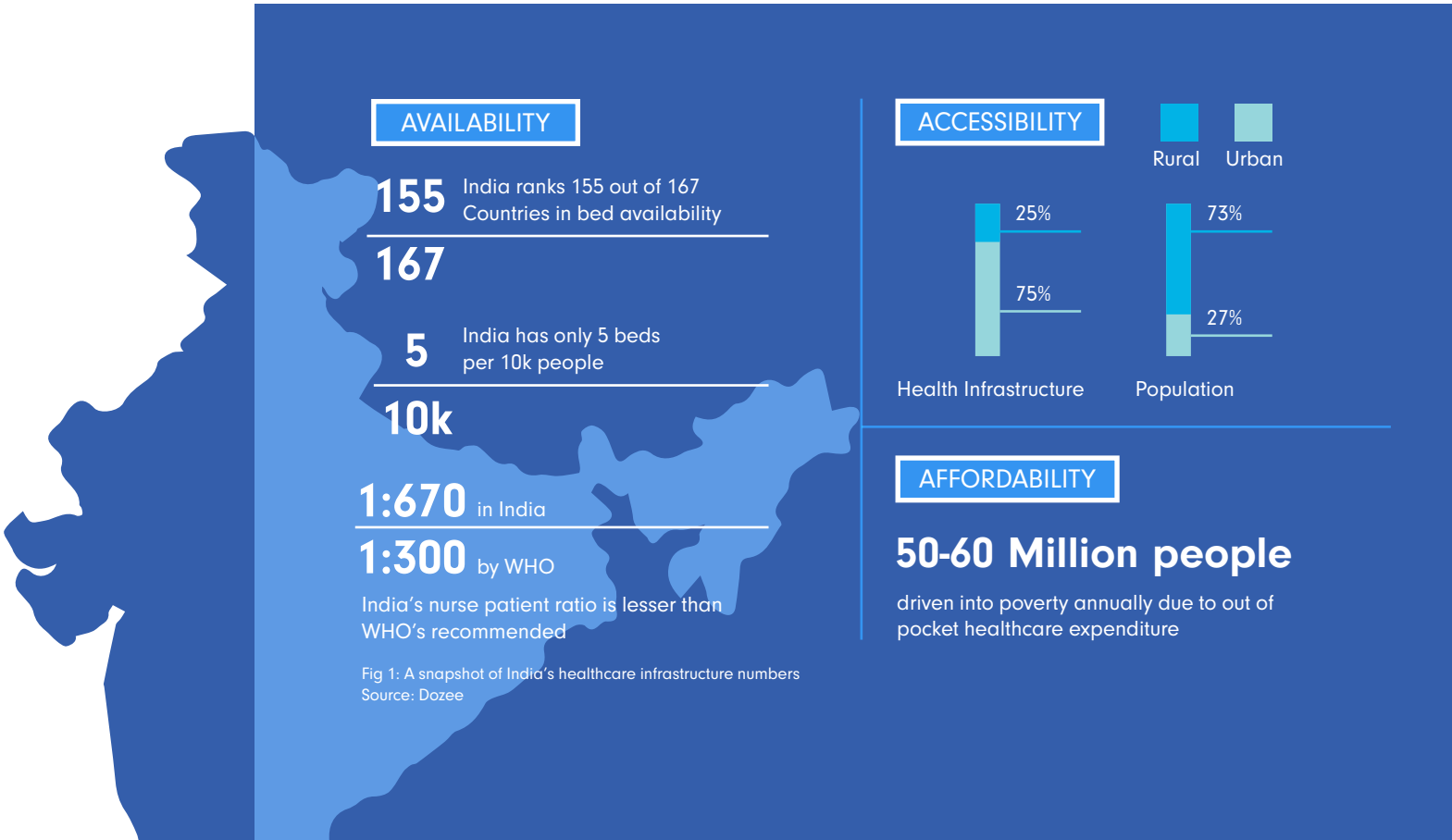


Fig 1: A snapshot of India's healthcare infrastructure numbers
Source: Dozee

THE PROBLEM SPACE IN HEADLINES

"District hospitals have avg 24 beds per 1 lakh people, Bihar lowest at 6: NITI Aayog report"

The NITI Aayog report also shows that in 15 states and UT's, the average number of beds in a district hospital was lower than 22 beds per 1 lakh population as recommended by the IPHS 2012 guidelines.

As published in Indian Express

"As many as 69 percent of hospital beds in India are concentrated in urban areas; Pune outranks other cities on health parameters."

India has an abysmally low 0.5 public hospital beds per 1,000 population and mere 1.4 beds, including public and private hospital beds per 1,000 persons.

As published in Money Control

"Around 65% hospital beds cater to 50% population of country: Niti Aayog"

Niti Aayog has said that about percent of hospital beds in country cater to almost 50 per cent of population and stressed that the number of beds must be increased by atleast 30 percent

As published in Business Standard

"India in need of 4.3 mn more nurses by 2024 to meet WHO norms: Nurse org"

India is need of 4.3 million more nurses by 2024 to meet WHO norms, nursing and midwifery professional organisations said

As published in Business Standard

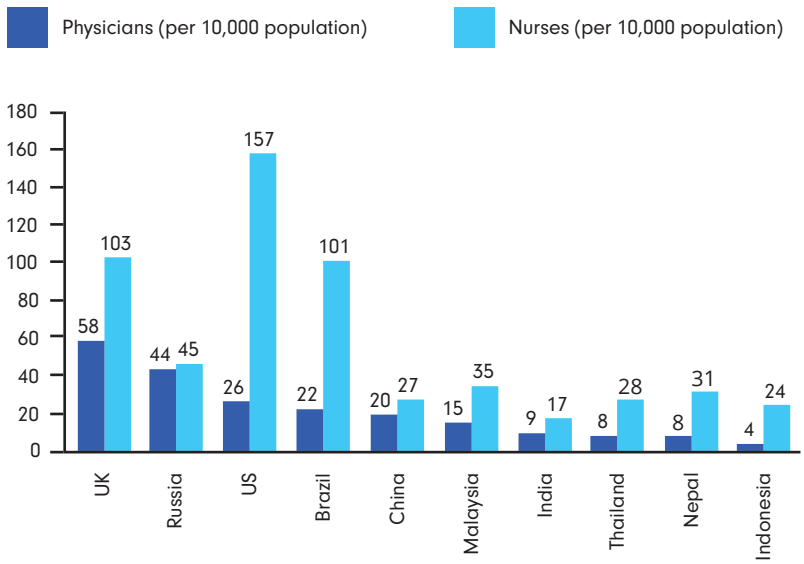


Fig 2: India's number of healthcare professionals versus other countries. Source: WHO, Equirus

Nursing and other healthcare staff have also been experiencing increasing rates of burnout. In a recent survey based study, 37.6% of the sampled nurses working at intensive care units reported experiencing high burnout.[1] In yet another study, more than half of the respondents complained of pandemic related burnout, with doctors being 1.64 times and the support staff being 5 times more likely to experience pandemic-related burnout.[2]

Rising healthcare costs combined with India's uncharacteristically high out-of-pocket expenditure on health has further exacerbated the situation. Moreover, India's disease profile is changing– the disease burden is increasingly being dominated by non-communicable diseases (NCDs). According to a WHO report, NCDs accounted for 66% of deaths in India in 2019. Over 2.5 million deaths were caused by cardiovascular diseases; 1.15 million by chronic respiratory diseases; and almost 3,50,000 by diabetes.[3]

A compromise on the amount & quality of sleep has resulted in a faster onset of some of these conditions. A survey by Fitbit found that its Indian users were the least active and second most sleep deprived globally.[4]

To make matters worse, a large number of Indians, more than 500 million, are at risk of hypertension, stroke, cardiovascular diseases etc. thereby necessitating thorough and continuous monitoring.[5]

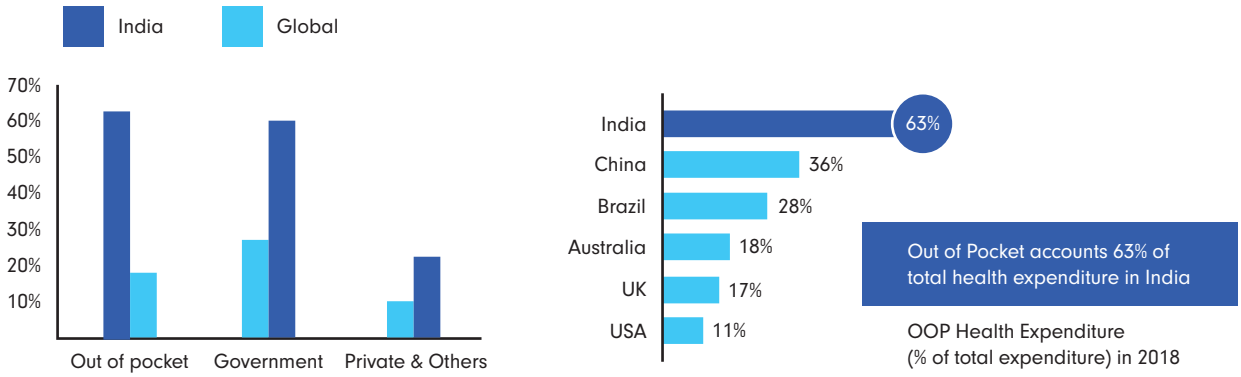
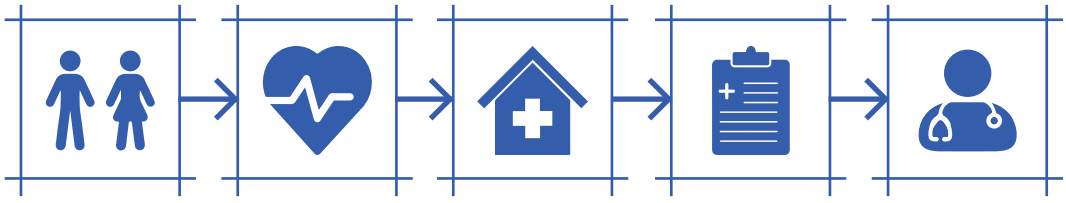


Fig 3: India has much higher out-of-pocket health expenditure compared to the global average. Sources: World Bank, HSIE Research, Data as of 2018, HDFC Securities

DOZEE'S SOLUTION

With machine learning techniques, microelectronics miniaturisation, Wifi and 4G connectivity, and an increasingly educated population, there is an opportunity to turn this tide around.

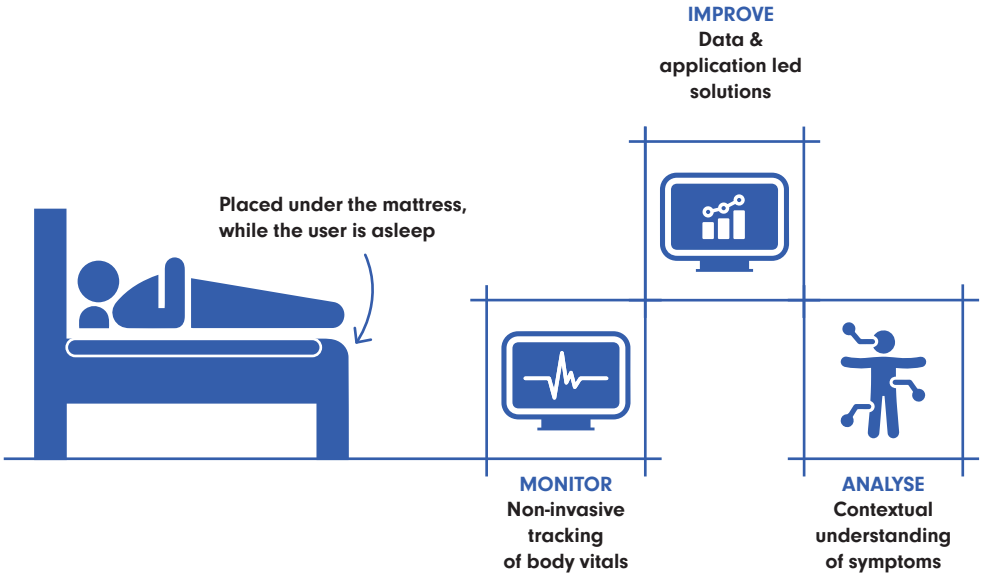


Enter Dozee

"From food delivery to booking a cab, everything is now at our fingertips. But healthcare still lags behind in giving that comfort. I want to change this.

- Mudit Dandwate (co-founder of Dozee)

Using Ballistocardiography (BCG), Dozee's product offering involves the placement of a thin sensor sheet under the mattress thereby converting any standard bed into a step-down ICU. It contactlessly tracks heart rate, respiration, cardiac performance, blood pressure, sleep and heart rate variability. It also comes with additional components to monitor oxygen saturation, ECG and temperature. Dozee then uses AI algorithms to generate an Early Warning Score enabling early detection of health deterioration for timely medical intervention to provide unmatched patient safety.



Parameters measured by Dozee-

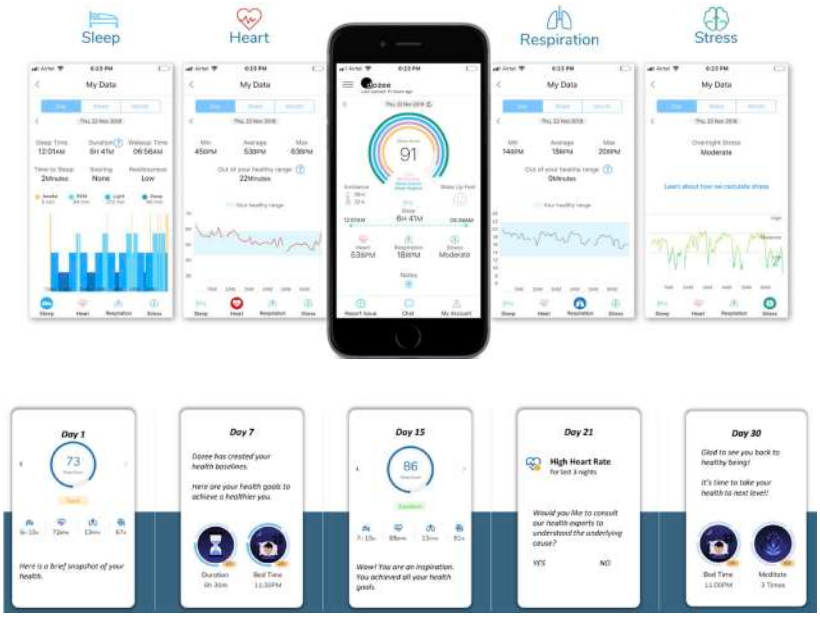
India's only contactless Blood Pressure, Heart Rate, Respiration Rate & Sleep Monitor

***98.4% Accurate**

Heart Rate	Respiration Rate	Heart Rate Variability	Oxygen Saturation
Blood Pressure	Cardiac Performace Matrix	Sleep Stages	Stress & Recovery
Snoring Index	Restlessness	DEWS Score	Apnea-Hypopnea Index

*According to benchmark studies published against clinical-grade ECG

Dozee's easy to use interface provides a stress-free experience to the user for gathering, retrieving, and engaging with the recorded health data.



The whole tech-suite places the user at the centre and operates seamlessly to offer a range of services.

DOZEE CONTACTLESS MONITORING DEVICE

Contactless Remote Monitoring

Daily triaging report

Easy access to patient vitals through mobile app

Risk scoring through Dozee Early Warning System (DEWS)

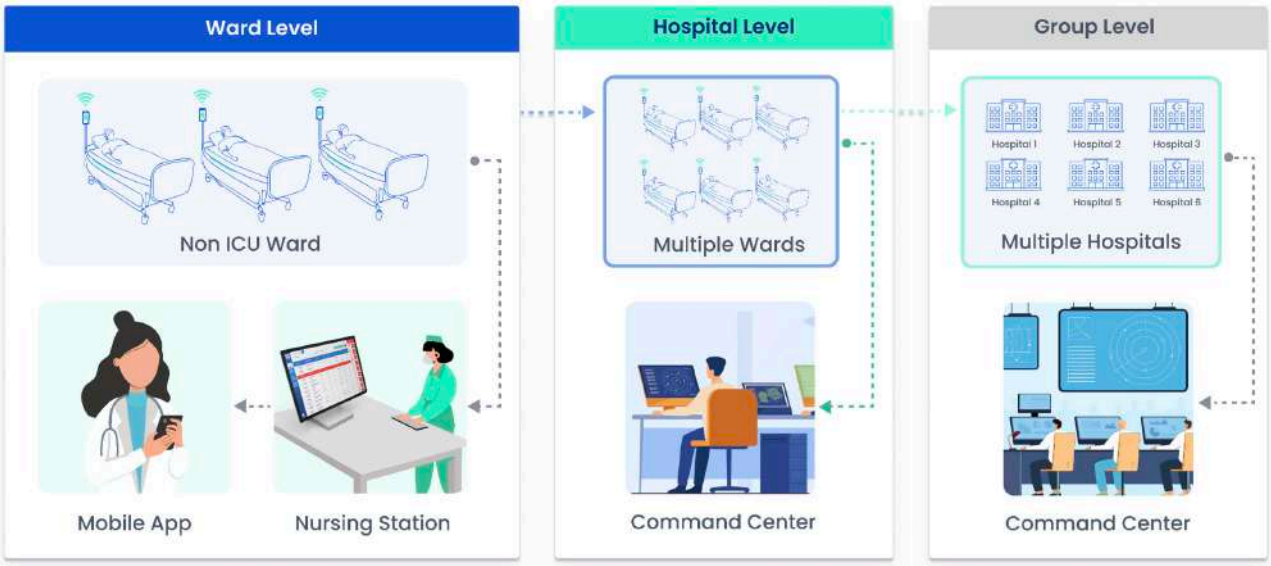
Centralised web dashboard available on TVs installed in hospitals

DOZEE FOR HOSPITALS

Dozee's solution has proved to be especially helpful for hospitals, allowing for the conversion of regular ward beds into step-down ICUs, streamlining vitals monitoring for hundreds of patients on a single dashboard, digitalising early warning alerts generation, automating critical care outreach, optimising nursing efficiency, and maximising ICU bed throughput. It allows the hospital healthcare staff to make data-backed clinical decisions thereby easing their patient burden.

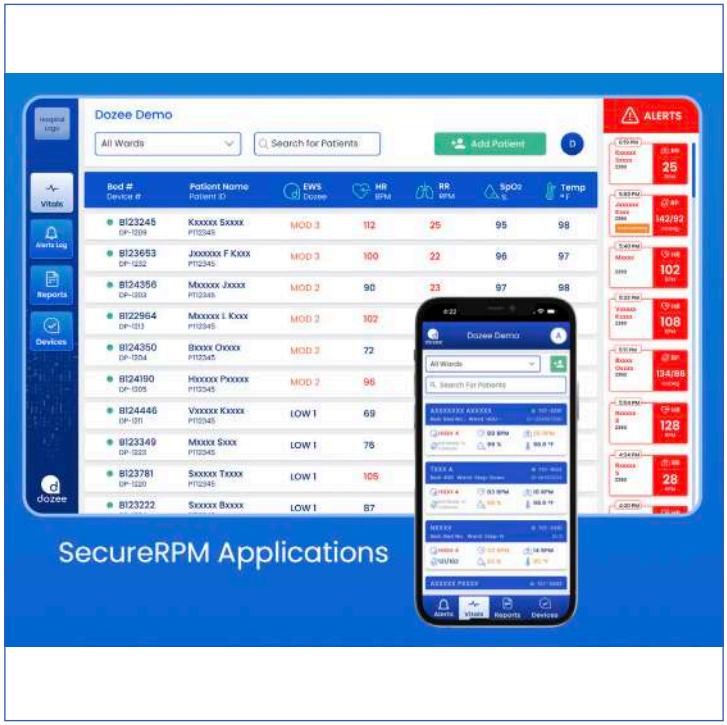
Clinical studies have shown that Dozee alerts healthcare providers 8 hours in advance of patient deterioration.

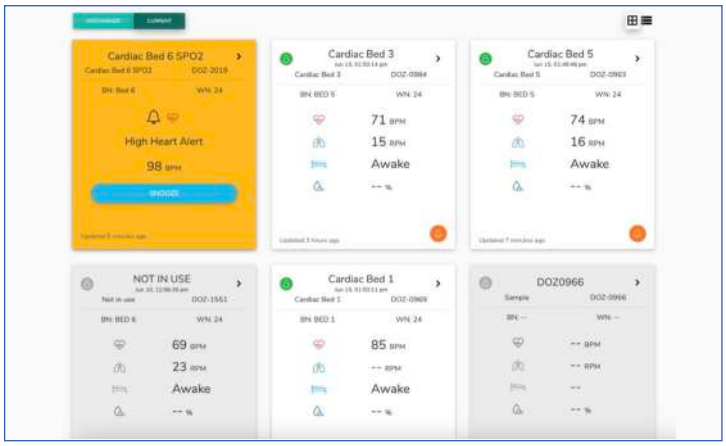
Dozee saw widespread adoption of its solution across public healthcare establishments because of their critical role in helping hospital administrations manage the COVID-19 pandemic. With its ease of use and minimal training requirements, Dozee has been able to achieve strong penetration in previously neglected regions by strengthening secondary and tertiary health infrastructure at the level of district and sub-district hospitals in India.

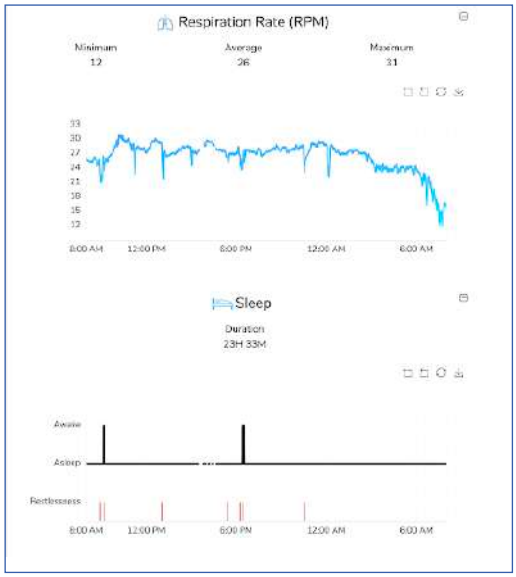


70+ healthcare providers trust Dozee to provide proactive care

The installation of Dozee devices at a hospital sets up the provision for risk scoring through the Dozee Early Warning Score (DEWS). Based on this score, daily factor reports are created and shared with doctors and nurses, helping prioritise high risk patients and improve clinical outcomes through smart alert triggers. As alluded to earlier, each patient's risk status can easily be accessed as part of a centralised web dashboard through a mobile app or on TVs installed in hospital premises. The remote monitoring enabled by the device lowers human exposure and risk of infections, diminishes the risk of manual error and saves time for both nurses and doctors.







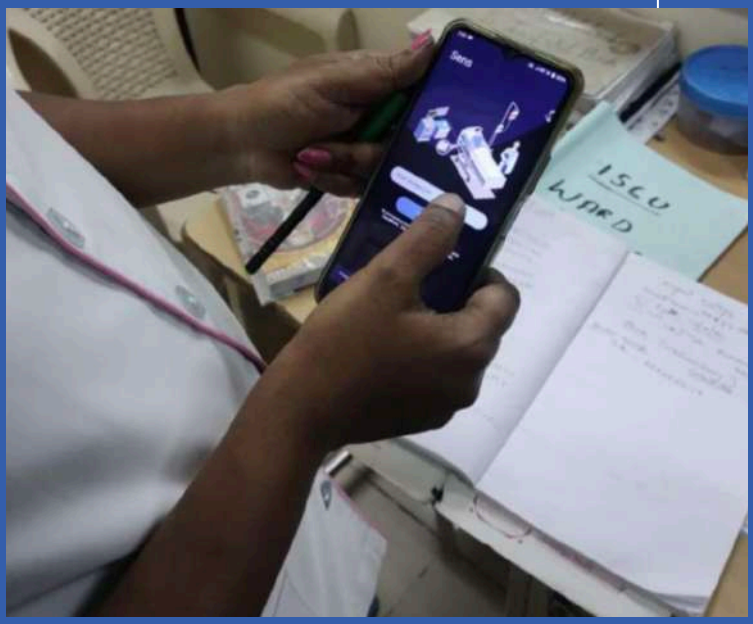
A SNAPSHOT OF DOZEE'S IMPACT IN 2023

In a short span of time Dozee has helped save more than 10,000 lives, and improve health outcomes for a lot many others. The figure below gives a snapshot of Dozee's positive impact-

11,500+	Life saving alerts generated
11,000+	New Dozee beds
275,000+	Patients monitored
5+Mn	Nursing hours saved
5,000+	Nurses trained
200+	Hospitals signed up for Dozee

Given Dozee's early yet nevertheless giant strides towards fixing India's broken healthcare system, it further aims to be an integral part of the transformation of healthcare for secondary and tertiary services in states and districts in India. Building on the Government's vision of ensuring universally accessible healthcare, Dozee has launched the 'Million ICU Initiative'– an ambitious endeavour to address the massive shortage of ICU beds in public hospitals to alleviate the immense load on both the healthcare infrastructure as well as the concerned staff. Dozee intends to convert 1 million public hospital ward beds into step-down ICUs with the installation of its remote sensing devices through this initiative. Coupled with nurse and doctor training on the use of concerned devices and their features, this initiative enables the setting up of a 24x7 central patient monitoring cell and a holistic contactless remote health monitoring platform.

The Million ICU Initiative has been an extraordinary success, impacting 54,273 lives in 323 hospitals across 14 states within 18 months.



Dozee has installed 50 step-down ICU beds in Tirunelveli Government Hospital under its Million ICU initiative.

Dozee conducted a Remote Patient Monitoring training session for the nursing staff at Government General Hospital, Vijayawada on 6th April, 2022 under its Million ICU Initiative.

Dozee's MillionICU initiative has partnered with British International Investment (BII) to transform India's public healthcare infrastructure

The partnership will work to upgrade 6,000 beds in 140 public hospitals and improve access to quality healthcare for ~600,000 high risk patients.

At a time marked by concerns surrounding an upcoming slowdown and accompanying investor hesitancy, Dozee has successfully entered into a partnership with British International Investment (BII), the UK's Development Finance Institution (DFI), an LP of 3one4 Capital and one of the world's foremost impact investors. Signed in January 2023, the partnership will work to scale Dozee's MillionICU initiative, and thereby improve access to healthcare across the country while alleviating the workload of healthcare workers and caregivers, especially nurses.

As discussed in the problem space section, India's healthcare infrastructure finds itself under immense stress on account of the increasing numerical gap between individuals needing care, and those capable of providing it, besides, of course, a dire shortage in certain physical resources such as ICU beds. The country's 1:40 nurse-to-patient ratio—against a WHO recommended 1:4—means that nurses face acute time and attention related constraints which render optimal patient monitoring well-nigh impossible, despite their best efforts. Indeed, more than 95% of hospital beds in India are sub-optimally monitored with manual spot-checks by a usually understaffed nursing pool severely restricting the ability to timely detect a patient's deteriorating condition. This often leads to delayed escalation, inefficient ICU throughput, and longer hospitalisation spells which further heighten the caregiving workload in an already under-resourced healthcare setup.

BII recognises that technology can be a massive force for good in tranforming the status quo. Dozee's elegant AI backed solution can help save nearly 2.5 hours of nursing time per patient per day, thereby reducing nurse burnout in hospital wards. **The MillionICU initiative** already has a footprint across 46 hospitals in more than 15 districts, having monitored more than 10,000 patients and saved over 25,000 nursing hours. **With BII's support, Dozee will work to upgrade 6,000 beds in around 140 public hospitals across India and in other regions to wholly transform the existing public healthcare landscape. The partnership aims to facilitate access to quality healthcare for an additional 600,000 high-risk patients over the next two years.**

The MillionICU initiative in consonance with BII's long-term capital will transform India's affordable healthcare landscape by enabling access and improving clinical outcomes. Dozee's ability to secure support from a highly sought after, globally reputed institutional investor is a testament to the trust the company has been able to garner as a category creator in the field of connected healthcare. The partnership validates its efforts to generate rapid, long-term, large-scale impact as India's first AI-based contactless Remote Patient Monitoring (RPM) & Early Warning System (EWS).

"According to the 2021 Niti Aayog report, India currently has 1.3 hospital beds per 1,000 population. There is also a shortage of skilled health workers, with 0.65 physicians per 1,000 people (the World Health Organisation standard is 1 per 1,000 people) and 1.3 nurses per 1,000 people, putting immense stress on the nation's healthcare infrastructure. The public healthcare delivery system's connected care model can help bridge this gap, supported by technological advancements such as AI-based early warning systems and contactless remote monitoring systems that have the potential to transform standard hospital beds into connected step-down ICU beds. By creating step-down ICUs in some of the low hospital density regions of the country, it is our mission to unburden the healthcare system and make quality healthcare accessible to all"

— Mudit Dandwate (CEO and Co-founder at Dozee)

"Improved access to affordable healthcare significantly boosts productivity and development outcomes. Our partnership with Dozee will help to scale tech-enabled healthcare solutions which will alleviate the burden on healthcare staff and increase patients' access to quality and affordable healthcare in India. We are thrilled that BII's patient and flexible capital combined with Dozee's MillionICU initiative will contribute towards transforming healthcare infrastructure in India over the long-term and help improve clinical outcomes for patients in public hospitals in the country"

— Manav Bansal (Managing Director and Head of India, British International Investment)

3one4 Capital is thrilled to have brought BII and Dozee together to launch this important initiative. As a significant investor in 3one4 Capital's funds, BII's dedication to delivering measurable impact at population scale is a powerful support vector of our ability to converge tech towards these imperatives. We look forward to building this fabric of intentional capital and dedicated resources that will support Dozee's role in transforming vital infrastructure in India.

RECENT MILESTONES

Dozee's proprietary contactless vital signs (VS) measurement technology received US FDA 510(k) clearance, paving the way for the company to bridge healthcare gaps in India and other emerging markets by delivering world-class medical devices in line with its vision of 'Make in India, Made for the World'. The company also recently received its first US patent for its revolutionary contactless cardiac assessment technology, harnessing micro-vibrations. Dozee's good work has been duly recognised for its potential to transform healthcare delivery in India. It was one of the winners of the prestigious Innovation for India Awards 2023 by Marico Innovation Foundation which seeks to empower first-to-the-world innovations that hold the potential to generate large-scale impact. Dozee also received an award for Digital Innovation in Healthcare at the FICCI Healthcare Excellence Awards 2022. As a partner to Apollo Hospitals in its Enhanced Connected Care Programme, Dozee helped ensure zero code blue events over 200 days— a remarkable demonstration of its commitment to patient safety.

TESTIMONIALS

"It helped reduce exposure with the patients, especially during COVID-19 situation. Time and energy were saved, as other productive work could be done now. It also added to patient safety. Dozee also helped identify the critical patient adequately. Digital monitoring helped to identify high-mid-low risk patience with timely insights which helped to prioritize critical patients. It is easier now to exchange medical information/opinion across medical staff/departments due to digitisation as the data is accessible as and when required."

Dr. Vaishali Shelgaonkar
(Associate Professor and Head of Department of Anaesthesiology, IGGMC, Nagpur)

"We can now monitor patients in high dependancy unit continuously because of Dozee. Devices are easily set up remotely and our nurses were able to adopt to it quickly"

Dr. GK Kumar (Intensivist, Chengalpattu Medical College)

"Dozee has been instrumental for us in providing holistic solutions to the residents of Kolkata through our 360° offering of hospital, home and hotel quarantine"

Mr.Debashis Dhar (Group VP, ILS Hospital)

"As a device that combines the aspect of wellness and medical care, I see a lot of potential in it. It will be of great help, especially for people who are in the critical care unit or spend a lot of time in bed. Also for people who have a history of heart ailments to keep a continuous check."

Dr. Deepak Padmanabhan (User)

"Dozee's early detection proved life-saving for my grandmother. Its AI algorithms flagged about the decreasing heart rate. On further medical tests, we found heart abnormality. Left alone, it would have been catastrophic."

Mr.Arjun Harish (User's grandson)

"I remember one case in ward no.37 during the pandemic. We received an alert from the dozee device for that patient. As soon as we received it, we immediately transferred him to the ICU ward and started giving the best treatment before time. Hence, we were able to save the patient's life and he survived."

Rekha (Staff nurse)

As an independent assessment partner, Sattva Consulting recently conducted a retrospective impact assessment study on the impact and potential of Dozee's devices across the public healthcare system in India. The findings were overwhelmingly positive. Some of the major findings have been highlighted below.

ON GROUND ADOPTION OF DOZEE

< 15 min Time taken to upgrade to step-down ICU bed

94% Nurses found Dozee's continuous monitoring useful

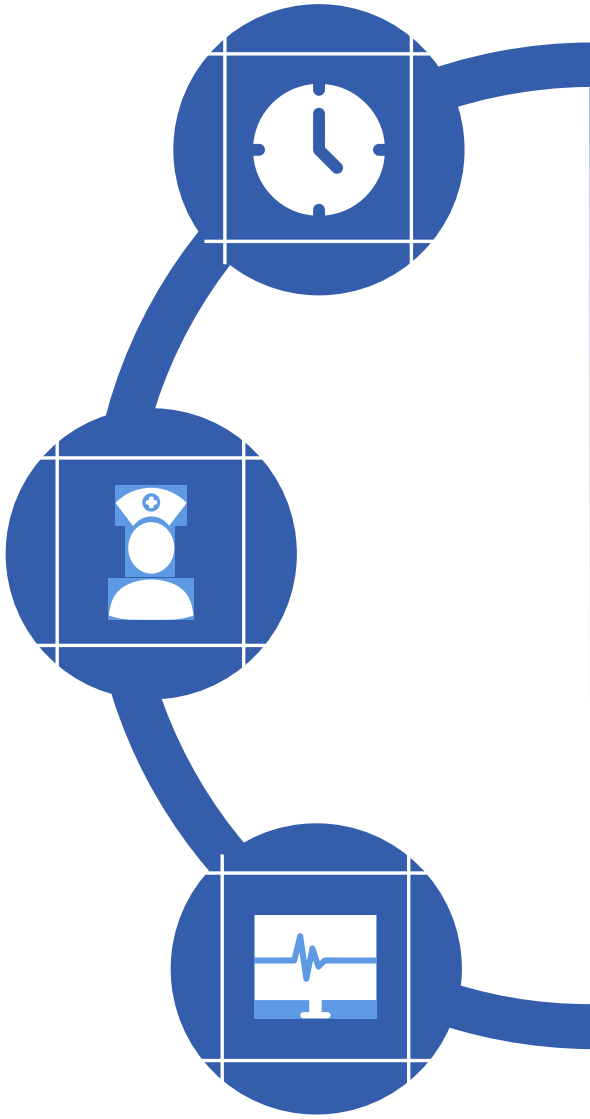
< 1 day Training time for medical staff

REDUCTION OF WORK LOAD FOR MEDICAL STAFF

70% Nurses reported a decrease in their workload and stress

80% Reduction in time taken to record patients vitals

2.5 hrs Time saved everyday per nurse



IMPROVED QUALITY OF PATIENT CARE

77% Nurses felt more in control of a patient's health

1,874 Total life saving alerts triggred

144 Estimated lives potentially saved anually/ 100 Dozee beds

DIGITIZATION OF PATIENT VITALS

97% Medical professionals root for automation & digitisation of patient vitals

The impact assessment study found that approximately 1600 more patients could potentially be treated at a mid-sized public hospital on account of more efficient hospital bed utilisation. When extrapolated to cover the entire public healthcare system, this number crosses the 12 million mark on an annual basis.

TREATING MORE PATIENTS BY OPTIMIZING HOSPITAL BED UTILIZATION

0.7 Days Decrease in average stay in hospital ward beds

1,092 Estimated additional patients treated in a public hospital ward per year

1.3 Days Decrease in average stay in ICU beds

504 Estimated additional patients treated in ICU/year

1,596 Estimated additional patients treated in a public hospital/year

12 million+ Estimated additional patients treated through the public healthcare systems/year

Efficient bed utilisation could also unlock savings of almost INR 39 lakhs at a mid-size public hospital.

COST SAVING POTENTIAL

14% Decrease in cost for hospital ward operations

26% Decrease in cost for ICU operations

39 Lakhs Savings unlocked annually/100 Dozee beds

If scaled for use across secondary and tertiary hospitals, the Million ICU initiative can catalyse total potential savings of INR 2,881+ Cr for the public healthcare system in India.

CASE STUDY: IGGMC MEDICAL COLLEGE, NAGPUR

The Indira Gandhi Government Medical College (IGGMC) and Hospital in Nagpur, Maharashtra is one of three Government Medical Colleges in the city. It is equipped with 822 beds and admits about 90-120 patients per day, charging INR 30 per day for admission under the general ward and INR 400 for a day's stay at the ICU.

After the breakout of the COVID-19 virus, IGGMC was quick to upgrade its services and safety protocols to fight against the virus. But the staff was overwhelmed with the number of cases they had to deal with and the risk of infection was high, given the need for constant manual monitoring of patient vitals. The hospital was struggling to optimise the time of its healthcare staff.

Dozee stepped in and did the following-

• Enabled 150 HDU beds with Dozee devices to continuously monitor heart-rate, respiration-rate and SPO2 vitals.

• Set up a holistic patient monitoring solution with a central patient monitoring platform for remote monitoring.

• Trained medical staff on the go for adoption of new technology on a day-to-day basis along with Dozee's on-ground team.

• Facilitated monitoring of 150 beds by a single nursing staff in a shift through its central monitoring platform.

The results were immediate and readily perceivable. Dozee monitored the HR, RR & SPO2 for more than 1,800 patients. Its advanced health intelligence algorithms tracked the patients' vitals continuously and converted them into risk scores. Based on these scores early warning alerts were generated for more than 200 patients which ensured their timely ICU transfers and provided them with life-saving medical support.

SDG ALIGNMENT

Dozee is an inspiring example of a startup that interlaces technology and domain insight to attempt category redefinition. It can transform care delivery across the world. It also turns every hospital bed into a potential ARR generating asset for itself, thus "SAAS-ifying" patient monitoring. We are excited to continue our partnership in scaling this company forward. Dozee is aligned with the following SDG goals.

Licious


Safe & hygienic meats
Shop by categories
Today's Deals
Chicken
Fish & Seafood
Mutton
Ready to Cook
Prawns
Cold Cuts
Spreads
Eggs
Biryani & Kebab
Combos
Featured Collections
Up to
Licious
Categories
Search
Account
Licious
PRAWNS IN A PICKLE
PRATIK MATRA
FAVOURITE ORDER: Chicken Thighs

Redefining Sustainable Vertical Supply Chains For D2C Food

Licious is a category-creating, tech-first, full-stack, D2C animal protein brand. Since launching in 2016, it has continually set benchmarks for quality, sustainability, and transparency in India's predominantly unorganised meat and seafood sector. The company has confronted deeply rooted and outdated practices in the food supply chain to reimagine the customer experience with a daily consumption staple. Today, Licious is India's first D2C unicorn, a category creator, and amongst the country's most valuable startup consumer brands.

Licious operates on a farm-to-fork model, owning and operating a highly-controlled value chain right from the time of procurement, to processing, storage, and then to delivery. It prides itself on its direct engagement with poultry farmers, fishermen, their ecological environments, and the larger communities the brand works with. Having created the first vertically integrated supply chain in the fresh protein space, it is now counted as the category creator of the segment in India and has set the benchmarks across emerging markets.

Owing to its unrelenting pursuit of increased sustainability and improved ESG alignment as it scales out nationally, Licious was honoured with the 'Thought Leadership Award' for its ambitious ESG goals at the ESG Summit & Awards 2021. More recently, it was awarded the "ESG Rising Stars" award at the ESG World Summit & GRIT Awards 2022.

THE PROBLEM SPACE

India suffers from widespread protein deficiency, with a daily average protein intake of just 0.6 grams per kilo of body weight. This is far below the WHO recommended figure of 0.8g/kg. For reference, the global average for protein intake is around 68 grams per person per day—roughly more than one-third higher than the average recommended daily adult requirement.

According to an estimate, more than 24,000 people died on account of protein-energy malnutrition (PEM) in 2017. PEM has also contributed to India's high stunting and wasting rates, with the National Family Health Survey (NFHS-5) data suggesting that during 2019 to 2021, 35.5% and 32.1% of children below five years of age were found to be stunted and underweight respectively. According to UNICEF, India has one of the highest numbers of children suffering from severe acute malnutrition. Consumption of safe and hygienic protein is one of the best ways to fill this nutritional gap.

Furthermore, India's meat and seafood industry—which also happens to be one of the largest agrarian sectors in the country— has traditionally been highly unorganised with a lack of oversight or enforcement of global best practices with regard to animal welfare and consumer hygiene. Incidents involving animal abuse, inhumane confinement or even toxic buildup of ammonia have been reported from various regions across the country.

The landscape for ESG discourse and practice surrounding the meat sector in India does, however, vary significantly from that in the global north. Not only does India's poorer starting point on protein intake outweigh the usual concerns around the industry's oversized carbon footprint and the fear of zoonotic transmission, greenhouse gas emissions for mutton and poultry production—the most commonly consumed meat types in various parts of the country—are several orders of magnitude lower than that for beef. As are

fat percentages, with Indian meat being considerably leaner with just 4% of fat compared to 15-20% fat in meats elsewhere. Moreover, Indian livestock have negligible risk of contracting Bovine Spongiform Encephalopathy, commonly called the mad cow disease. The dependency on pasture rearing and the general absence of growth hormones and antibiotics in the feed ensures that Indian meat is produced in a manner that is substantially more friendly to the environment and its associated ecosystems when compared to industrial setups in more developed economies.

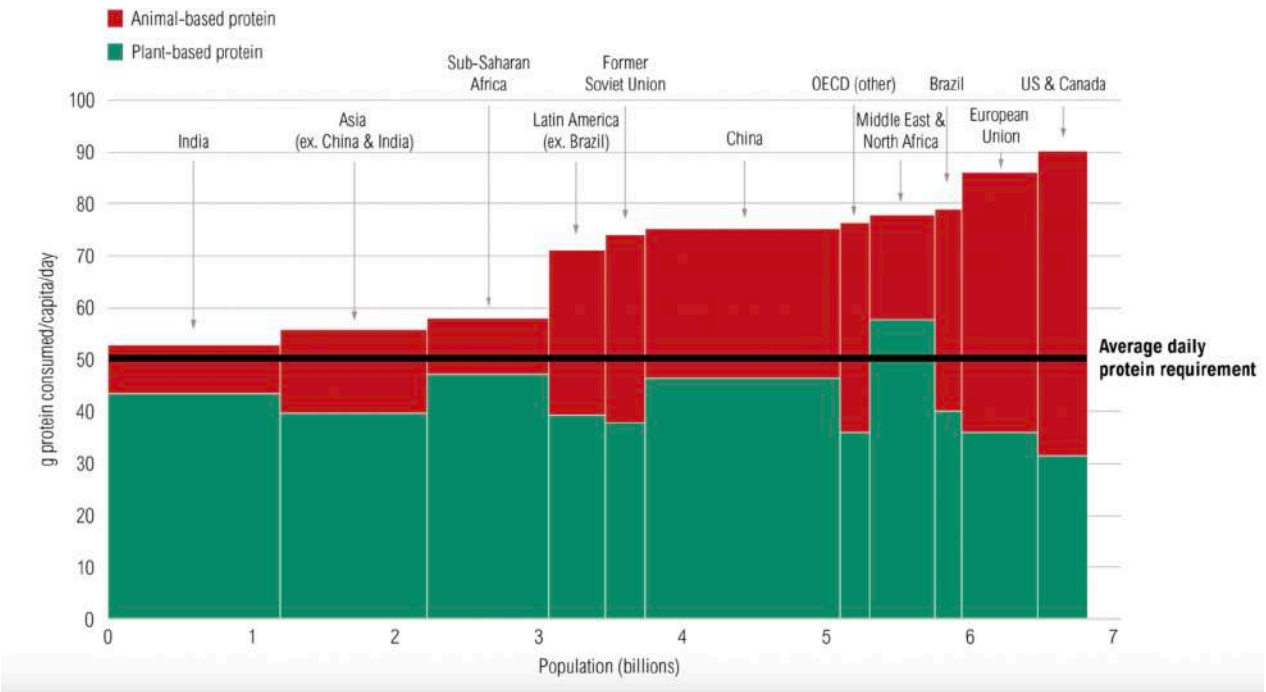
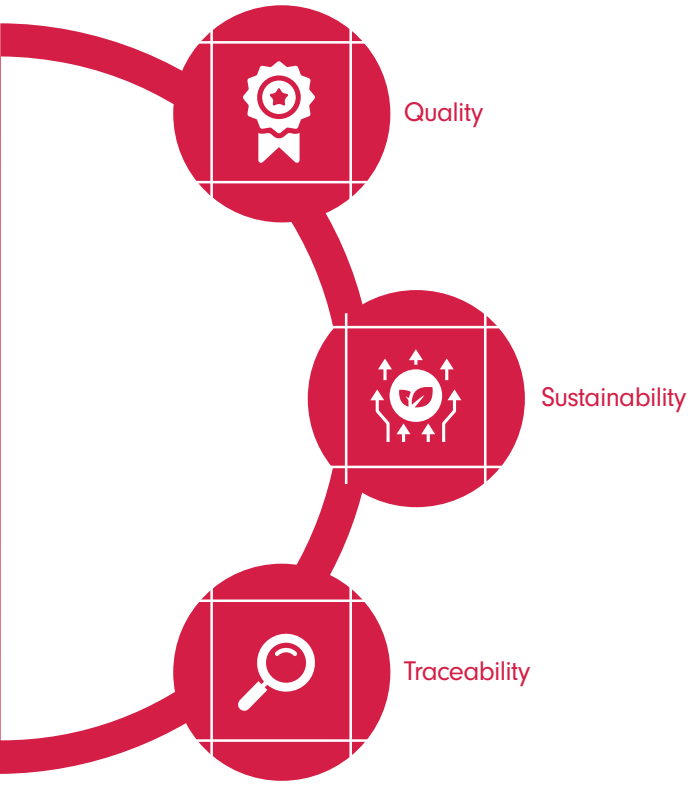


Fig 1: Average Daily protein intake across regions and countries. Source: WRI

LICIOUS' VISION

Since its inception, Licious has made pioneering strides to organise the fresh animal protein sector in India and disrupt the consumer experience by mainstreaming global standards for quality, sourcing, processing, and technology usage. Licious has harnessed a range of firsts in the ESG domain to develop high affinity among a diverse set of stakeholders, including vendor communities, customers, and investors.

Licious was the first Indian meat and seafood company to undertake a pledge to become ESG compliant; the first from the sector to be certified with FSSC 22000— one of the highest food safety certifications in the world; and recently became the first Indian animal protein brand to attain the SA8000 certification— a leading global standard that encourages organisations to maintain and apply socially responsible and acceptable practices in their workplace.



ESG PLEDGE	
Energy Efficiency	Employee Health & Safety
Natural Resource Conservation	Emmisions Monitoring
Pollution Control	Farmer, Fishermen Community Upliftment
Animal Welfare	

Fig 2: Elements in Licious' ESG Pledge. Source: Licious

Licious strongly believes that an ESG-focused approach is the only way forward for businesses looking to secure a resilient future for themselves and their stakeholders. The adoption of this approach by the company and its founders exemplifies the firm's commitment to 'profit with a purpose'.

"The journey that Licious is on is best described as a marathon. While business growth is the cornerstone, sustainable progress is what we truly focus on. With our ESG commitment and global recognition, we have embarked on the journey of building an environmental management system that focuses on being more environmentally friendly with the efficient use of resources across different sectors we work with. At Licious, we will continue to improve employee safety, reduce workplace risks, and create better, safer working conditions across the communities we work with and across the organization. We would always be pegged higher on safeguarding the interest of humankind we work with, we work for, while fostering responsible operations and processes and social accountability. Our aim is to create a positive & meaningful impact for all our stakeholders."

— Vivek Gupta and Abhay Hanjura (co-founders of Licious)

ADVANCING ESG COMMITMENT AS A CORE DRIVER FOR GROWTH

Licious works with over 5,500 farmers and maintains a trained staff of more than 4,400 employees to make sure that it is able to manage a tightly-controlled, temperature regulated supply chain that delivers consistently on quality, sustainability, and traceability. Licious sources its meats and seafood from certified partners who have passed 100+ safety and legal checks. All of their partner farms have government approval, are monitored by qualified veterinarians, and practise hygienic and humane raising practices. They source their poultry from biosecure farms which follow strict processes and management practices to prevent the spread of diseases. Over the past few years, the company has made deliberate and concerted efforts to ascertain a clear path towards ESG compliance and SDG alignment. Licious onboarded EY to conduct an ESG compliance assessment and help develop a roadmap towards achieving ESG compliance. This led to the company taking a pledge to become ESG compliant and setting up an internal ESG and Sustainability division to monitor progress.

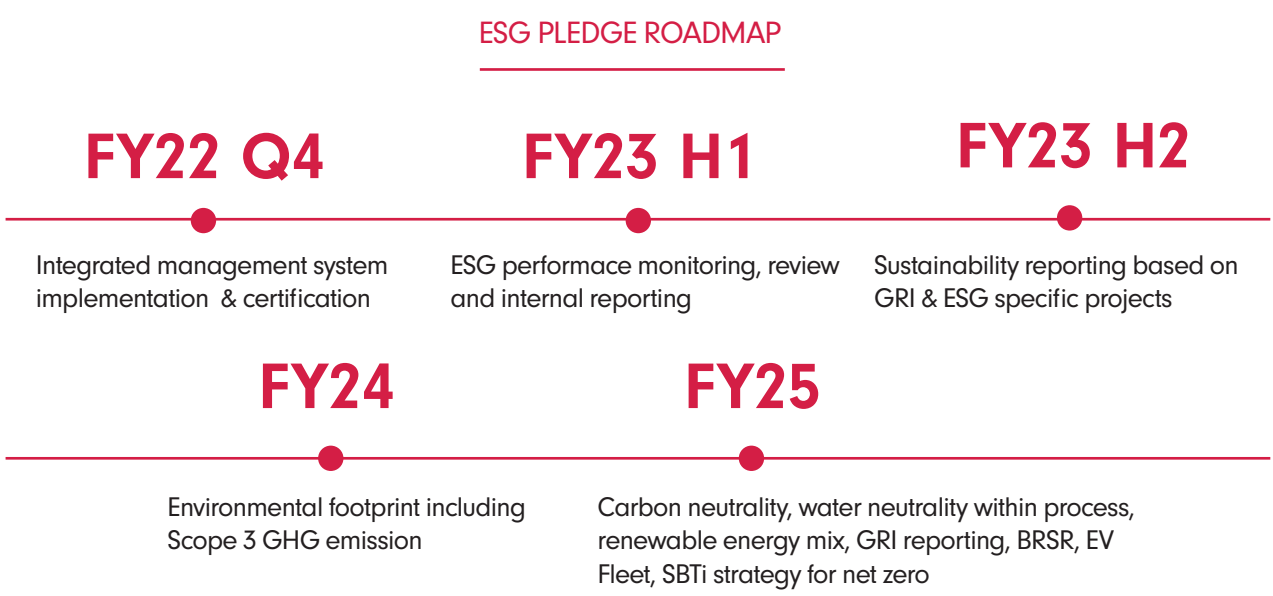


Fig 3: Licious' ESG compliance roadmap. Source: Licious

As a purpose-driven organisation, Licious prides itself in its pledge to:

• "Act as an environmentally responsible entity monitoring energy use, waste generation, pollution control, natural resource conservation, and animal welfare.

• Dedicate resources towards strengthening & creating a people-first organization which is inclusive and diverse.

• Continue to positively contribute towards the growth & welfare of the fishermen & farmer communities.

• Maintain complete transparency in internal practices, controls, stakeholder engagement & regulatory compliance."

For a category-creating firm like Licious, it is important that it demonstrates industry stewardship. To this end, Licious has sought several global certifications and audits that would serve as the "golden standards which could aid the overall advancement of the industry- delivering an elevated value to all its stakeholders." In addition to the FSSC 22000 and SA8000 mentioned earlier, Licious has checkmarked ISO 14001 and ISO 45001 as well which deal with environmental management and occupational health and safety respectively. The firm has

also been the recipient of several awards including the AMST Industrial Award and the CII Food Safety Award. These certifications and awards have helped Licious in defining their business strategies in a systematic manner with strong linkages to relevant SDGs.

In partnership with the World Animal Protection India, Licious has signed up for the 'Commitment to Chicken Welfare' standards, becoming the first Indian brand to do so and potentially benefiting 12 million birds per year. Under adherence to these standards, the firm has committed to ensuring that no caged bird will ever enter its supply chain. Furthermore, it will make suitable arrangements to secure a minimum square footage of space for each bird in addition to providing adequate light and healthy air quality among other necessities. Its partners will also have to comply with undergoing third party audits to maintain strict adherence to the standards.

In a similar vein, Licious has initiated an association with 'Friend of the Sea', a leading global sustainable seafood ecolabel, certifying both wild and farmed fish as well as seafood.

"Licious has had a large and measurable positive impact on the fishermen and livestock farmers, improving their income and bringing predictability to their businesses. Licious' continued investments and commitments towards community welfare will be instrumental in the evolution of the ecosystem."

— Mohandas Pai (Early Investor)

Licious' earnest attempts to create more inclusive outcomes through its business has been a running theme through its history of operations.

"My father worked as a butcher and I have learned this craft from him. Since I started working at Licious, I have received a lot of respect for my work. And it has made me understand that butchers can also have value and be worthy of respect in society, something I had not encountered before. Here at Licious, I get recognition for my work. It makes me feel proud."

— Mohammed Azan (Meat technician at Licious)

Fig 4: Licious' achievements in the ESG Space. Source: Licious

"As the first ESG committed brand in the sector we will continue to pave the way for conscious and responsible ways of doing business in India.

Our ESG pledge comprises eight specific themes focused on quality, sustainability, and traceability, aligned with the United Nations Sustainable Development Goals (UN SDGs). It has received several certifications that reinstate our commitment to become a socially and ecologically responsible organisation."

— Abhay Hanjura (Co-founder, Licious)

Licious partners with Recykal to achieve plastic neutrality

Licious' plastic waste management efforts have allowed it to responsibly redirect several hundred tonnes of plastic waste away from landfills and towards waste-to-energy plants, cement kilns, and a host of recycling partners. In the process, Licious has ended up achieving more than 100% of its target beyond compliance for Extended Producer Responsibility (EPR).

On World Environment Day 2023, Licious announced that it had achieved plastic neutrality for FY2022 in partnership with Recykal, a digital solutions company in the circularity and sustainability domain.

With Recykal's Plastic Neutrality solution, Licious was able to successfully recover a staggering 530 metric tonnes of plastic waste, effectively offsetting its plastic footprint for the year. The magnitude of waste recovered is roughly equivalent to the weight of the world's largest passenger airliner– the Airbus A380. The waste was retrieved from environmentally sensitive regions in India and processed using industry approved recycling methods.

"Our pledge towards being plastic waste neutral marks a milestone in our journey of being a responsible and sustainable brand. We are glad to play our part this World Environment Day and join in supporting global efforts to #BeatPlasticPollution through Recykal's digitally transparent sustainability solutions we aim to reaffirm our commitment to building a brand with a purpose; a purpose that safeguards the interest of mankind and the planet."

— Rajesh K (Chief Quality and Sustainability Officer at Licious)

"It is heartening to see organizations like Licious take a proactive approach toward addressing the plastic waste crisis and adopting responsible waste management practices."

— Ekta Narain (Co-founder and Chief Business Officer of Recykal)

530 Tonnes Responsibly managed plastic waste

1,49,000 +kWh Waste to energy converted

355 MT Carbon Dioxide Emissions Mitigated

4,94,000 +Litres Oil Saved

3,100 +Cubic metres Water Saved

SDG ALIGNMENT

Licious has strengthened its resolve towards creating a more sustainable and inclusive meat and seafood sector in India. As a leader and torchbearer of the industry, it has consolidated its position as India's most loved meat brand. We are excited to continue our partnership with this category-creating company.

Yulu

MaaS made in India, for millions of urban Indians

Yulu is India's largest shared electric mobility and Battery-as-a-Service (BaaS) company, maintaining the country's largest electric vehicle (EV) battery pool. Having built a technology-led mobility platform utilising IoT and ML for demand-supply management and efficient operations, Yulu has pioneered the use of Micro-Mobility Vehicles (MMVs) through a user-friendly mobile app for first and last-mile connectivity that is seamless, shared, and sustainable.

The company provides an economical and regulated solution network to the Indian urban mobility landscape via an intelligent, dynamically-balanced, on-demand network of over 18,000 electric scooters across Bangalore, Pune, Mumbai, Bhubaneswar, Gurgaon, and Delhi. Following the docked model, it has ensured efficient commercials in deployment and has earned the buy-in of city governments due to its regulatory adherence. Yulu is determined to uphold the three seminal guiding principles of inclusive and integrated urban mobility–accessibility, availability, and affordability, with a strong emphasis on convenience, ease of use, and reliability under Indian road conditions.

Given India's ongoing challenges against the consequences of rapid urbanisation such as air pollution, congestion, inadequate capacity, and persistent first and last-mile connectivity issues, Yulu is transforming the urban mobility experience for millions of Indians while working closely with policymakers and city authorities to help enhance the ESG impact of public transportation loops in India's major cities. Through the course of the pandemic, Yulu emerged as a true smart city solution, helping gig-workers deliver essential food, grocery, and other supplies under trying circumstances.

Since its inception, Yulu has thrived as the quintessential new-age sustainability-focused startup, creatively rupturing established practices in urban mobility. In this journey, it has accumulated several accolades including the Best Smart City Solution Startup At StartUp Awards 2021; the best innovator and disruptor in mobility technology award at the The BW Disrupt TechTors Summit & Awards; the best "Smart Mobility" company at the FICCI (Federation of Indian Chambers of Commerce & Industry) 4th Smart Urban Innovation awards; as well the Aegis Graham Bell Award for Best Innovation in Transport Technology. Yulu is mainstreaming Mobility-as-a-Service (MaaS) for millions of urban Indians. And if their growth trajectory is anything to go by, it seems they are just getting started.

Fig 1: The new Yulu Miracle GR
Source: Yulu

THE PROBLEM SPACE

Many Indian cities are plagued with incredibly high levels of air pollution. According to the 2022 World Air Quality Report released by IQAir, India has 39 out of the 50 most polluted cities on the planet, including six in the top 10[1]. The situation seems to be worsening with an estimate suggesting that India is home to 18 of the top 20 cities with the most severe increase in fine particle pollutants (PM2.5) between 2010 and 2019.[2] Unhealthy air already kills millions in India; a Lancet study put the number of premature deaths on account of air pollution at 1.6 million in 2019. [3] Given the current levels of pollution, nearly 40% of India's population is expected to lose, on average, 7.6 years in life expectancy.[4] Almost a third of India's particulate matter (PM) pollution comes from the transport sector, which is also the primary source for urban accumulations of nitrous oxide and carbon monoxide in densely populated cities such as Delhi and Mumbai.[5]

Moreover, India is the third largest consumer of crude oil in the world and one of its top importers. The country imports more than 80% of its crude oil requirements, spending about INR 2,000 crore (USD 250M) every day.[6] Approximately 50% of this oil demand comes from the transport sector.[7] These facts warrant a serious reconsideration of the current state of fossil fuel reliance that the transport sector has engendered.

Add to this India's burgeoning urban population, growing consistently without a increase in the infrastructural capacity, and we have a complex urban problem space in the making. Several Indian cities are bursting at the seams with unprecedented increases in economic activity and migrant inflow. Cities' structural resilience, especially in terms of public transport adequacy, non-motorised transport (NMT) usability, and last and first-mile connectivity, is being put to the test on a near daily basis.

Despite efforts from municipal authorities and governments at all levels, issues with regard to first and last-mile connectivity—and travel over short distances in general—continue to persist in India. Our first and last-mile connectivity apparatuses are oftentimes inaccessible and laborious to navigate, with commuters forced to utilise unsatisfactory transit options such as rickety rickshaw rides or, alternatively, walk long distances over inadequately built pedestrian pathways between their point of origin and the point of access to the concerned bus stop or metro station. This has had an obvious detrimental impact on accessibility and public transport ridership. In the absence of safe, accessible, and affordable first and last mile connectivity options, most commuters are unable to fully leverage the public transport system.

The paucity of reliable last mile connectivity choices coupled with issues of comfort, frequency, and convenience with regard to public transport modes has compelled individuals to either switch to private vehicle usage or resist the adoption of public transport. This is one of the reasons why India has seen a disproportionate increase in the number of private vehicles: between 1961 and 2011, the number of cities increased threefold and the overall urban population fivefold but the number of private vehicles increased more than 200 times.[8]

Increasing urbanisation thus threatens a further increase in the number of private vehicles, especially since India sees a strong correlation between the size of a city and the percentage of private transport dependent daily trips taken by commuters.

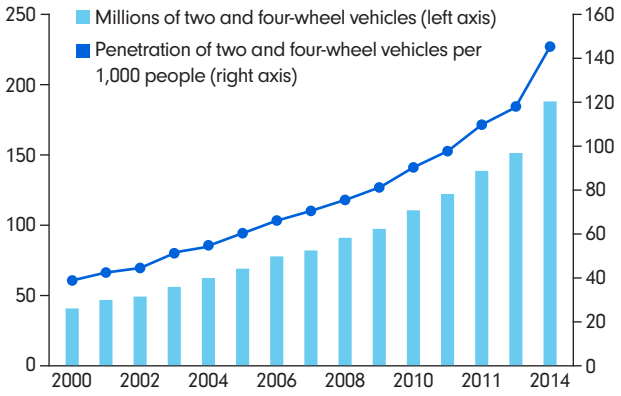


Fig 2: Vehicle ownership in India has been rising steadily.
Source: Oxford Institute for Energy Studies, U.S. Global Investors Inc.[9]

The factors mentioned above have led to choked arterial roads and heavy congestion across nearly all of India's major urban centres. According to the Tom Tom Traffic Index 2021, Mumbai, Bengaluru, and New Delhi are among the top 12 most congested cities in the world.[10]

An added problem is that of accessibility. Driving motorised vehicles usually demands skills which need substantial training as well as a licence to operate the vehicle on the roads. Not everyone has the time or access to resources—having a bike or car to practise on for a start—to undergo the necessary training or to obtain a licence. A vast number of individuals, including a vast majority of Indian women, do not have a driving licence. 85% of unemployed underprivileged youth are excluded from the opportunities the gig economy offers for delivery services because they do not have a driving licence nor can they afford a vehicle of their own.[11]

Notwithstanding the notable improvements in this domain over the past few years, the prevailing transport system in India continues to be environmentally unsustainable, infrastructurally under capacity, and inadvertently exclusionary.

YULU'S SOLUTION

"Yulu has been practising what the world is converging on now. EVs are the need of the hour. Shared EVs were quite a new concept for people when we started off and it was not easy to sell our idea. But in recent times, shared EVs and battery-as-a-service have taken over the auto market and we will continue to stay ahead of the curve"

— Amit Gupta (Co-founder and CEO of Yulu)

The issues highlighted make urban mobility, and more importantly intermediate public transport (IPT), ripe for strategic disruption. Yulu has been able to do just that by betting big on micro-mobility and working diligently to create this category.

To understand the value-add of Yulu's proposition, it is imperative that we recognise the potential of electric micro-mobility options to drastically reduce the resource burden of the transport sector by improving the underlying efficiency multifold. Figure 3 gives an indication of this.

Efficiency gains coupled with electric vehicles being considerably greener than their internal combustion engine counterparts on a well-to-wheel basis means that emissions can go down drastically. Additionally, electric MMVs can help ease congestion; provide flexibility of commute; bring down journey times and the associated costs; reliably meet first and last mile connectivity needs; and potentially, perhaps over a long period of time, bring down the number of private vehicles on the roads, especially ICE two-wheelers. India is uniquely positioned to leverage the advantages that MMVs offer (see Figure 4).

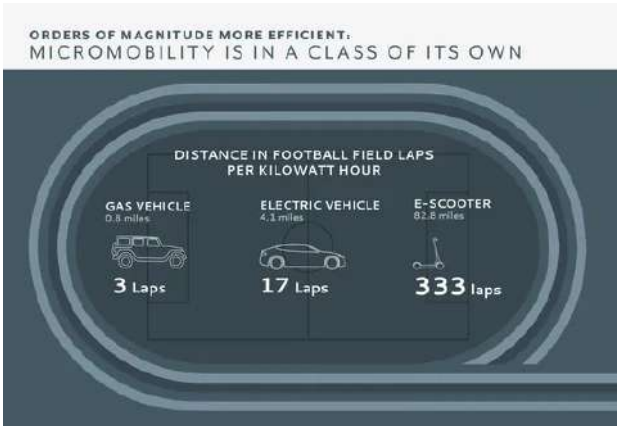


Fig 3: Micro-mobility options are orders of magnitude more efficient
Source: Levi Tillemann and Lassor Feasley, Wired.[12]

Fig 4: India's potential for micro-mobility. Source: Yulu

Yulu has strategically positioned a fleet of cost-effective, easy to manoeuvre MMVs all across select cities which can be unlocked using a simple mobile application. Overall, their vertically integrated solution comprises[13]—

• **Purpose-built electric 2-wheelers:** Yulu's electric bikes harmoniously combine smart features, aesthetics, and practicality, catering to a range of use-cases and demographic segments.

• **Reliable Li-ion batteries:** Yulu EVs are fueled by secure and dependable Li-Ion batteries utilising LFP chemistry. These intelligent batteries—equipped with Controller Area Network (CAN) based protocols—establish communication with the EV at a frequency of 10 times per second, resulting in elevated ride performance and enhanced efficiency.

• **Intelligent Charging Stations:**Yulu's ergonomically designed charging stations are deeply embedded in its core mobility platform, allowing for safe and efficient battery charging at scale. The charging network is equipped with smart charging systems that are able to detect and diagnose battery charging concerns and only charge batteries when they're healthy and fault-free.[14]

• **AI optimised operations workflows:** Yulu's operations management system is similarly optimised for scale with machine-learning enabled, iterative feedback loops ensuring data integration at high levels of depth and granularity.

• **A user-friendly customer app:** Yulu's easy to use app lets users locate and unlock Yulu bikes. For Wynn—the ownership focused electric bike—the app lets owners access ride statistics, monitor battery health, reserve batteries at swapping stations, access payment data and do much more.

At present, Yulu offers three products (see Figure 5):

A) YULU MIRACLE: light-weight, dockless electric two-wheeler powered by state-of-the-art IoT with a maximum speed of 25 km/hr.

B) DEX: delivery-focused, 100% made in India, smart, dockless electric two-wheeler with a goods carrying capacity of 15kg .

C) WYNN: Made in India, digital-first, ownership oriented electric two-wheeler with battery swapping based subscription plans to reduce upfront ownership costs, specifically targeting the mobility needs of women, students, and the elderly. The Wynn additionally boasts of truly-keyless access combined with family sharing, vehicle tracking, and over-the-air (OTA) software upgrades capabilities.

Fig 5: Different Form-factors available in Yulu product suite. From left to right: Miracle GR, Dex GR, and Wynn XP. Source: Yulu

Unlike the case with other motor vehicles on the roads, one does not need a licence to operate any of Yulu's offerings. This makes Yulu's offerings a lot more accessible than their motorised counterparts. It is not an overstatement to say that **Yulu is running the largest organised experiment towards mass-scale, demand responsive (MaaS), self operated mobility in India.** The image below shows the process a user has to undertake to use a Yulu bike.

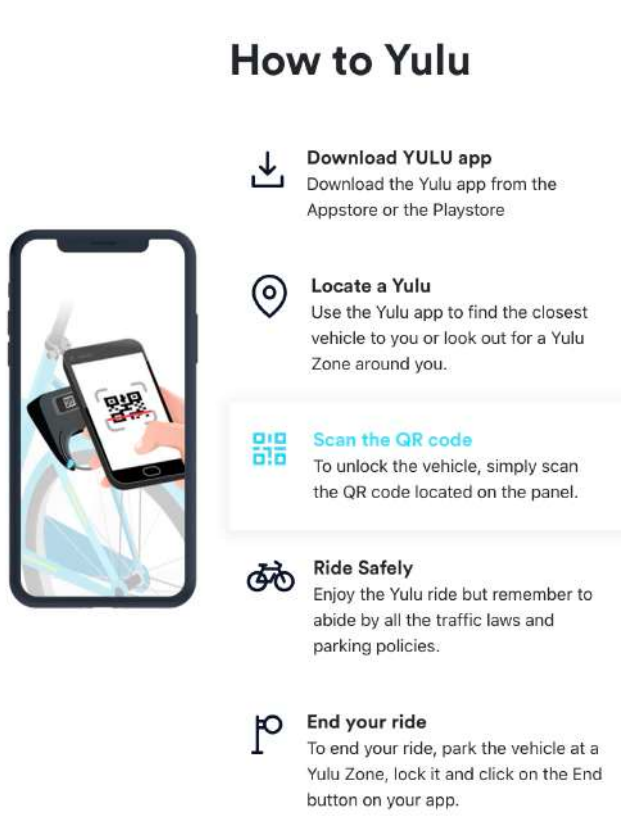


Fig 6: Process to use a Yulu. Source: Yulu

Using this simple onboarding and utilisation process, Yulu has been able to achieve remarkable scale and impact over a short period of time. Some of its key usage numbers for FY23 are mentioned in the table below.

37,500+	Average number of trips per day
19.94	Average number of trips per unique customer per month
3,000+	Number of Yulu Zones

Table 1: Select operating metrics for Yulu in H1 FY23. Source: Yulu

In 2023 alone, the company completed more than **70 million goods deliveries** and much of this boils down to Yulu's success in building a dense, cluster-based network and service model supported by the use of intelligent technology (see Figure 6). It has been able to do so by gradually strengthening the deployment of MMVs over strategic intersections and creating a compelling solution for its users by delivering a reliable and cost-effective method for short distance commute. **Thanks to its focused efforts, Yulu is currently the only large-scale dockless EV solution for micro-mobility in India.**

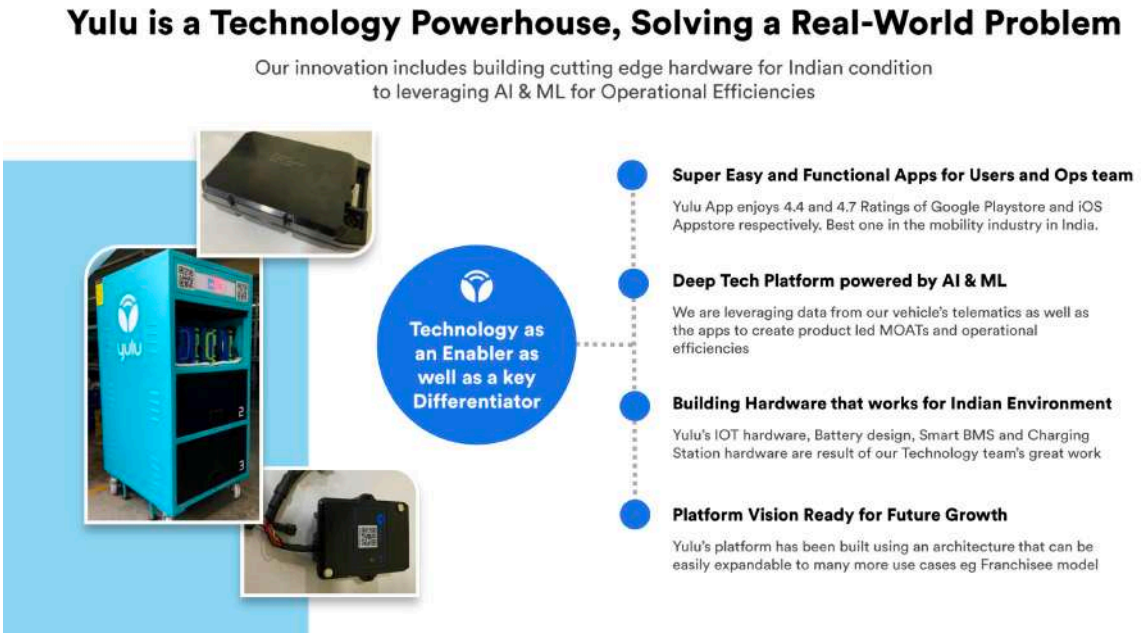


Fig 7: A snapshot of Yulu's technological prowess. Source: Yulu

Yulu zones, Yulu's proprietary docking and swapping bays, act as convenient boarding and drop off locations for riders. At present, the company operates more than 3,000 such zones with development and expansion plans for another 9-10 thousand in the works. Yulu has built India's largest battery pool with arguably one of the largest and densest battery swapping networks in the world.

Through its partnership with Magna, a leading global automotive components manufacturer, Yulu seeks to build the requisite infrastructure and capacity to ramp up its swapping network. Under the initiative, Yulu and Magna plan to open up their expanded battery swapping and charging network to other players and the public at large. Magna brings with it extensive capabilities in design, engineering, and manufacturing to Yulu's cause. At present, Yuma, the joint entity between Yulu and Magna, is operating more than 125 swap stations in India and has already completed 10 million swaps.

As a category creator, Yulu leads a service lineup that addresses previously unattended mobility challenges, serving diverse use-cases and demographics (see Figure 7).

Fig 8: Yulu is empowering delivery riders. Source: Yulu

During the pandemic, the company added a new customer segment: delivery personnel. Yulu emerged as a veritable lifeline for delivery personnel in this period, unlocking robust B2B use cases and driving up utilisation levels for its vehicles. Over time, the share of goods mobility in Yulu's business has increased multifold, thereby allowing large swathes of individuals to join the workforce by delivering for platforms such as Zomato and Swiggy even if they do not possess a vehicle of their own. This has resulted in a 25% net increase in monthly earnings for delivery personnel and a 40% reduction in fuel expenses for those who were previously using their own two-wheelers to service deliveries.

Over the past few months, Yulu has partnered with a range of food aggregators and hyperlocal delivery firms. Some of its prominent partnerships include–

• Yulu's partnership with Zepto: The partnership involves the deployment of 20,000 DeX EVs for the company's delivery partners to help Zepto transition to an all-electric vehicle fleet. This partnership will go a long way in helping unlicensed delivery partners work for Zepto and in promoting women's participation in the delivery sector.

• Yulu's partnership with Zomato: Yulu has partnered with Zomato, providing 25,000-35,000 Yulu DeX to delivery partners onboarded on Zomato's platform with a view to increase their earnings by up to 40% and potentially enable 3 lakh green deliveries a day by 2026.

Yulu's team has additionally entered into long-term partnerships with policymakers, urban planning consortiums, and public transportation authorities like those responsible for Metro and bus services to create a favourable environment for sustainable, multimodal, short distance commute and IPT.

By putting in the hard yards, Yulu has set in motion a catalytic reaction to mainstream electric mobility in India and make it easier for companies to innovate in the domain and subsequently ensure the necessary institutional and consumer buy-in from various stakeholders.

Fig 9: A snapshot of Yulu Dex's impact. Source: Yulu

YULU'S ESG VISION

Yulu's forays into the electric mobility sector in India have been coterminous with a renewed government and private sector push to increase the uptake of electric vehicles in the country. The Central Government's FAME I and FAME II policies, coupled with efforts from respective State Governments—19 states have dedicated EV policies at the approved, notified, or draft stages—have augured well for the sector. More recently, the acceptance of successful bids for the Government's Production Linked Incentive (PLI) scheme for advanced chemistry cell battery storage, India's reaffirmation of support to the EV30@30 campaign targeting 30% of new vehicle sales to be electric by 2030, and its pledge to achieve Net-Zero by 2070, have further galvanised the entire ecosystem to work towards promoting sustainable mobility in the country. Accordingly, Yulu is a part of NITI Aayog's Shoonya campaign which seeks to bring together industry and consumers to promote zero pollution mobility for ride hailing and deliveries.

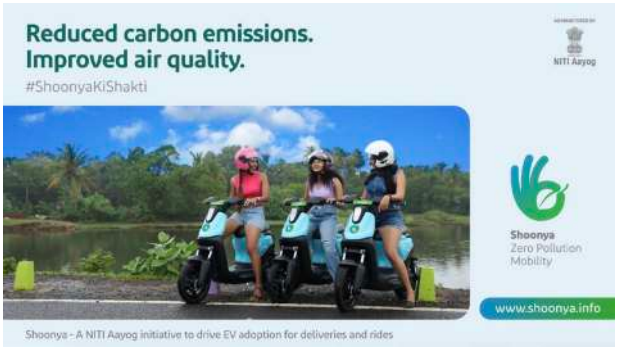


Figure 10: The new Yulu Miracle featured in the responsible tourism leg of NITI Aayog's Shoonya campaign. Source: Yulu

Yulu aims to play its part in India's journey to Net-Zero. Riding on the demand for, and the ensuing success of, electric MMVs, Yulu is set to build on its achievements and usher in Mobility 2.0 for millions of Indians. The first wave of digitally enabled mobility innovations in India saw the rise of mobile application driven ride-hailing platforms and a few scattered, hesitant attempts towards creating a multi-modal MaaS framework. But its generated impact has been far from ideal — ride-hailing cab services continue to be unaffordable for the vast majority of Indians, with concerned companies not being able to support even 1% of the overall market for daily trips. Moreover, most cab rides ferry a single rider, thereby eventuating inefficient resource utilisation of road and vehicle space besides furthering congestion and air pollution.

In light of these deficiencies, Yulu is eager to build Mobility 2.0 for 100 million Indians by mainstreaming electric mobility which is smart, shared, sustainable, small, and safe. This will allow for shared mobility to occupy a greater share of the public's daily mobility mix. According to Yulu, three key developments will influence the future of mobility (see figure 9).

Figure 11: Critical developments driving the future of mobility
Source: Yulu

To assist with the second development, Yulu and Magna are opening up their expanded battery swapping and charging network to other players and the public at large. The company is also looking to adopt an additional charging standard to aid with improved usability across OEMs.[15]

With regard to delivery services, Yulu has made a calculated expansion towards B2B last-mile logistics. Yulu's offerings make for a cost effective solution for gig-workers since they can use a Yulu bike at highly affordable rates; adhere to pre-set delivery timelines by scything through traffic; commute safely in a vehicle tailor-made for Indian road conditions and alley sizes; and operate without a licence.

Yulu is creating earning opportunities for individuals from socio-economically underprivileged segments, 80% of whom would otherwise have fallen by the wayside with the recruitment funnel due to the lack of a licence. Yulu is able to reduce delivery costs by 35% due to the EV form factor and help delivery companies onboard more executives.

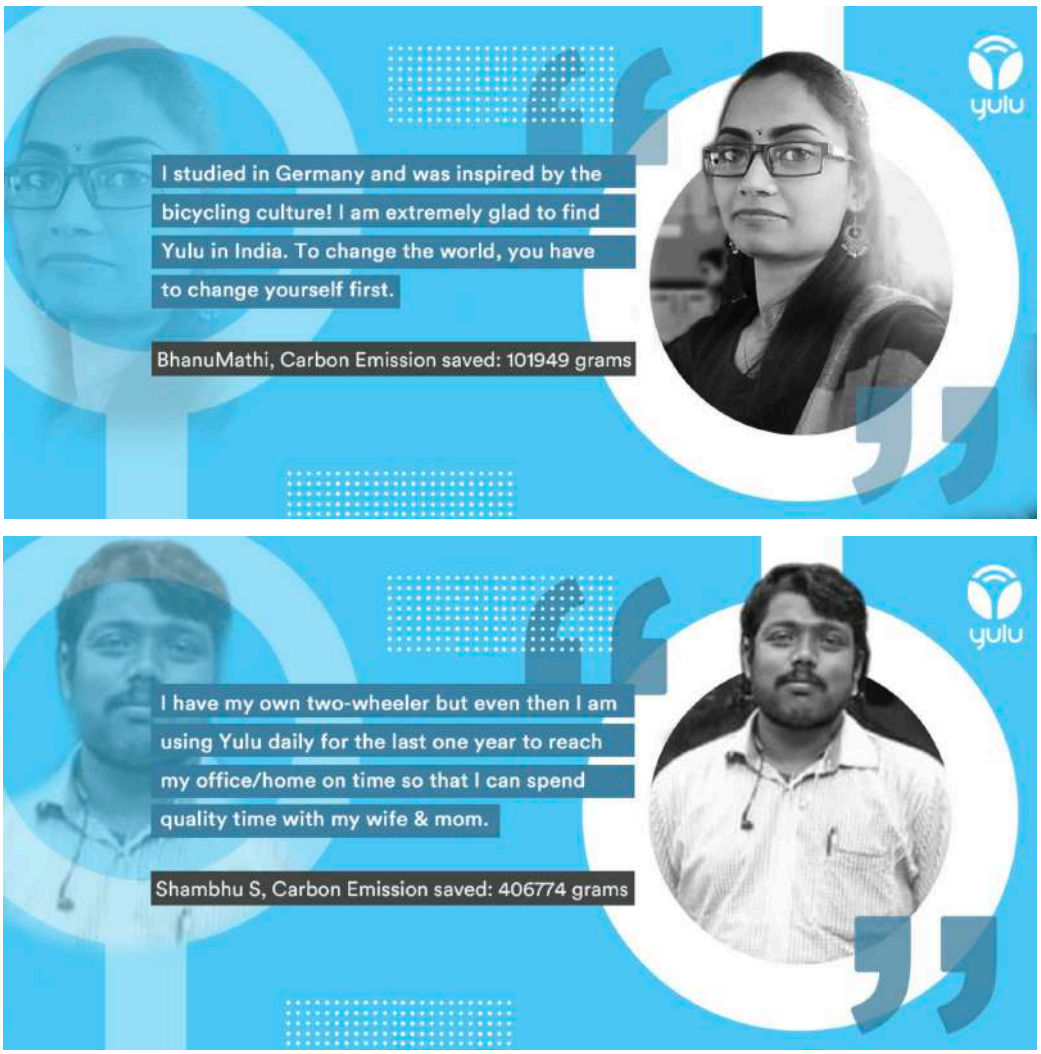


Fig 12: Yulu user feedback and their emission savings. Source: Yulu

A prominent strand in Yulu's ESG vision is to promote safe ridership. As Yulu's gig-workers user base grew, it realised that many of them were first time vehicle users and were not well versed with traffic rules, road safety protocols, or best practices in safe riding behaviour. To improve the status quo, Yulu co-developed the country's first road safety certificate program for delivery partners with the Traffic Training Road Safety Institute (TTRSI) and the Bengaluru Traffic Police (BTP). The program comprises interactive modules with a healthy mix of classroom training and practical learning. The modules cover "traffic engineering, traffic awareness, signboard education, defensive riding, and road rules and regulations to provide the partners with a clear understanding of road safety and correct driving behavior."[16] The company is also in the works to introduce a wrong-way detection feature for which its tech is currently awaiting patent approval.[17]

Fig 13: Glimpses from Yulu's safe rider program . Source: Yulu

Under an initiative in the same vein, Yulu had earlier partnered with Rotary Bangalore IT Corridor (RBITC), Directorate of Urban Land Transportation (DULT), Bruhat Bengaluru Mahanagara Palike (BBMP) and Bengaluru Traffic Police (BTP) to organise two Cycling Awareness rallies. In association with the Bengaluru City Police and the Bengaluru Traffic Police, Yulu has organised multiple safety drives all around the garden city.

Yulu also undertakes skilling programs for its on-ground force to create a robust skill pool of mechanics, electricians, battery handlers, and other ancillary workers. It uses advanced training methods and strategies with gamified content and augmented reality platforms to further learning outcomes.

Additionally, Yulu has emerged as the preferred choice for short commutes among women. Many women neither have access to private vehicles nor the economic means and social or familial sanction to purchase one. As mentioned earlier, a small percentage of women in India have a driving licence. The paucity of women drivers on Indian roads hinders confidence building and stokes safety concerns among women who are eager to drive. This perpetuates a vicious cycle that limits women's participation in a range of socio-economic activities due to their inability to access safe, reliable, and affordable mobility options. Yulu is breaking this cycle by providing comfortable rides at reasonable costs. With Yulu, women have found access to an asset that can help them earn an income which not only furthers their attempts at gaining financial independence but also empowers them to support their families.

Yulu enjoys a first-of-its-kind strategic partnership with Bajaj with the latter helming the production of 100% home-grown, purpose-built electric vehicles for Yulu's fleet. Bajaj's decades of experience in design and manufacturing make for a perfect match with Yulu's state of the art IoT and data analytics capabilities. Going forward, all of Yulu's new bikes will be designed and manufactured at Bajaj's Pune facility. The new DeX GR, for instance, is a 100% made in India vehicle for last-mile logistics.

Yulu also takes efforts to institutionalise circularity and minimise resource use in its operations. 98% of Yulu Zones are cost free, with city authorities, citizens, and corporates coming forward to help make their cities more sustainable. This 3C (Citizen-Corporate-City) partnership approach by Yulu has ensured that the firm is able to provide parking spots at prime locations such as Metro stations and Tech Parks at negligible costs to the company.

With regard to Yulu's commitment to principles of the circular economy, the firm ensures that its materials and parts are recycled by authorised recyclers. At present, "Yulu recycles motors, throttles, Daytime Running Lights (DRL), controllers, chargers, wire harnesses, PCB boards, and batteries to extend their normal life cycle so that they can be reused far beyond their end."[18] By partnering with external recyclers who extract precious metals such as lithium and cobalt from used batteries and resell them to cell manufacturers, Yulu is helping close the loop for EV and EV battery manufacturing through the promotion of urban mining.

Finally, Yulu is best positioned to leverage its deep tech platform and data analytics capabilities to assist urban planners and civic authorities. With over 70 million trips each year, Yulu is ahead of any other micro-mobility player in data collection. By relying on this rich, granular, and diversified data repository, planners and policymakers may undertake data-backed, evidence-based policy measures as they go about redesigning existing transportation systems to streamline last-mile commutes and reduce the carbon footprint of cities.

Fig 14: Photos from Yulu's safety drives organised with the Bengaluru City Police and the Bengaluru Traffic Police. Source: Yulu

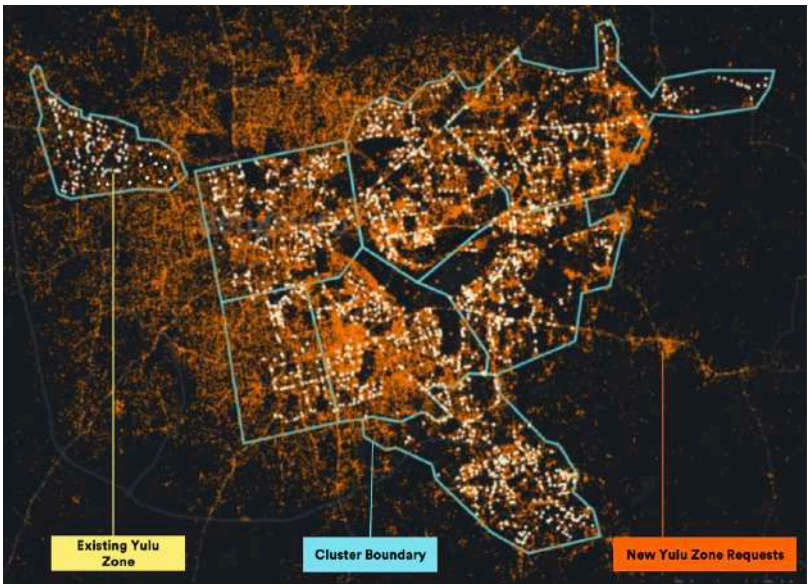


Fig 15: An example of Yulu's data and mapping capabilities. Source: Yulu

YULU'S IMPACT

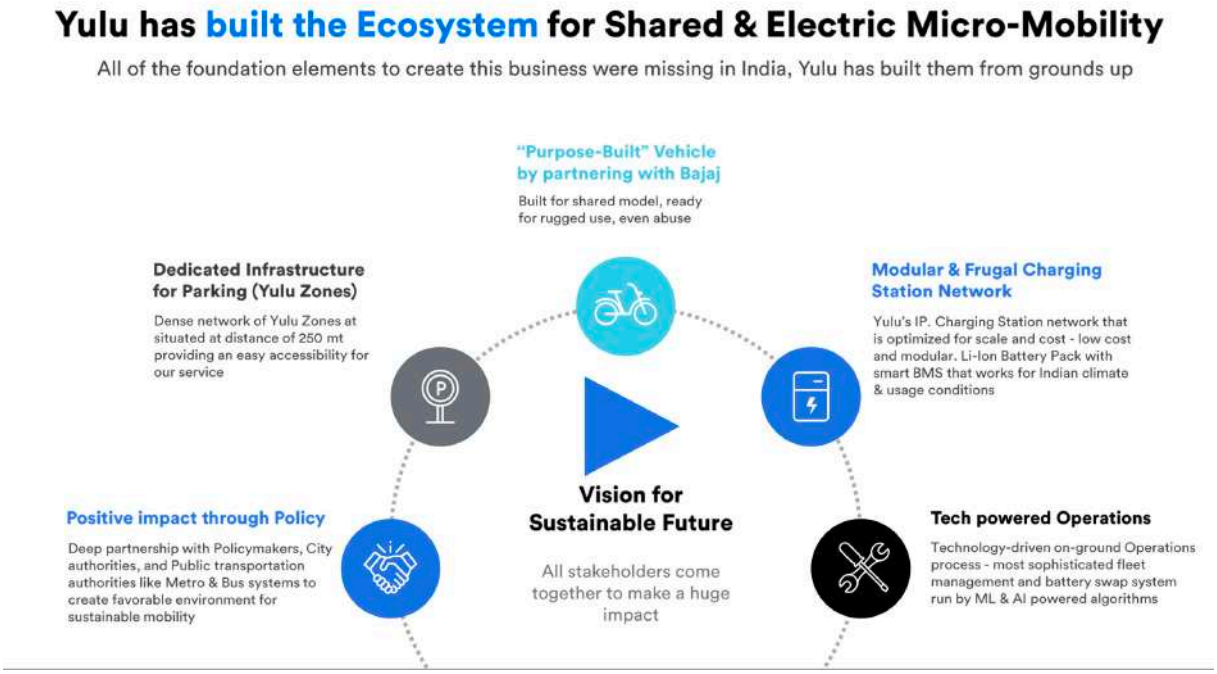


Fig 16: Facets of Yulu's vision for a sustainable future. Source: Yulu

Yulu has made impactful strides towards mainstreaming a sustainable urban future for millions of Indians, **facilitating 4 green deliveries every second.**

Over the years, Yulu has saved over 20,000 metric tons of carbon emissions. To put that in perspective, a typical car would emit nearly one metric ton of carbon dioxide in a single trip from Srinagar to Kanyakumari—a distance of over 3,600 kilometres! Cars emit nearly 4.6 metric tons of CO2 a year; with increasing adoption, Yulu is primed to make a significant dent in offsetting passenger vehicle emissions. [19]

Some impact metrics for Yulu are presented in the table below-

425 +Mn	Sustainable Commute undertaken by Yulu users (in Kms)
30 +Mn	Productive hours saved by Yulu
1300+	Daily Women riders of DeX
35 %	Cost savings per green delivery
6 +Mn	Green deliveries made on Yulu every month

Table 2: A snapshot of Yulu's impact. Source: Yulu

There are hundreds of testimonials to highlight the positive impact that Yulu has made in people's lives.

"I used to deliver food by my cycle until I got to know about Yulu. It is accessible and reasonable to me. I have to pay 100 rupees per day for it. I deliver food in Lajpat Nagar, Jangpura, Greater Kailash, CR park, and nearby areas. A lot of my colleagues also use it for the same."

- Rajeev (Delivery Executive, Zomato)

"I used to work in Connaught Place as a sales executive. Due to the Covid-19 situation I lost my job back in 2020. After that I decided to start my own tiffin service. My mother helps me in the kitchen and I use Yulu to deliver the food to nearby offices in Connaught place. Yulu has helped me a lot in these last few years as I didn't want to depend on someone for delivery so I did it all by myself. Thanks Yulu!!"

— Rekha (Tiffin service provider)

"I work as a newspaper distributor in the morning and run a small tea shop later on. Initially I used to do it on a cycle but riding cycle in summers gets very harsh and an impossible task. I saw people riding Yulu before so I decided to try it some day. One day my cycle broke so it was a good chance to try Yulu and I did it. Since then I have been using Yulu daily for my work. It's been a year and I am happy using it."

— Rambabu (Newspaper distributor)

"I am a student of B.com DU SOL. I belong to a poverty-stricken family where it often gets hard to manage our expenses. After schooling I decided to help my family financially and started working at a small restaurant where I used to get paid 5 to 7K a month. One day one of the Yulu field staff offered me a job and I have been working as an operator at Yulu for the last 1.5 years. I am now able to help my family very well and I am also about to graduate. Yulu has helped me grow in a better direction in my life."

— Ashish (Yulu operator)

DFC partners with Yulu to expand clean transportation in India

Yulu has secured USD 9 million in debt financing from the U.S. International Development Finance Corporation (DFC)—the United States' Development Finance Institution (DFI) and marquee impact investor working to support organisations designing solutions to address the most critical challenges confronting emerging markets today.20

DFC proposed the investment through its new e-mobility financing team, as part of its efforts to finance zero emissions transportation solutions across the value chain—from vehicle production to MaaS enablement. The investment will bolster Yulu's vision of advancing green last-mile mobility solutions for the movement of people and the delivery of goods.

This funding will accelerate the execution of Yulu's objectives to install their battery swapping network and cover 500 stations across multiple cities over CY 2023 and 2024.

"This financing from a forward-looking institution as the DFC speaks about their belief in Yulu's vision and the ability to execute at scale, to not just create a green mobility alternative but also to create livelihoods through direct and indirect employment opportunities. We are quite thrilled."

—Anuj Tewari (Chief Financial Officer, Yulu)

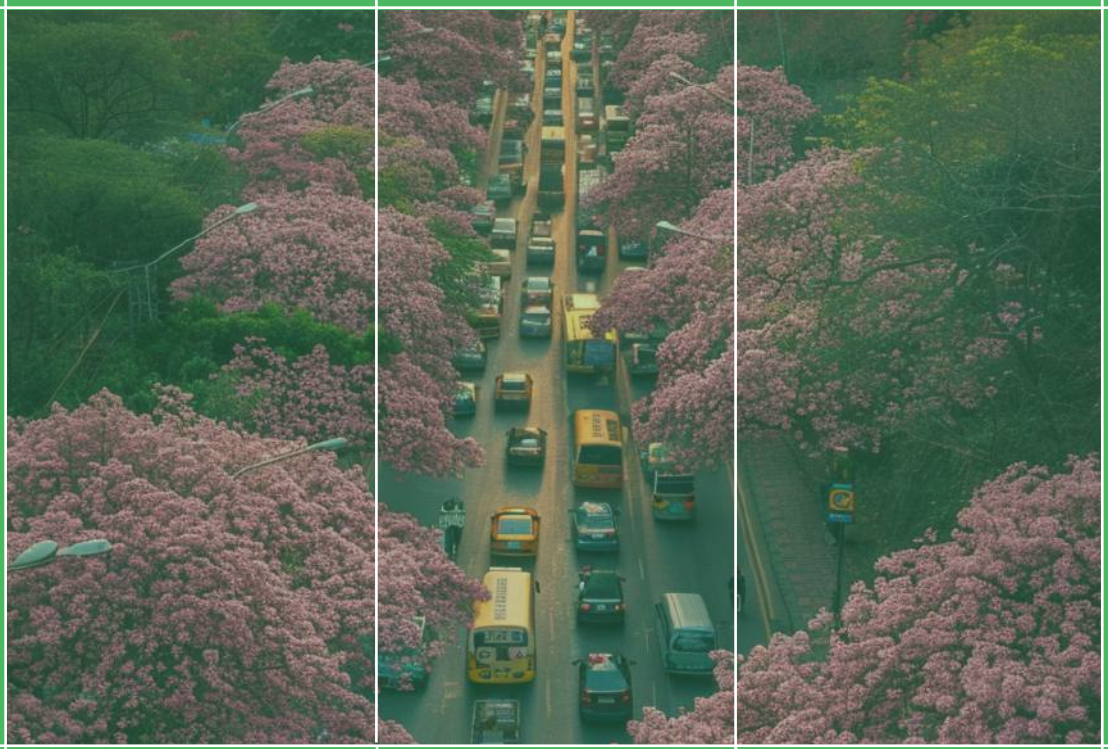
DFC's support to Yulu vindicates the company's impact credentials—and future potential—in anchoring mobility outcomes that further sustainability, accessibility, safety, and affordability at unprecedented scale. DFC's emphasis on empowering organisations that helm transformative projects to drive economic growth and improve livelihoods is strikingly congruent with 3one4 Capital's thesis on advancing technologically progressive, innovative solutions that expand access to opportunities without worsening environmental degradation. 3one4 Capital looks forward to working with Yulu to build purposeful and intentional relationships with like-minded investors and generate outsized ESG returns.

During the pandemic, Yulu established itself as an agile and responsive smart city solution, becoming the partner of choice for the delivery of essential goods and medicines. Under its "PranVayu" initiative, it even delivered oxygen concentrators to those in need for free.

SDG ALIGNMENT

Yulu is building a full stack MaaS solution for millions of urban Indians. By providing a feasible, affordable, convenient, and sustainable alternative to existing mobility options, Yulu is spearheading mass adoption of both micro-mobility and electric vehicles in the country. Its attempt to create and nurture this category in India has already demonstrated industry-leading impact on inclusivity, income earnings, emissions reduction, and infrastructure utilisation. Its deep tech platform backed by machine intelligence and IoT is creating an ecosystem for exciting innovations in the mobility domain. We are excited to continue our partnership with Yulu as it scales its impact across cities.

Fig 17: Yulu's SDG Alignment. Source: Yulu



3one4 Capital Insights

Overview of the ESG Regulatory Environment

Global perspective – ESG sensitivity and world regulations

International organisations have been warning governments time and time again of the devastating impact of human activity not curtailed or regulated from an environmental impact perspective. The sixth UN Intergovernmental Panel on Climate Change (IPCC) report (2021)[1] crystal gazes into the impact on climate change as a consequence of human activity becoming increasingly devastating unless governments' current targets to reduce emissions are exceeded.

1980

Human Development Index (HDI)
UNDP releases HDI socio-economic indicators to monitor development of Nations

1999

The Triple Bottom Line (TBL) suggested business should be concerned about impact on people & planet – and not only finance and profit

2000

Global Reporting Initiative (GRI)
Non-Govt. org. that launched 1st version of guidelines, was inaugurated as a UNEP collaborating organization in 2002

2006

Principles for Responsible Investment (PRI)
World's leading proponent of responsible investment, promoting to incorporate ESG into investment decision making

2007

Climate Disclosure Standards Board (CDSB)
A non-profit org. providing material information for investors & financial markets through integration of climate related information into mainstream financial reporting

2011

Sustainability Accounting Standards Board (SASB)
A non-profit org. founded to establish industry specific disclosure standards across ESG topics that facilitate communication between companies and investors

2013

Integrated Reporting (IR)
A concise communication on how an organization's strategy, governance, performance and prospects lead to value creation over the short, medium and long term

2015

Task Force on Climate Related Financial Disclosures (TCFD)
Focuses on reporting the impact of an organisation on global climate. It seeks to make disclosures more consistent & comparable

2021

Value Reporting Framework (VRF)
SASB merged with integrated Reporting framework to form VRF which is industry agnostic. By June '22, VRF will consolidate with CDSB to form the International Sustainability Standards Board (ISSB)

Fig 1: Global Evolution of Disclosure Metrics for Sustainable Business Practices.

Currently, Europe is leading the way in terms of regulations that lie at the crossroads of capital, business, and institutional impact of climate change.[2] The regulations have sustainable finance at the forefront of its agenda and aim to demonstrate that market incentives can shift the allocation of capital to combat climate change and environmental degradation.[3] The United States has begun legislating to direct funding towards ESG-friendly projects.[4] Considering the diversity of the Asia-Pacific region, the manner in which each of the regimes operate has been dependent on the economy they serve. However, the general trend shows movement towards improved data and disclosures.[5]

While countries around the world have begun to regulate, several research bodies and other entities are measuring the impact of such regulations and the activities of entities across sectors. Largely, the ESG regulations

and disclosure requirements in most countries apply to public companies or companies which meet a prescribed revenue threshold and number of employees. The nature of such regulations in certain conditions is mandatory and in others, voluntary.

Fig 2: Number of voluntary vs mandatory provisions by region. Source: Carrots & Sticks[6]

UNITED KINGDOM

The United Kingdom has enacted two new laws that, when combined, apply to all UK registered companies and Limited Liability Partnerships (LLPs) with more than 500 employees and annual revenue of more than £500 million; namely, the (a) Companies (Strategic Report) (Climate-related Financial Disclosure) Regulations 2022; and (b) Limited Liability Partnerships (Climate-related Financial Disclosure) Regulations 2022. The legislation also requires all UK Public Interest Entities to produce "non-financial information statements" under existing reporting regulations to include environmental reporting. In its current form, the law requires environmental disclosure reporting to include fairly standard risk management information about how risks are identified, controlled, and measured.

The regulations were passed by the UK Parliament in January 2022 and to be implemented from April 6, 2022. As the UK Parliament had been hinting at the need to implement ESG laws post haste for months prior to adoption of the official legislation, many corporations have already begun to document their environmental agenda. While most of the countries across the world have mandated public/publicly listed companies to ensure ESG compliance, and have generally left the private companies unregulated, the United Kingdom has recognised that it is crucial to ensure that sizable private companies (in terms of number of employees and revenue) are treated on par with public companies. Pursuant to this move, the United Kingdom has set off in a progressive direction in terms of treating certain private companies on par with public companies and finding a balance between addressing ESG issues versus burdening private companies with compliance.

UNITED STATES OF AMERICA

In the United States (US), there are no mandatory ESG disclosure requirements at a federal level[7]. In contrast to the European Commission, which has established more precise conduct-based rules on ESG disclosures, the focus by the US on ESG has been on voluntary, market-led processes rather than new regulations.

The SEC recently announced an all-agency approach to tackling climate change and other ESG parameters by establishing climate change and other ESG Task Forces to enforce climate-related risks and disclosures[8]. The SEC has till date recommended three main disclosure frameworks for climate change disclosures. They are primarily the Task Force on Climate-Related Disclosures (TCFD), Climate Disclosures Standards Board (CDSB), and Sustainability Accounting Standards Boards (SASB).

TASK FORCE FOR CLIMATE-RELATED DISCLOSURES (TCFD)

SCOPE	Established in 2015 by the Financial Stability Board (FSB). Scope of over 1000 supporters globally as of 2020
OBJECTIVE	Industry-led initiative created to develop a set of recommendations for voluntary climate-related financial disclosures
BACKGROUND	The TCFD has developed recommendations for companies to focus on to create more transparent disclosures around climate-related issues. When following these recommendations, stakeholders are more informed around their investment, credit and insurance underwriting decisions
METHODOLOGY	Disclosures recommendations structured around four thematic areas that represent core elements of how organisations operate: Governance, Strategy, Risk Management, Metrics & Target

CLIMATE DISCLOSURES STANDARDS BOARDS (CDSB)

SCOPE	Established in 2007 by the World Economic Forum (WEF). Scope usage by over 300 companies, 32 countries across 10 sectors as of 2017

OBJECTIVE	To promote and advance climate change-related disclosure in a mainstream report through the development of a global framework
BACKGROUND	The CDSB provides companies with a framework for reporting environmental and climate change related information that complements already existing financial reporting. It allows companies to provide investors with environmental information through a standard corporate report to aid in decision making
METHODOLOGY	12 reporting requirements while aligning with TCFD elements include: Governance, Management's environmental policies, strategy & targets, Risks and opportunities, Sources of environmental impact, Performance and comparative analysis, Outlook, Organisational boundary, Reporting policies, Reporting period, Restatements, Conformance, and Assurance
SUSTAINABILITY ACCOUNTING STANDARDS BOARDS (SASB)	
SCOPE	Established in 2011. Scope covers over 598 reporters and 727 mentions in 2021
OBJECTIVE	To develop standards for use in corporate filings to the U.S Securities and Exchange Commission (SEC), so investors can have comparable or non-financial
BACKGROUND	SASB developed these standards in order to answer the increasing demand from investors are allowed to compare performance on critical ESG issues within an industry
METHODOLOGY	Available for 77 industries internationally. Companies are rated according to five ESG dimensions: Environment, Social Capital. Human Capital, Business Model & Innovation, and Leadership & Governance

Table 1: Overview of the three major SEC recommended disclosure frameworks

At present, the SEC requires all public companies to disclose information that may be material to investors, including ESG related information and disclosures of how diversity plays a prominent factor in considering directorial candidates. Further, the SEC has approved a change to the Nasdaq rules that will require explanations by listed companies on their failure to appoint at least two diverse directors on their boards.

SINGAPORE

Singapore has taken a two-prong approach where it has dealt with ESG through regulations and initiatives supporting the ESG agenda.

The Singapore Exchange began requiring listed companies to publish an annual sustainability report on a 'comply or explain' basis in 2016. When combined with existing reporting requirements, the sustainability reporting would enable a better assessment of a company's financial prospects and management quality.

On the investment front, the Monetary Authority of Singapore (MAS) has provided guidelines on Environmental Risk Management (EnRM) for Asset Managers, enhanced disclosures for ESG retail funds, and constitution of the Green Finance Industry Taskforce (GFIT) to develop a green taxonomy. The EnRM provides guidelines for asset managers, bankers, and insurers. In relation to asset managers, the EnRM aims to provide guidance in relation to environmental risks, governance and strategy, research and portfolio, portfolio risk management, disclosure, etc. The EnRM for asset managers essentially provides a roadmap for asset managers to build resilience against environmental risks by including proper governance and strategy practices in respect of awareness of environmental risks (both generally in relation to investments by the investors and the risks on a portfolio's potential returns to identify and assess riskier investments).

EUROPEAN UNION

In March of 2018, the European Commission published its Sustainable Finance Action Plan (EU Action Plan) for a greener and cleaner economy. The EU Action Plan is part of the Capital Markets Union's initiative (CMU) and was a key step towards implementing the Paris Agreement and the EU's agenda for sustainable development.[9]

A couple of months later, the European Commission followed up its EU Action Plan, with legislative proposals aimed at creating an EU sustainability taxonomy, developing disclosures relating to environmental, social and governance factors and the creation of low carbon and positive carbon impact benchmarks. The European Commission delivered what it called the "first concrete actions to enable the EU financial sector to lead the way to a greener and cleaner economy"[10]. The legislative proposals mentioned above seek to define which activities are deemed sustainable. They offer a taxonomy of sustainable financial products, complete with standards and labelling, to help investors make educated decisions. They also investigate how asset managers and investment advisors should include ESG considerations into their investment decision-making processes, how investments might be aligned with ESG considerations, and how this alignment is disclosed to the investors. They further proposed establishing a new category of benchmarks to represent corporations' carbon footprints and provide investors with more information about the carbon footprint of their investment portfolios.[11]

The European Parliament and EU Member States had arrived at a political agreement on new regulations governing disclosure obligations for sustainable investments and risks in March 2019. Sustainability risks are defined as an ESG event that could have a real or potentially negative impact on the value of an investment due to a negative sustainability impact. By the end of 2020, firms were expected to publish their policies on the assimilation of sustainability risks into their investment decision-making process. They must demonstrate that they have evaluated the effects of sustainability concerns on investments and provide relevant information to investors. If a company has not accounted for these considerations, they must provide reasons for the same and a timeline on taking into account such considerations.[12]

One of the main aims of the regulation mentioned above is to eliminate greenwashing (unsubstantiated or misleading claims about sustainability characteristics and benefits of an investment product). The regulation also requires disclosures to be made where there is an adverse impact on ESG matters.[13]

The European Securities and Markets Authority (ESMA) established a Coordination Network on Sustainability and has been actively looking into sustainability reporting and risk assessment.

There are 20 countries that have ten or more reporting frameworks in their country, with the United Kingdom having the maximum with 21 of them. According to the Carrots & Sticks Report (2020), out of 84 major economies by GDP, there are about 614 sustainability reporting instruments, of which 350 are mandatory, and the rest 264 are voluntary. Figures 3 and 4 below depict the manner in which the regulatory framework (governmental or otherwise) has dealt with ESG.

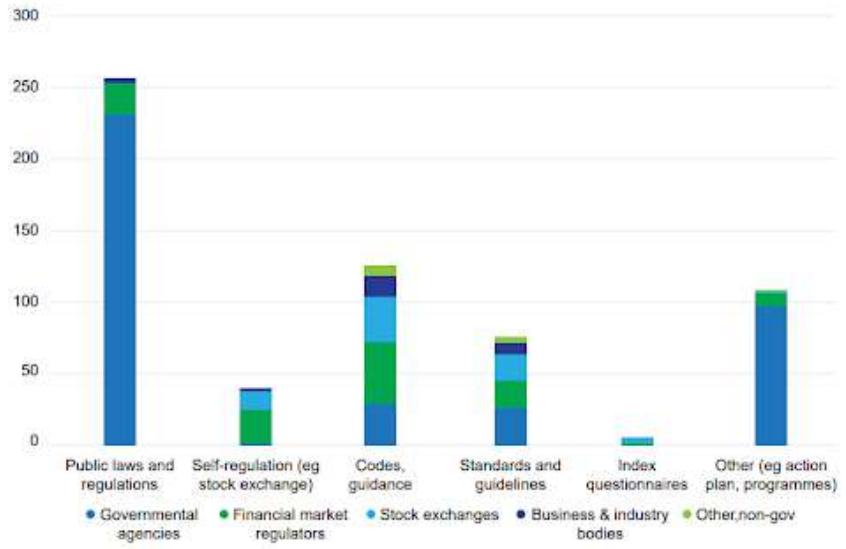


Fig 3: Number of provisions, types, and the organisations that have issued them. Source: Carrots & Sticks[14]

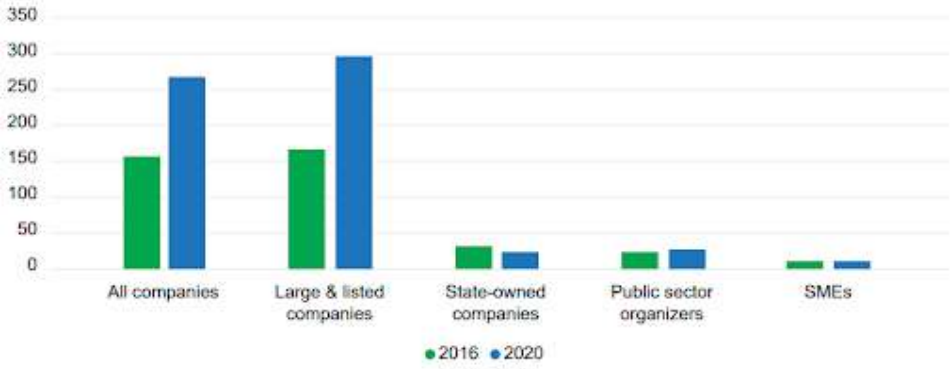


Fig 4: Organisations covered by reporting provisions. Source: Carrots & Stocks[15]

ESG in India

The global community came together in the 2021 Conference of Parties on Climate Change (CoP26) held in Glasgow to consider measures to manage climate change and minimise its impact while ensuring that no harmful effects on jobs, food security, or living standards of the masses are felt.

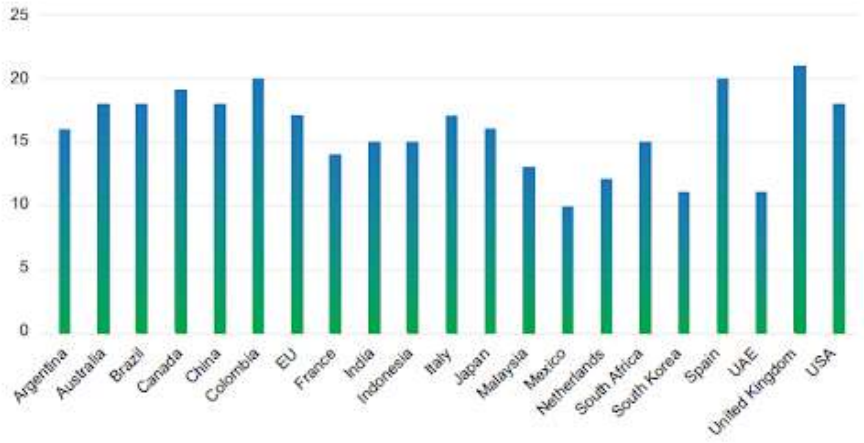


Fig 5: The countries with the largest number of reporting provisions. Source: Carrots & Stocks[16]

India stated at CoP26 that it would attain net zero emissions by 2070 consistent with regulative actions that it has taken over the past decade. India has generally taken a proactive approach towards decarbonization by urging market entities to adopt sustainable economic practices. The adoption of comprehensive sustainability and ESG related disclosures to urge entities to go beyond the traditional finance-centric models is testament to this approach.

2008

S&P ESG India Index launched by CRISIL, Standard and Poor, KLD Research & Analytics, was the first investible index for Indian enterprises

2009

National Voluntary Guideline (NVGs) issued by MCA to offer businesses an Indian approach to inculcate responsible business conduct

2012

Business Responsibility Report (BRR)
SEBI mandated top 100 listed companies by market capitalization to file BRR based on NVGs

2014

Corporate Social Responsibility (CSR)
CSR rules come into force; mandates organisations to spend 2% of average profit on their social responsibility

2016

Green bond guidelines issued by SEBI making India the second country after China to provide national level guidelines

2017

Integrated Reporting (IR)
SEBI advised the top 500 companies required to file BRR, to adopt IR on voluntary basis

2019

National Guidelines on Responsible Business Conduct (NGRBC) released by MCA for ensuring responsible business conduct by businesses

2021

Business Responsibility & Sustainability Report (BRSR) for top 1000 listed companies by market capitalization to report voluntarily, mandatory reporting from FY 22-23

Fig 6: Evolution of ESG Reporting Frameworks in India.

CORPORATE SOCIAL RESPONSIBILITY VOLUNTARY (CSRV) GUIDELINES (2009)

The CSRV guidelines were the first steps from India towards the inception of an ESG reporting ethos in India. The guidelines largely provided for a set of principles which required the corporate sector to engage in activities which included care for all stakeholders, ethical functioning, respect for workers' rights and welfare, respect for human rights and the environment, activities for social and inclusive development. The compliance with guidelines was, however, only voluntary.

NATIONAL VOLUNTARY GUIDELINES ON SOCIAL, ENVIRONMENTAL & ECONOMIC RESPONSIBILITIES OF BUSINESS (NVG) (2011)

The CSRV guidelines generally addressed governance and environmental issues to provide for a runway for entities to travel towards an ESG positive path. The NVG attempted to refine the CSRV guidelines by providing additional core principles to include sustainability and heightened participation by businesses in policy and regulations as well, such as (a) transparency and accountability; (b) sustainability as a business model; (c) respect for stakeholder interests; (d) respect and promote human rights; (e) make efforts to restore and protect the environment; (f) engage in a responsible manner in influencing public and regulatory policy; (g) support inclusive growth and equitable development; and (h) protection of consumer welfare.

These guidelines also went on to adopt the Business Responsibility Report (BRR) reporting framework (predecessor to the now BRSR reporting framework). BRR essentially aimed to provide stakeholders with pertinent information and data demonstrating the adoption of the guidelines and the progress of businesses in being cognizant of the crossroads of impact and growth. Subsequently, SEBI in 2012 mandated and required 100 listed companies (by market cap) to file BRRs, which was later increased to 500 listed companies and in 2019 was further increased to 1,000 listed companies. To further solidify the ESG ethos, BRR framework was also made part of the SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015.

NATIONAL GUIDELINES ON RESPONSIBLE BUSINESS CONDUCT (NGRBC) (2019)

Key international and domestic regulatory developments such as the UN Guiding Principles for Business and Human rights (UNGPs), UN Sustainable Development Goals (SDGs), Paris Agreement on Climate Change (2015), Core Convention 138 and 182 on Child Labour by the International Labour Organization (ILO), Annual Business Responsibility Reports (ABRRs), and the Companies Act, 2013 required the adoption of a new set of principles which were to accommodate for the evolution in business responsibility and sustainability. This resulted in the formulation of the NGRBC in 2019 in the form of 9 core principles of business responsibility which have been drafted in line with the SDGs:

Fig 7: NGRBC's 9 core principles of business responsibility. Source: NGRBC[17]

It is pertinent to note that these principles enabled a shift from a largely voluntary compliance regime to one that is mandatory. These principles were made applicable to all entities irrespective of size, structure, ownership model or location.

BUSINESS RESPONSIBILITY AND SUSTAINABILITY REPORT (BRSR) (2021)

To further strengthen the ESG disclosure regime in India, the Securities Board of India amended the SEBI (Listing Obligation and Disclosure Requirements) Regulation, 2015 to replace the erstwhile BRR with BRSR in 2021. BRSR continues to incorporate the 9 core principles as set out in the NGBRCs and it is mandatory for the top 1,000 listed companies to annually disclose ESG-related information from the financial year 2022-23.

BRSR covers the following features, in addition to creating a rather thorough disclosure structure, with the goal of improving ESG compliant business practices in India:

a. A company's policies and mechanisms for being ESG-compliant must be disclosed. In order to provide a comparison across industries, companies, and time periods, BRSR places a strong focus on quantitative criteria.

b. Enhanced disclosures on climate and social related issues;

c. Bifurcation of disclosures into essential and leadership indicators, with the former being mandatory. The leadership indicators, among other things, promote

disclosures about the value chain of certain firms; and

d. BRSR enables organisations that are already publishing ESG reports under other internationally recognized frameworks to collaborate with the Indian regime.

The BRSR is the latest and most positive development in the evolution of ESG reporting in India. Since BRSR provides wider and comprehensive standards for ESG disclosure, it presents stakeholders with the opportunity to compare ESG parameters across industries – enabling the understanding of factors that are beyond mere financials of a company.

BUSINESS RESPONSIBILITY AND SUSTAINABILITY REPORT LITE (BRSR-LITE) (2021)

The Committee on Business Responsibility and Reporting ("Committee"), constituted to prepare business responsibility reporting formats for listed and unlisted companies, submitted its report on May 8, 2020, with a view towards global developments which are increasingly seeking businesses to be responsible and sustainable towards their environment and society.

The Committee took cognizance of the fact that different reporting requirements are necessary for different classes of companies, especially smaller companies. BRSR-Lite has been developed for unlisted companies unfamiliar with the groundwork of sustainability reporting. This format will encourage more companies to begin sustainability reporting as it is easier for all companies to adopt this format. The adoption of BRSR-Lite would be voluntary for such companies. The underlying principle behind this thinking is that the implementation of reporting requirements would be done in a phase manner, so that smaller companies would get the time to adapt and learn from the larger ones.

Comparison between BRSR and BRSR-Lite

REPORTING UNDER BRSR

BRSR is a more comprehensive framework for ESG disclosures than its predecessor BRR and is the next phase in ESG reporting in India. BRSR is not merely presenting the data collected, but an approach to drive an organisation's commitment to sustainability, and a way to demonstrate such commitment to the stakeholders in a transparent manner.

The BRSR is an initiative towards ensuring that investors have access to standardised disclosures on ESG parameters. Access to relevant and comparable information will enable investors to identify and assess sustainability-related risks and opportunities of companies and make better investment decisions. At the same time, companies will be able to better demonstrate their sustainability objectives, position, and performance resulting in long-term value creation.

The disclosures / reporting requirements are divided into 3 sections:

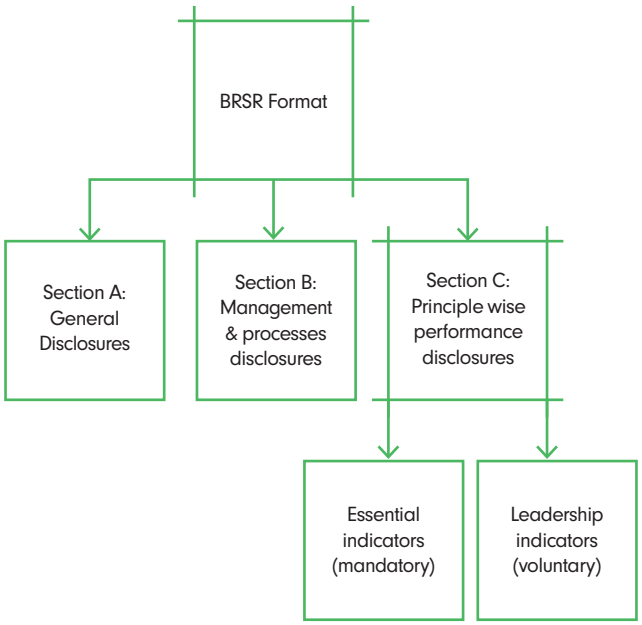


Fig 8: BRSR Format. Source: SEBI[18]

Section A: General disclosures: The section deals with details of the listed entity, products/services, operations, employees, holding, subsidiary and associate companies (including joint ventures), CSR, and transparency and disclosure compliances.

Section B: Management and Process disclosures: Section B provides for questions related to policy and management processes, governance, leadership and oversight.

Section C: Principle-wise performance disclosures
Companies are required to report upon key performance indicators in accordance with the nine principles of the NGRBC highlighted in Figure 7 above. The section classifies reporting key performance indicators into two sub-categories:

- **Essential indicators (mandatory):** Key performance indicators include, inter alia, data on training programs conducted, environmental data on energy, emissions, water and waste, and social impact generated by the company.

- **Leadership indicators (voluntary):** Companies are expected to comply with these indicators for better accountability and from a responsibility perspective. Some of the key performance indicators include data on life cycle assessments, details on conflict management policy, additional data on biodiversity, breakup of energy consumption, emissions and supply chain disclosures.

Compatibility of BRSR with other reporting frameworks

Companies preparing and disclosing sustainability reports based on internationally accepted reporting frameworks such as GRI, SASB, TCFD, are permitted to cross reference the disclosures made under such framework to the disclosures sought under BRSR. Mandatory reporting under BRSR will not restrict companies from making extensive disclosures in their annual reports voluntarily through integrated reporting or other sustainability report frameworks.

Name	Metrics Covered	Purpose served	Disclosures	Suitable for	Audience
Global Reporting Initiative (GRI) (1997)	Environmental Social Governance	It considered various ranges of interests and facilitates organisations to report on environmental, social and economic impact.	• General Disclosures (governance, stakeholder engagement and reporting practices) • Economic impact • Environmental impact • Social impact	Companies of any size sector or location	Wide range of stakeholders
Carbon Disclosure Project (CDP) (2002)	Environmental Governance	Collection of data on environmental performance and emission of Greenhouse Gases (GHG).	• Climate change impact • Water impact • Forest impact • Supply chain	Companies (public listed and suppliers) attempting to limit and disclose carbon footprint.	• Investors • Policymakers
International Integrated Reporting Council (IR) (2010)	Environmental Social Governance	Facilitates companies to produce integrated reports by establishing guiding principles to achieve the same.	• Environmental impacts • Social capital • Human capital • Business model resilience and innovation • Physical climate change impacts • Leadership and governance	Framework guidance for how information is presented on topics of global industry agnostic principles based high level elements which drive connectivity of information	• Investors • Lenders
Sustainability Accounting Standards Board (SASB) (2012)	Environmental Social Governance	Facilitated material information on sustainability to be disclosed for SEC filing in the US.	• Environmental impact • Social capital • Human capital • Business model resilience and innovation • Physical climate change impacts • Leadership and governance	• US only • Industry specific metrics-based disclosure topics • Metrics enable compatibility of information.	Financial stakeholders
Task Force on Climate related Financial Disclosures (TCFD) (2017)	Environmental Governance	Encouraged firms to align climate risks disclosures with investors interests.	• Governance • Strategy planning including climate change • Risk management	Companies concerned with mitigation of climate related risks.	Wide range of stakeholders (not just financial)
International Sustainability Standards Board (ISSB) (2021)	Environmental Social Governance	Provides a comprehensive comparative line with information on risks and opportunities related to sustainability.	• Technical Readiness Working Groups (TRWG) • Climate specific and general requirements prototype sets	Identification, measurement, and disclosure of climate related financial information	Investors and capital market participants.

Table 2: Reporting requirements under different reporting systems. Source: Sattva Consulting[19]

What are the steps to be followed by aspiring companies?

Companies who are mandated to comply with BRSR reporting requirements need to invest in necessary mechanisms which could help in the following aspects:

- Selection of the relevant and applicable ESG requirements material to the organisation
- Enable capturing the required data for reporting on the selected ESG issues
- Selection of a suitable framework and related metrics that can be adopted by companies to facilitate transparent and accurate reporting
- Level of assurance to be provided on such reporting

REPORTING UNDER BRSR-LITE

BRSR-Lite is a self-assessment tool that assists corporations with sustainability reporting by providing a general format that applies to all business sectors. The pared down version of BRSR, BRSR-Lite generally seeks certain essential indicators and the leadership indicators, which unlisted companies should be in a position to provide. Since certain provisions of the form may not be applicable to certain companies, the total score received in BRSR scoring should be reduced correspondingly while only applicable provisions are considered

ESG Ratings & Early Stage ESG Score (ES²):

A Framework by 3one4 Capital

ESG Ratings – Methods and regulatory landscape

The current landscape of ESG rating methods, parameters, and considerations remains generally unregulated. Private entities specialising in ESG reporting and forensics have developed various methodologies and parameters for assessing companies in respect of ESG compliance and provide comprehensive ESG ratings. While ESG ratings are critical for narrowing the scope of any information asymmetry between investors and portfolio companies, there is general market awareness that individual ESG ratings vary. This is not entirely a negative facet since it reflects the fact that sustainability is a complicated area.[1]

Several third-party providers have developed ESG reporting and rating mechanisms to evaluate and rate companies on their ESG compliance. These ratings have been used by several investors, asset managers, financial institutions, and other stakeholders to evaluate and measure a company's performance on non-financial parameters. The rating mechanisms vary greatly on the basis of scope, methodology, and coverage by the rating agencies. An overview of the factors employed by major private ESG rating providers in their assessment mechanisms is provided in Table 1: [2]

	MSCI (1990)	Vigeo-Eiris (Acquired by Moody's in 2019)	Refintiv (2002)	Sustainalytics (1992)	RobecoSAM ESG (acquired by S&P Global in 2020)	Bloomberg (2009)	FTSE Russell (2001)
Rating Score	CCC to AAA	– - to + +	D- to A+ and 0 to 100	0 to 100	0 to 100	0 to 100	0 to 5
Data Sources	Company disclosures, 1,600+ media sources, 100+ specialised dataset	Company disclosures, recommendations, conventions	Company websites, company reports, NGO websites, media and news, stock exchange filings	Public disclosure, media and news, NGO reports	Survey approach	Company's sustainability reports, annual reports and websites, publicly available information, and company direct contact	Publicly available information, company direct contact, other sources (governments and NGOs)
No. of ESG Criteria	37	38	178	155	74	120	300
Main Risk Factors	Climate change, natural resources, pollution and waste management, product liability, human capital, stakeholder needs, corporate behavior, and corporate governance	Human resources, human rights, environment, business behavior, community involvement, and corporate governance	Resource use, emission, innovation, workforce, human rights, community, product liability, management, shareholders, and CSR strategy	Factors are determined basis to the industrial group to which a company belongs	About 21 industry specific indicators.	Carbon emissions, climate change effect, pollution, waste disposal, renewable energy, resource depletion, supply chain, political contributions, discrimination, diversity, community relations, human rights, cumulative voting, executive compensation, shareholders' rights, takeover defense, staggered boards, and independent directors	Biodiversity, climate change, pollution and resources, water security, supply chain, labour standards, human rights and community, health and safety, customer responsibility, tax transparency, risk management, corporate governance, anti-corruption

	MSCI (1990)	Vigeo-Eiris (Acquired by Moody's in 2019)	Refintiv (2002)	Sustainalytics (1992)	RobecoSAM ESG (acquired by S&P Global in 2020)	Bloomberg (2009)	FTSE Russell (2001)
Weightage	Analysis on material risks and opportunities for all the GICS sub sectors	Based on principles developed by International Bodies.	Standard weighting for all the categories: Environmental - 34%, Social - 35.5%, Governance -30.5%	-	Disclosure of criteria and weighting based on the 61 industries analysed	Based on principles developed by International Bodies (e.g., GRI, CDP, SASM for three industries). FSB Task Force on Climate related Financial Disclosures	Ratings are calculated using an Exposure weighted average. Alignment with the UN Sustainable Development Goals (SDGs)

Table 1: ESG rating providers - Benchmarks

It is clear from Table 1 that ESG rating agencies are vastly different on almost all matrices including the number of ESG criteria, the weightage on data in determining such criteria, and the data sources that the agencies assess to arrive at the ratings. This results in an unreliable rating ecosystem where there is scope for manipulation and cherry-picking. The information gap between rating agencies makes it difficult for an investor to assess and check the veracity and transparency of the ESG reports, leading to an assessment market that may be generally influenced by ESG rating agencies and their discretionary assessment metrics.

The European Commission (EC) had published a consultation paper on the functioning of the ESG ratings market in the European Union and on the consideration of ESG factors in the ratings. The consultation seeks to consider concerns identified in a study commissioned by the European Commission and published in January 2021.[3] The study highlighted several concerns in relation to ESG ratings, specifically on (a) transparency about methodologies and data sources, (b) timeliness, accuracy and reliability of ESG ratings, (c) biases in relation to size and location of rated companies, and (d) potential conflicts of interest of rating providers. The results of the consultation are yet to be published. Based on public documents available in this regard, however, the push generally is towards regulating entities providing ESG ratings to ensure that the concerns are adequately addressed.

In order to supplement the above study and consultation, the European Securities and Markets Authority (ESMA) had, in February 2022, published a consultation to evaluate the size, structure, resourcing, revenues and product offerings of the different ESG rating providers operating in the European Union. The consultation paper was addressed to ESG rating providers, users of ESG ratings, and the entities that are subject to rating assessments of the ESG rating providers. Per the published letter by ESMA addressed to the EC, the responses received from the various stakeholders seem to indicate that the ESG market is immature but is on a progressive curve which is generally serviced by a number of large non-EU entities.

In the UK, there is a similar reaction as in the EU and push to regulate ESG ratings to achieve improved transparency in such ratings. The International Regulatory Strategy Group (IRSG) has expressed its support for the regulation of ESG ratings and this is likely to encourage the Financial Conduct Authority (FCA) to draft rules that would require ratings agencies to demonstrate the manner in which they conduct their sustainability assessments. The UK government has also promoted this cause by stating that an obligation on ESG rating agencies to comply with the regulations and to obtain FCA's approval will impose a duty on providers to have robust governance and conflict of interest management which would, in turn, help alleviate some of the risks inherent in the existing system. The FCA has announced in its strategy for 2022 to 2025 that it will continue to collaborate with the UK government and other UK regulators on regulating ESG rating and the agencies servicing the same.

As of February 2022, ESG investing in the United States approximately accounted for more than USD 1 for every USD 3 managed by a financial professional. Agencies providing ESG ratings have played a hand in determining ESG investment opportunities. Due to their increased influence in determining such investments, ESG rating agencies and their ratings have come under increasing

scrutiny. There are calls for the Securities and Exchange Commission (SEC) and other agencies to regulate the ESG rating agencies with concerns that ESG ratings lack clarity, rely on inconsistent criteria, and suffer from conflicts of interest.

In India, SEBI has published a consultation paper on Environmental, Social and Governance (ESG) Rating Providers for Securities Markets[4] following discussions that it had held with relevant stakeholders, including global and national ESG rating agencies, CRAs, mutual funds offering ESG schemes, and research/ audit firms. SEBI has particularly identified the following issues with respect to the current ESG rating ecosystem:

1) Ambiguity in Ratings: Concerns have been raised that there is a lack of clear terminologies, definitions, objectives of products due to non-disclosure or inadequate disclosure. The numerous products available in the ESG market exacerbate the existing conundrum.

2) Inadequate Transparency: Since ESG rating agencies use different metrics to arrive at an ESG rating, SEBI recognises that there are risks around transparency and verifiability. This is more so since there are no disclosure obligations on the ESG rating agencies to provide adequate disclosures on the methodologies used by them to arrive at the ratings, thereby causing further interpretational issues.

3) Potential conflict of interest: Since ESG rating agencies are engaged in providing services other than the ESG ratings including index solutions, ESG related advisory services, etc., there is significant risk of conflict of interests. Furthermore, due to a lack of transparency around the manner of usage of ESG ratings by investors as well as types of ESG rating products of different ESG rating agencies, there is a risk of misallocation and greenwashing.

4) Absence of Rating Agencies in India: The ESG rating market in India is still nascent. SEBI mentions that large institutional investors primarily rely on in-house research and supplement their due diligence with ESG rating or data products offered by global or unregulated providers of ESG ratings or data for India.

SUSTAINABILITY REPORTING MATURITY MODEL (SRMM) VERSION 1.0

As an answer to the general concerns raised by stakeholders in respect of ESG ratings, the Institute of Chartered Accountants of India (ICAI) had in 2021 released the SRMM "with an objective to bring out a comprehensive scoring tool based on report of the Committee on Business Responsibility Reporting constituted by the Ministry of Corporate Affairs (MCA) in August, 2020."

The ICAI believes that the SRMM "would on one hand facilitate the corporates to assess their sustainability maturity level and at the same time will also aid in improving their scores with the availability of this easy-to-use tool thereby achieving the vision of a sustainable ecosystem across the country".

The BRSR scoring mechanism comprises a total of 300 scores, by completing the scoring of all three sections and nine principles of the BRSR. SRMM would allow rating agencies and other stakeholders to compare the sustainable nature of Indian companies with other international companies. Levels 1 to 4 of the SRMM represent the sustainability maturity of companies based on the total range of scores obtained by the companies in a financial year as per the BRSR scoring mechanism. The same is detailed in Table 2:

	Level 1	Level 2	Level 3	Level 4
Stage of the Company	Formative Stage	Emerging Stage	Established Stage	Leading by Example
BRSR Score (Percentage of Grand Total Score	Upto 25%	> 25% and up to 50%	> 50% and upto 75%	>75%
Explanation	Organisations are at the initial level of reporting and are in the process of identifying the need and responsibility of BRSR Try to establish policies/ systems for data collection and disclosures.	Organisations realise the value of BRSR and respond to it by setting up robust mechanisms for reporting, etc. Functions/ policies/ systems for such reporting is still to be formalised/ focused Organisation is working towards establishing/ enhancing internal controls, data collection and disclosures.	Organisations have established formal functions/ policies/ systems for BRSR. Involved in compliance functions, etc., and focus increasingly on qualitative aspects.	Strategically differentiating by enhancing disclosures vis a vis innovative methods/ techniques employed.

Table 2: SRMM version 1.0

The SRMM Version 1.0 would encourage corporations to measure and generate greater impact on the environment and society. ICAI has also set out a strategy for developing version 2.0 of SRMM based on the views/inputs from corporates with regard to implementation of SRMM Version 1.0.

The Need for Suitable Parameters

The primary interest of a start-up is generally growth of its business and hence, start-ups expend a significant amount of their resources into maximising growth. In addition to the objectives of start-ups being different from ESG goals (unless a start-up's business is ESG focused), it is pertinent to note that there is a general lack of information and research publicly available which helps start-up founders navigate ESG goals while ensuring minimum impact or burden on the business. This is not to say that the importance of ESG is lost in the start-up ecosystem. With the increase in limited partners and institutional investors driving investments based on ESG compliances, ensuring certain critical aspects of ESG are complied with is becoming more relevant to start-ups.

The issues with the existing ESG rating ecosystem have already been detailed in this report above. In the case of start-ups, these issues are further exacerbated. The current ESG rating methodologies are prepared for larger companies which may already have certain disclosure obligations. The metrics are also developed on the basis of established international reporting organisations and their recommendations or requirements in relation to disclosure. These reporting requirements are generally applicable to public companies and take into consideration the impact of such businesses and their specific interactions with areas involving ESG.

There has been an exponential increase in investments in early stage and seed stage start-ups, the ESG rating ecosystem continues to largely be in absentia or barely catered to. Looking at any of the rating providers in respect of their assessment mechanism, it is clear that the data sources that are relied on are generally reports and disclosures of the Company, publicly available information, or direct contact with the Company. Start-ups are seldom required to make any disclosures or reports in relation to its ESG endeavours, and in fact are not required to meet any ESG parameters by regulatory authorities. Data sources such as these are rarely available in respect

of start-ups, and an ESG rating provider may have to rely on direct contact with the company or on the survey method. This leaves investors who rely on the ratings exposed to significant risk of greenwashing of the ratings.

Currently, per a report by the International Organization of Securities Commissions (IOSCO), a significant finding from their roundtable was that investors are more inclined to create proprietary rating methodologies due to lack of transparency around external ESG rating methodologies. The investors were generally aligned on the fact that third party ESG ratings and methodologies may not align with their investment strategy, and this further contributed to making external ESG ratings unreliable by investors.

ESG rating agencies will have to develop a specific ESG rating methodology that is adapted to each sector when catering to ESG rating requirements of start-ups. Other than addressing the issues that have been highlighted globally in respect of their operations, ESG rating providers will have to consider separate methodologies to consider the manner in which data is collected, the ESG criteria and risk factors specifically in respect of start-ups. ESG rating providers will have to further study the start-up ecosystem sector-wise and formulate a balanced rating system as well, keeping in mind the regulatory requirements on start-ups and the extent of ESG compliances that may be generally comparable and applicable to the start-up market.

The ESG rating initiative undertaken by the ICAI seems to attempt to cater to requirements of start-ups by providing different ratings for companies in different stages of their life cycle. However, the percentage of compliance under the ratings still seems to trickle from the requirements under BRSR and a comparison to the full extent of requirements under BRSR. It may be observed from the announcement made by ICAI that the percentage assigned for compliance does not have its full rationale fleshed out, which may make it difficult for investors to objectively rely on. While this is an appreciated first step towards recognizing and filling lacunae in the market for ESG ratings for start-ups, the need for more research, learning, and thought leadership on this continues.

Early Stage ESG Score (ES^2)

As discussed at multiple places throughout the report, there are abject deficiencies and glaring lacunae when it comes to existing tools, standards, ratings, and metrics for assessing, evaluating, and benchmarking ESG performance for early stage companies. Commonly used ESG standards have primarily been designed keeping large, publicly traded companies in mind and the ecosystem for ESG performance mapping with regard to early stage companies is currently fraught with incomplete, inconsistent, and oftentimes conflicting performance monitoring methodologies and corporate policy approaches. Despite the conspicuous shift towards responsible investing, companies at the early stage have, therefore, typically struggled with navigating this complex web of differing ESG data reporting standards, taxonomy requirements, and ratings, none of which seem to offer substantive guidance or structured frameworks for young private companies.

3one4 Capital is keen to change this status-quo and is developing an Early Stage ESG Score (ES^2) framework that will serve as a barometer of an early stage venture's performance on various ESG attributes and effectively create an objective framework to numerically transcribe its ESG performance. Similar to how financial statements measure a company's performance in monetary terms, the ES^2 will enhance comparison of various early-stage ventures based on the ability of the company to contribute positively to the environment as well as to society at large, in addition to their economic contributions.

The ES^2 is being tailored to ensure that actionables within the power of the management of an early-stage company are identified and mapped out, so that the management can work towards achieving the tangible objectives that scale with the growth of the organisation. The ES^2 measures a company's exposure to long-term environmental, social, and governance considerations. These considerations — such as energy efficiency, worker safety, and board independence — have financial implications. But they are often not highlighted during traditional financial reviews. 3one4 Capital plans to

implement the ES^2 to supplement financial analysis and gain a broader view of a company's long-term potential.

We are currently in the process of creating a framework for an in-house ES^2 that can be applied across the Firm's portfolio to better assess and track the progress made by our portfolio companies over the period of our investment. This score is based on verified data obtained from the portfolio companies through the reporting framework developed post the completion of the investment screening process. The category scores are rolled up into three-pillar scores – environmental, social, and corporate governance. The ES^2 is a collective summation of the reported figures across various key performance indicators and parameters that have been aligned with the company.

THE ES^2 ENCOMPASSES THE BELOW CONSIDERATIONS

ENVIRONMENTAL CONSIDERATIONS

Environmental issues include:
- Carbon emissions
- Product carbon footprint
- Financing environmental impact
- Climate change vulnerability
- Raw material sourcing

The pollution and waste category encompasses:
- Toxic emissions and waste
- Packaging material and waste
- Electronic waste

Environmental opportunities are:
- Clean technology
- Green building
- Renewable energy

SOCIAL CONSIDERATIONS

Human capital issues:
- How labor is managed
- Health and safety practices and protocols
- Worker training
- Supply chain labor standards
- Product liability areas of focus:
- Product safety and quality
- Chemical safety
- Consumer financial protection
- Privacy and data security
- Responsible investing
- Insuring health and demographic risk

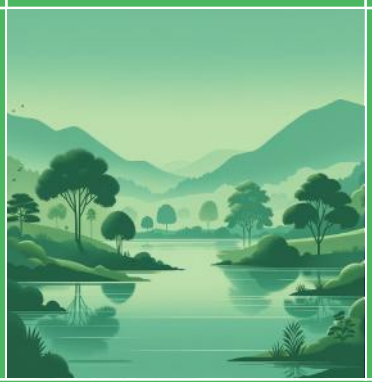
Stakeholder concerns:
- Controversial sourcing
- Community relations

Social opportunities:
- Access to communication
- Access to finance
- Access to healthcare
- Opportunities in nutrition and health

GOVERNANCE CONSIDERATIONS

Corporate governance:
- Composition of the board in terms of diversity and independence
- Executive compensation
- Ownership
- Accounting practices

Corporate behavior:
- Business ethics
- Tax transparency



Climate-tech Thesis

The Policy and Macroeconomic Context for Climate-tech

To state that climate change is a defining challenge of our times would amount to an insincere encapsulation of our zeitgeist. Over the past two decades alone, atmospheric concentration of carbon dioxide has crossed the 400 parts per million (ppm) symbolic threshold, global mean sea level has risen by almost 3 inches, and global ice losses have soared to over 1.2 trillion tons per year.[1]

Climate change has imperilled food and water security, halted advances towards ensuring global energy access, induced distress migration, adversely impacted global health and nutrition outcomes, and threatened livelihood patterns of thousands of communities across the world. In the Global Risks Report 2024 released by the World Economic Forum, "Extreme weather events", "Critical change to Earth systems", and "Biodiversity loss and ecosystem collapse" were perceived to be the most severe long-term risks by experts and global thought leaders.[2]

The most vulnerable are developing countries like India, which often find themselves with the largest scale challenges to address: having an outsized portion of their population being vulnerable to the worst impacts of climate change while needing to synthesise the cutting edge of advances in climate finance and technology to catalyse a rapid transition. This is why, despite having incredibly low per capita emissions (see Figure 1), India finds itself at the centre of the mitigation shift.

The rise of an aspirational middle class coupled with an expanding economic base; a growing proliferation of personal and commercial transport; increasing urbanisation & formalisation, industrialisation, and infrastructure development—especially with respect to buildings construction and cooling provision—will eventuate the largest increase in energy demand of any country by 2040, according to the International Energy Agency (IEA)[4]. Fulfilling this increased demand for energy will require the set up of an additional power generation and transmission system the size of the European Union over the next twenty years. Over this same period, India will cement its position as the world's most populous nation, adding the equivalent of a city the size of Los Angeles to its urban population each year.

India's management of its future resource demand thus presents an unprecedented economic opportunity and will have seismic consequences not just for Asia but the planet as a whole. A technology-first, step-function congruent approach that dexterously leverages climate-tech can aid the country in managing this resource burden sustainably in its move towards becoming a low-carbon economy. Green shoots of growth are already visible with data from Dealroom suggesting that climate-tech firms in the country received approximately USD 1 billion in venture capital funding between 2016 and 2021.[5] Intentional, inclusive climate-tech innovation can—

- Help India mitigate the adverse effects of climate change and substantially offset its dire projected emission figures;
- Allow India's growing population to meet its exigent demands for energy consumption in a sustainable manner;
- Produce hundreds of thousands of green jobs thereby galvanising popular opinion and reducing friction towards adoption of climate resilient technologies;
- Lay the ground to incrementally synthesise further investments towards a low carbon future;
- Help India tread the tightrope between economic growth and environmental conservation;
- Expand clean energy access to hundreds of millions of Indians, catalysing cross-sectoral synergies to solve India's most pressing climate and energy-related challenges.

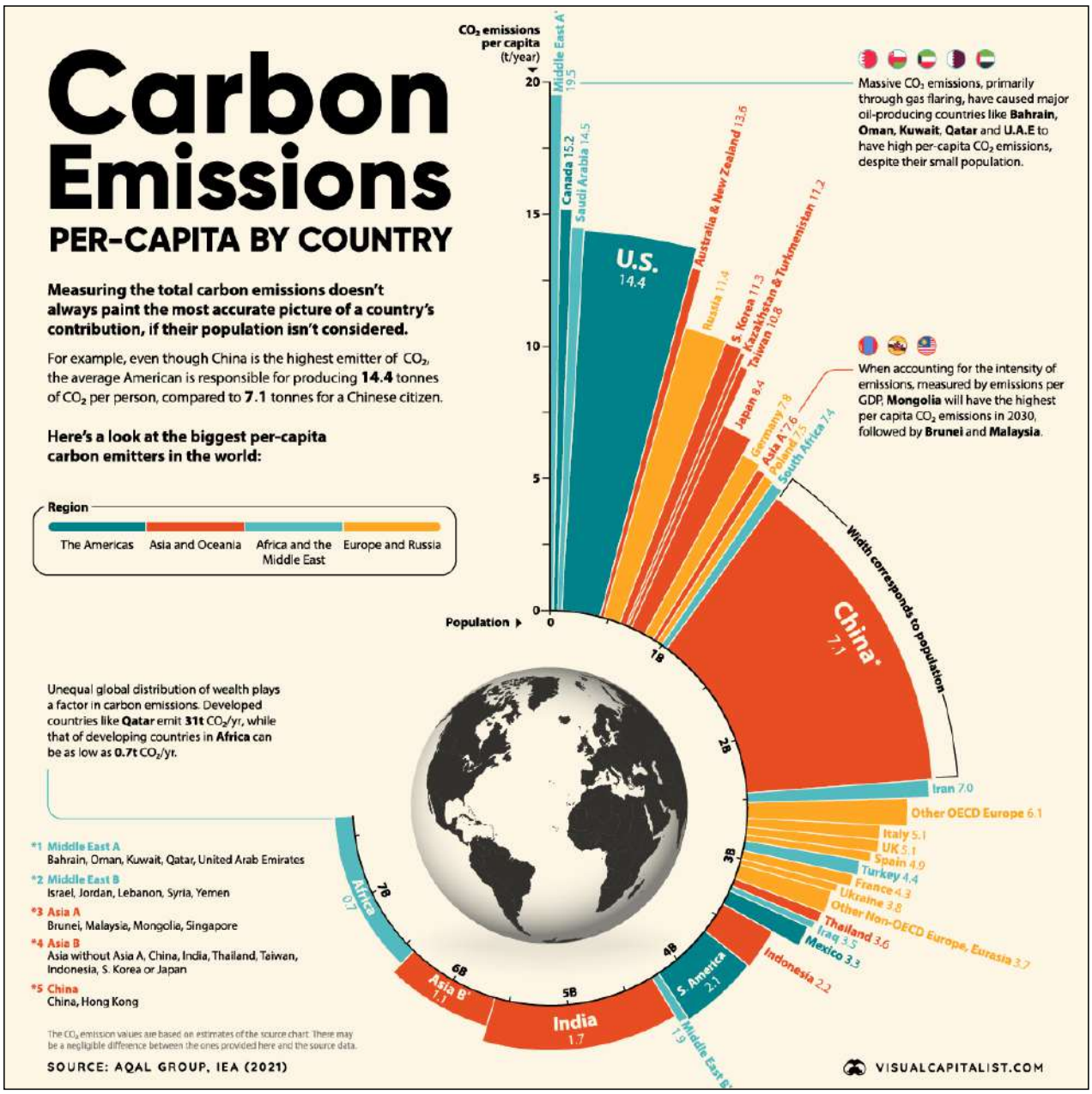


Fig 1: Per-capita carbon emissions by country. Source: The Visual Capitalist[3]

INDIA'S BROAD NATIONAL IMPERATIVES FOR CLIMATE-TECH

The systematic harnessing of progressively more efficient, convenient, and flexible forms of energy has been the cornerstone of civilisational progress over millennia. Energy is a universal and timeless currency, malleable enough to allow for the moulding of a wide variety of economic, cultural, and technological instruments and institutions across the spectrum of human history. The prevailing dominant stage of energy evolution, namely fossil fuel driven energy production, has proved to be particularly difficult to displace despite the finitude of fossil fuels and their other rather obvious drawbacks. And there are multiple reasons for that.

1. We have not as yet been able to find, or devise, a suitable substitute for oil, one that could match its adaptability, availability, and abundance across use cases. On the other hand, the technology used to extract it has only been getting better, thereby making extraction both less cumbersome and more economical. The same holds true for natural gas to a considerable extent as well.

2. Both coal and oil have developed deeply entrenched niches for themselves across a variety of use cases, most notably in electricity production and transportation, respectively. Coal, for instance, still accounts for over 35% of the global electricity mix. In India, the share of coal in power generation has lingered around the 70% mark for several decades.[6] Weaning either sector off its preferred energy source would require considerable effort, mobilisation, and investment to overcome the prevailing energy inertia.

3. Fossil fuels offer incredibly high energy densities and provide high degrees of heat with the promise of a steady, uninterrupted supply.

Climate-tech innovation is precisely the need of the hour because it has the potential to move the needle on these fronts substantively. While every innovation will not make a serious dent in the collective decarbonisation effort, the sheer scale and immediacy of the challenge warrant an all-hands-on-deck approach going forward. Even interventions which would, in isolation, seem inconsequential, can cumulatively create substantial impact when strategically deployed.

India's energy consumption is destined to increase. Not only is India's electricity demand set to increase six-fold by 2040, its energy demand for road transport is also set to double over the next two decades, and so is its building space and demand for oil.[7] Prudentially designed interventions targeting each of these developments can help India temper the projections of enhanced resource use by reducing the overall carbon footprint, increasing efficiency, limiting waste, and implementing closed-loop practices.

In addition to synthesising innovation for emissions reduction, energy storage, climate monitoring, improved energy efficiency, and low carbon industry and transport, climate-tech can play an outsized role in enhancing energy access for scores of Indians. For instance, even though almost all of India's households have been electrified, affordability, reliability, and retention of supply continue to be significant bottlenecks waiting to be addressed at scale. According to a survey by the Council of Energy, Environment and Water (CEEW), 76% of Indian households continue to face unanticipated supply interruptions, with two-thirds of rural and two-fifths of urban households facing outages at least once a day.[8]

Similarly, with regard to clean cooking gas, data from the National Family Health Survey (NFHS-5) has shown that there is a wide gap between the number of households that have LPG connections and those which use them frequently.[9] Mainstreaming energy access by catalysing clean energy solutions, boosting energy consumption for the most resource-deficient households, limiting supply interruptions, promoting distributed renewable energy, and enabling low-cost and low-energy consuming devices and applications are just some of the potential forays climate-tech interventions can make. Accelerating capital flows towards solutions of this sort and ensuring "access to affordable, reliable, sustainable and modern energy for all" in line with SDG 7 should form the normative raison d'etre for enterprises and investors in this sector.

Yet another possible avenue for the climate-tech sector in India relates to orderly and just management of the likely trade-offs that emerge when an economy-wide switch is made from fossil fuels to renewable energy. For instance, humanity has typically transitioned from relatively less dense sources of energy to sources that are both more energy dense and more convenient to use. But now, under the fourth energy transition, we seem to be aiming for a density reversal—going from concentrated fossil fuels to more dispersed renewable sources that pack a smaller punch per unit of weight and take up more land to produce (see Figure 2). This could translate into a greater quantum of land having to be allocated for energy production at a time when land resources are likely to be severely strained due to onerous demands from population increase, food production, and urbanisation.

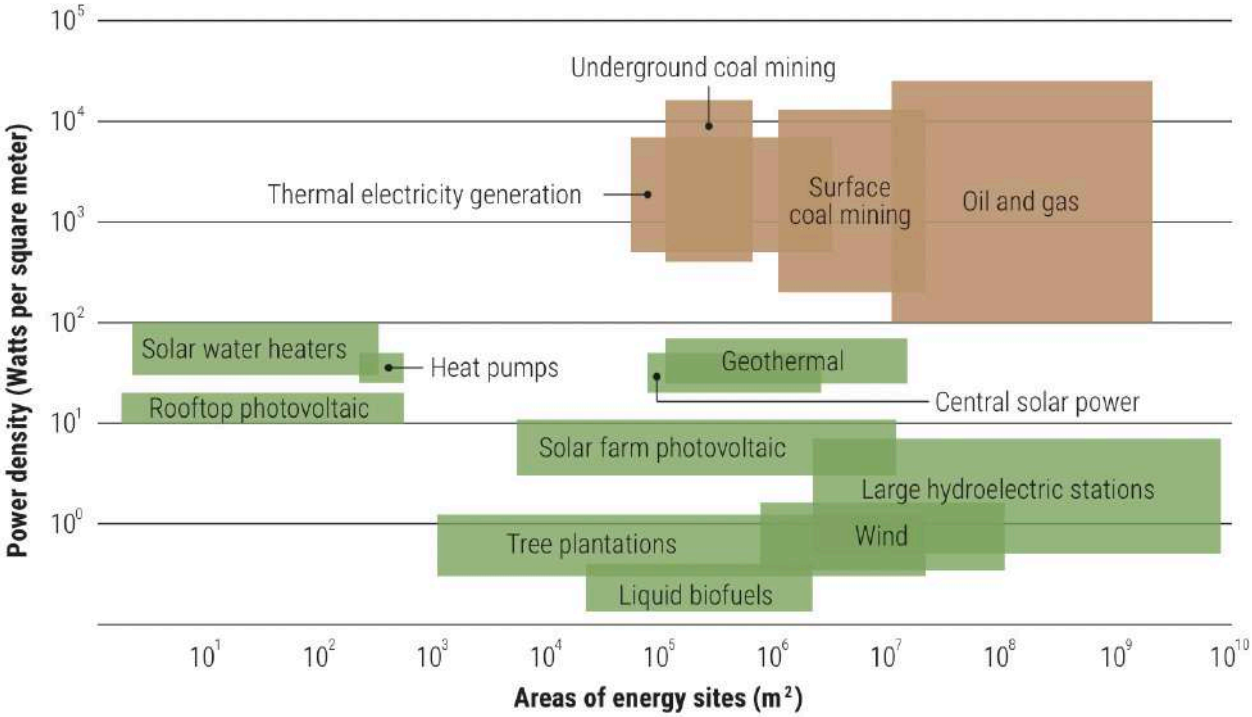


Fig 2: Mapping power density and area needed for production for various energy sources. Sources: Vaclav Smil, Science[10]

To take another example, India's solar energy generation capacity has increased more than 26x over the last nine years, going from a meagre 2.63 GW in 2014 to 70 GW by August 2023.[11] With the growing pervasiveness of intermittent solar, the infamous "duck curve"—the graphic representation portraying the need for progressively greater deployment of flexible, non-solar sources to counter the timing imbalance between peak demand and solar production—is potentially knocking on India's doors.

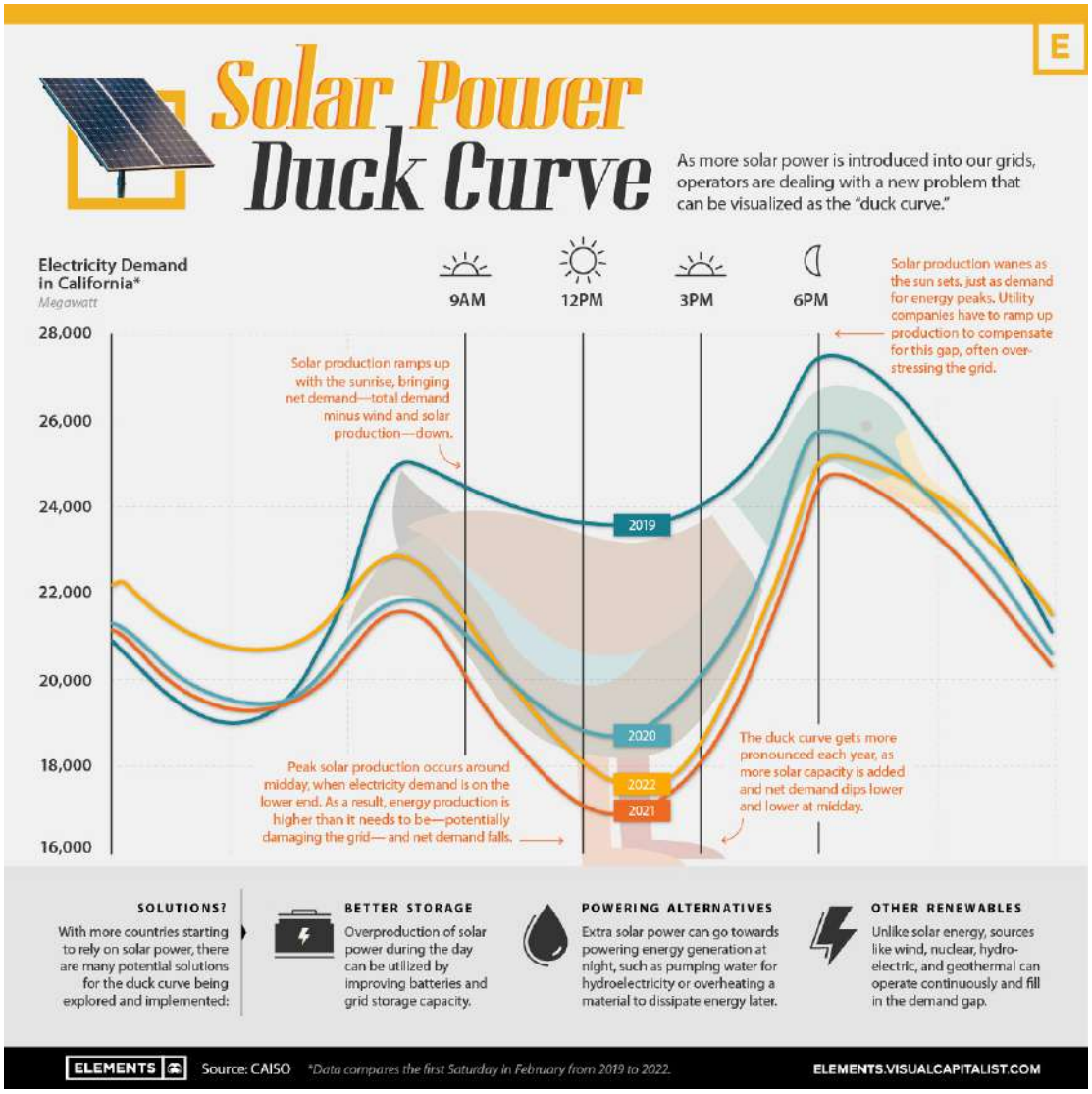


Fig 3: The California Solar Duck Curve. Source: The Visual Capitalist[12]

Climate-tech solutions to address, or reduce the intensity of, challenges of this sort will be pivotal in ensuring that green technologies retain their momentum towards greater acceptance and usability. Simultaneously, they will prevent backsliding, making sure that the likelihood of a technological regression towards polluting, less green solutions is minimised.

The last point connects us to perhaps the most important innovation imperative for the climate-tech sector, namely the need to safeguard, fully leverage, and allow for compounding of the myriad gains of the transition. This entails backing prudential policy measures and avoiding suboptimal macro energy strategies such as treadmill decarbonisation—the replacement of one clean energy source with another without any substantial reduction in carbon emissions—which squander the emissions reduction potential of a clean energy source, usually nuclear, and thus provide a poor guide for climate-tech to follow.

On the other end of the spectrum, there are a number of associated gains that can be pursued once we commit to a greener future. At present, over 40% of maritime trade by weight consists "either of fossil fuels on their way to be burned or of chemicals derived directly from fossil fuels."[13] Shifting en-masse to renewable energy could, therefore, open up possibilities for reduced cargo use for energy purposes, decreased maritime emissions, as well as favourable outcomes for ocean flora and fauna. It is necessary that capital flows and technology upgradation for climate-tech stay ahead of the curve in order to readily identify and fully leverage virtuous cycles of opportunity of this sort before they become emergent.

It is vital that the potentialities emanating from the benefits of the transition, including serendipitous unintended consequences and indirect, knock-on effects are duly recognised and promptly seized. Seminal cross-cutting shifts to climate-conscious consumption, production, and investing constitute once-in-a-generation shifts and thus potentially offer once-in-a-generation social, economic, and environmental returns. India must act deliberately and expeditiously to secure these gains.

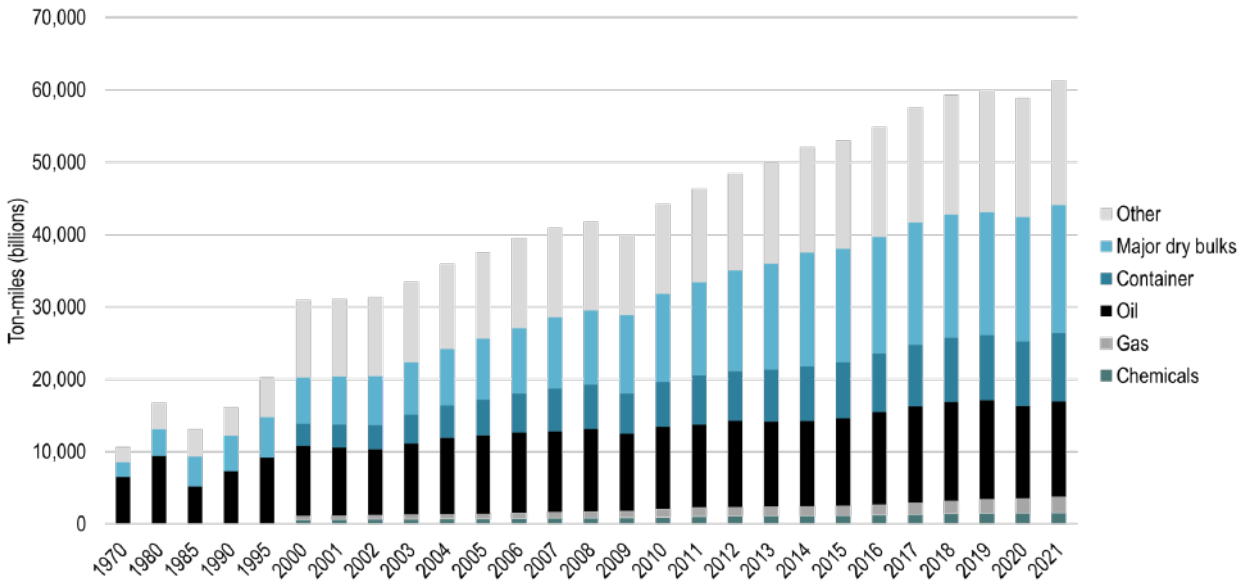


Fig 4: Global Maritime Trade by Cargo Type (1970-2021). Note: Major dry bulks are iron ore, grain, and coal. Source: UNCTAD, The Geography of Transport Systems.[14]

The role of Start-ups and Venture capital in the (Type) 0 to 1 journey

In the 1960s, Soviet astronomer Nikolai Kardashev developed a measure of a civilisation's level of technological advancement based on the amount of energy it is able to leverage. So, a Type 1 civilisation is able to harness all the energy available on its home planet; a Type 2 civilisation can access the energy of an entire star; and a Type 3 civilisation can capture all of the energy produced by an entire galaxy. The scale is obviously hypothetical and has been extrapolated in either direction to cover a Type 0 (harnessing just about 1MW of energy) to a Type 4 (controlling energy from the entire observable universe) and even beyond that. Humanity's current level has been characterised as being somewhere around 0.73-0.75.

Despite recent successes in quelling, or at least advocating against, the most egregiously rampant practices in consumerism and alternatively adopting lifestyles that foster sustainability, the arc of human progress will tend towards an increase in overall energy demand for the foreseeable future as access, information, and opportunities expand beyond their usual shores. Predominantly sustenance-driven communities in developing countries— invariably at the cusp of breaking into an aspirational middle-class—will gradually demand their historically denied, fair share of the energy pie, even as developed nations continue to put onerous demands on the existing energy pool while refusing to abide by their obligation to supply relevant technological and monetary resources to the developing world. As we collectively move forward from a 0.73 to a 0.8 or even Type 1 to meet our impending energy demands, capital providers and private companies, especially start-ups, will have to play an increasingly important role in making sure that this 0 to 1 journey is successful in decoupling the link between growth in the usable energy pool and an increase in environmental degradation, as has been the case since the beginning of the Industrial Age.

An earnest attempt towards this objective was made a few years ago. The mid 2000s saw a wave of VC activity in the cleantech space with a host of investors betting billions of dollars on advancements in renewable energy. Most investments went bust for a variety of reasons

including— i) unrealistic expectations set by investors of rapid, hockey-stick growth in technologies that usually have relatively longer gestation periods; ii) uncertain early market demand for cleantech products and compromised margins due to difficulties in establishing product differentiation; and iii) inconsistency in policy and regulatory signals, especially in the North American markets.[15]

Like most bubbles, however, the silver lining to the cleantech bubble was the accompanying over-investment in new infrastructure. The capital infusions at the time helped realise critical R&D breakthroughs and cost reductions propelling the sector forward today. Moreover, climate-tech—cleantech's more mature, and wider-scoped avatar—has now reached an inflection point with more amenable risk/return profiles of concerned companies and the greater presence of economically viable, revenue generating business models. Broadly, climate-tech covers companies or innovations falling under one or more of the following major sector-agnostic functions—reduction or removal of emissions, adaptation to the impacts of climate-change, and enhancement of capabilities to better understand, measure, and assess climate-related phenomena. Over the past few years, an array of tailwinds has aligned for the sector:-

1. Building blocks for the technologies leading the transition have achieved impressive cost reductions. Solar PV module costs have dropped by ~90 percent, battery pack costs by ~90%, and LEDs by ~85% over the last decade. Further R&D is in whirlwind mode, with aggressive grants and generous provisioning of incubatory support. The late 20th century saw the axis of innovation shift "from atoms to bits', signifying the digitalisation juggernaut. Now, the trend seems to be playing out in reverse, with a range of deeptech interventions targeting functional performance increments in physical R&D assets and solving for hardware. While deeptech innovations tend to have long gestation periods, and sometimes even longer go-to-market roadmaps, the rewards for perseverance are outsized with impressive moats—often backed by IP protections—and massive margins.

2. Massive government support has been catalysed for climate friendly innovations. The FAME I and II policies, National Missions for Solar, Hydrogen, and Energy Efficiency, along with Production Linked Incentive (PLI) schemes for advanced chemistry cell (ACC) battery storage, solar PV modules, white goods, electronics manufacturing, and drones and drone components are broadcasting unambiguously positive signals regarding the Government's inclinations. Start-ups have a head-start to prepare for the oncoming seismic shift and can accordingly reframe their value chains, and shore up their production and inventory capacities.

3. The pandemic followed by recent geopolitical upheavals on account of the Russia-Ukraine war have given a heightened sense of urgency to the demands of the transition, especially with sustained and legitimate fears around the worsening situation for energy access in Europe. Even as investments in climate progressive technologies have temporarily suffered and transition relevant minerals' commodity prices have seen a sharp increase, these should be seen as short-term aberrations. Over the long haul, the conflict's effect on the global energy markets should bring forward peak oil, help incrementally synthesise investments in fossil fuel alternatives and, with specific reference to India, positively influence popular opinion on building indigenous, resilient, new-energy linked value chains. Previously locked pools of patient capital such as sovereign wealth funds and pension funds are also seeing a gradual uptick in activity.

4. Climate-tech is now a hot-spot for top tech talent. In a survey conducted in the US, 43% of tech workers considered a prospective company's environmental impact to be a "very important" factor when looking at a new job.[16] Climatebase, a talent directory for climate jobs has helped more than half a million individuals find and apply for green jobs.[17] Stalwarts such as Bill Gates and Chris Sacca have founded climate related funds Breakthrough Energy and Lowercarbon Capital respectively. C-suite executives are also increasingly inclined to invest their energies in the climate domain; Mike Schroepfer made headlines back in March 2022 when he stepped down as CTO of Meta to focus on addressing the climate crisis.

With a host of narrative, policy, and corporate support measures, climate and sustainability are the new digital: aspects intrinsic to the very existence of an organisation, much like early ICT technologies at the start of the millennium. As Larry Fink, the CEO of BlackRock, has suggested, the next 1,000 unicorns will not be search engines or social media companies, but sustainable, scalable companies which will help the world "decarbonise and make the energy transition affordable for all consumers."[18]

CRUNCHING NUMBERS: FUNDING MATTERS

Global climate-tech VC funding has grown more than 4x since 2019, with venture capital infusion at over USD 70 billion for CY2022. India experienced an extraordinary increase in climate-tech funding in 2022—an uptick of nearly 10x over the previous year. (see Figure 5). The investment split across climate-tech sub-sectors (see Table 1) reveals that mitigation-oriented innovations in energy and transportation dominate the funding landscape, making up for 60% of the deals' volume, and nearly 80% of the cumulative value of all deals. This is in line with global trends where investments in energy storage and electric vehicles have dwarfed those in other climate-tech domains.

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Fig 5: Venture funding in Indian climate-tech. Source: Holon IQ[19]

	VALUE (USD MN)	NO.OF DEALS	VALUE (USD MN)	NO. OF DEALS	VALUE MN	NO. OF DEALS
ENERGY	45	15	60	14	100	20
SUSTAINABLE MOBILITY	83	27	457	39	978	61
ENVIRONMENTAL AND NATURAL RESOURCES	1	2	18	10	4	8
WASTE MANAGEMENT & CIRCULAR ECONOMY	54	10	8	5	65	12
CLIMATE-SMART AGRICULTURE & FOOD	6	8	12	6	40	15
OTHERS	5	6	40	10	28	14

Table 1: Investment Split by Value (in USD million) and Volume (number of deals) across climate-tech sub-sectors in India between 2020 and 2022. Source: Impact Investors Council (IIC)[20]

In terms of number of deals, there is a strong skew towards early stage rounds and small ticket sizes; the median deal size is about USD 2 million. In terms of value, however, a small number of Series B and later stage rounds, accounting for less than 15% of the deals, make for more than 60% of the total equity infusion.

	2020		2021		2022	
Stages	**Value (USD Mn)**	**No. of Deals**	**Value (USD Mn)**	**No. of Deals**	**Value (USD Mn)**	**No. of Deals**
Seed	59	45	94	55	165	93
Series A	60	15	155	20	239	20
Series B	12	3	57	5	317	8
Later Stages	64	5	288	4	493	9

Table 2: Climate-tech deals across stages in India between 2020 and 2022. Source: Impact Investors Council (IIC)[21]

Four aspects become conspicuous from the funding trends:

1. India galvanised USD 3.7 billion in climate-tech VC funding in 2022, almost double the amount for the previous five years combined. Notwithstanding the recent upsurge, India still trails the US, China, and other geographies such as Sweden, Germany, and the UK when it comes to climate-tech venture funding over the past half a decade or so. In a report by Dealroom, India was ranked ninth globally with about USD 1 billion in VC funding in climate-tech between 2016 and 2021; the ranking was topped by the US (USD 48 billion), followed by China (USD 18.6 billion).[22] Even with 2022 being India's best year on record, it still received considerably less in VC funding than the US (USD 28.6 billion) or China (USD 10.7 billion).[23] India needs to quickly, and drastically, ramp up its inflows of private climate finance, especially at the early stage, for it to substantially offset its emissions and mitigate the worst effects of climate change through innovation. According to an estimate by Unitus Capital and Climake, India needs more than USD 1 trillion in climate finance by the end of the decade to abide by its emissions targets for 2030 (see Figure 6). Further, there is a need for faster unlocking of patient capital comprising green bonds, pension funds, sovereign wealth funds etc.

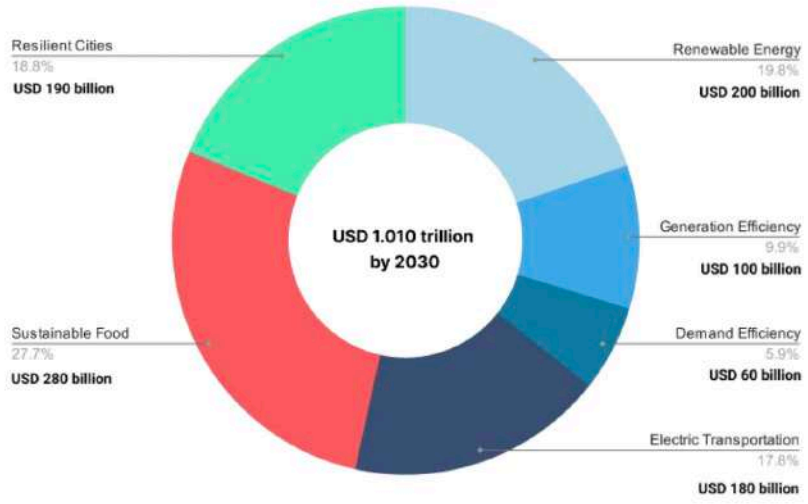


Fig 6: Estimates for India's climate finance requirements by 2030.
Source: Unitus Capital, Climake[24]

2. There seems to be a gap in funding for start-ups in the "missing middle"—start-ups wishing to go from the first grants or pre-seed/seed rounds (~USD 30,000-65,000) to the intermediate rounds (~USD 250,000-650,000) to bring their minimum viable product to the market and acquire scale through paying customers—which is of particular significance in capital intensive sectors such as renewable power or water management. According to a report by Climate Trends, start-ups in this "missing middle" struggle to raise enough funding to manage their working capital requirements even as they look to scale on the basis of their initial prototype.[25] Note that this is a global phenomenon with the much maligned term, "valley of death" being used to refer to this phase of inadequate funding for climate-tech startups (see Figure 7). In fact, several prominent investors have highlighted the "absence of Pilot/FOAK infrastructure funding and a dearth of Series B capital", especially for startups with a sizeable hardware constituent.[26] The global funding requirement for such pilot/prototype facilities working up to create their respective first-of-a-kind (FOAK) plants has been pinned at USD 150-190 Bn, several orders of magnitude higher than what is currently available for start-ups in the space.[27]

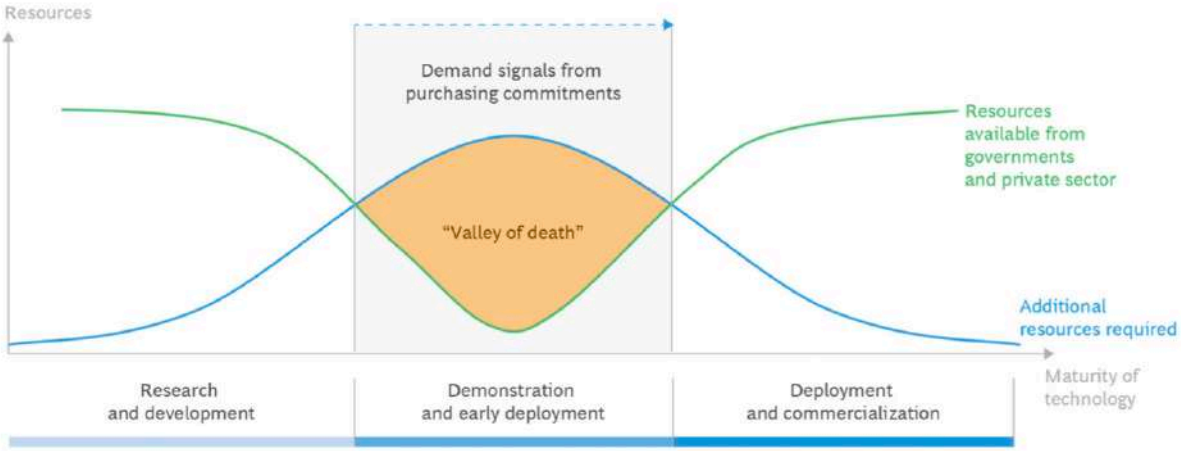


Fig 7: "Valley of death" for climate-tech startups. Source: BCG[28]

3. Sustainable mobility dominates other sectors in terms of funding. This trend holds true even if we consider a slightly longer time horizon (see Figure 8). Sustainable mobility, and the EV space in particular, has achieved a technological maturity threshold with proven products and stable revenue lines notwithstanding some recent valuation dips. It also helps that they constitute one of the few climate-tech interventions to enjoy widespread stakeholder and consumer buy-in. The resultant stability has perhaps convinced investors that this is the climate-tech sub-sector most likely to replicate the returns profile they are familiar with when dealing with technology/IT companies. This is both expected and, as mentioned earlier, in line with global trends. Going forward, India Inc. should like to catalyse similar levels of capital for deep-tech, high-capex, high-R&D companies, especially in certain "hard to abate" sub-sectors (see Figure 9). Adjacencies at the intersection of waste heat capture and industrial residue management, for instance, or innovations focusing on the built environment or improved grid management will need significant amounts of capital investment over the coming years.

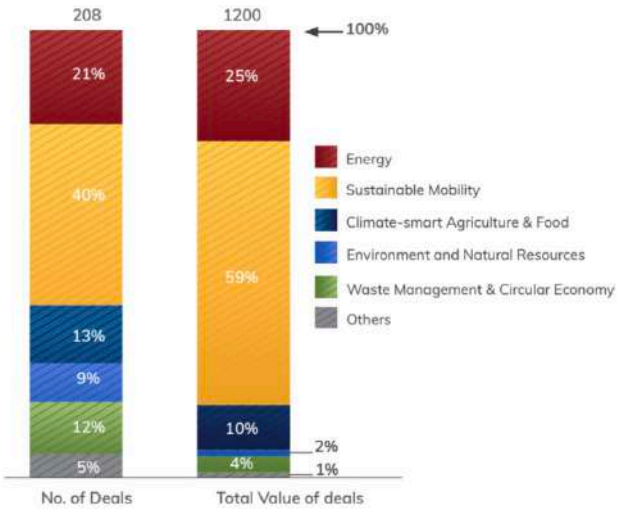


Fig 8: Investment Split by Value (in USD Mn) and Volume (number of deals) across climate-tech sub-sectors in India between 2016-20 . Source: Impact Investors Council (IIC)[29]

4. Globally, there has been a discernible trend towards an increase in investments directed at technologies targeting energy distribution, demand control, and end-use efficiency. However, India has seen relatively muted activity in this space, arguably due to the "highly regulated and subsidised nature of the electricity retail sector."[30] But things are changing; India is undertaking a range of measures to gradually open up its electricity sector, provide more robust market signals for power dispatch, and make its grid more flexible and demand responsive. Recent interventions include the introduction of time-of-day (ToD) tariff, announced in June 2023 and expected to come into effect in a phased manner from April 2024. Funding patterns closely follow patenting activity; a recent publication in Nature shows that patenting activity by low-carbon energy technology startups in India has been "concentrated in the mobility sub-sector, in contrast to global trends where patenting in grid management and

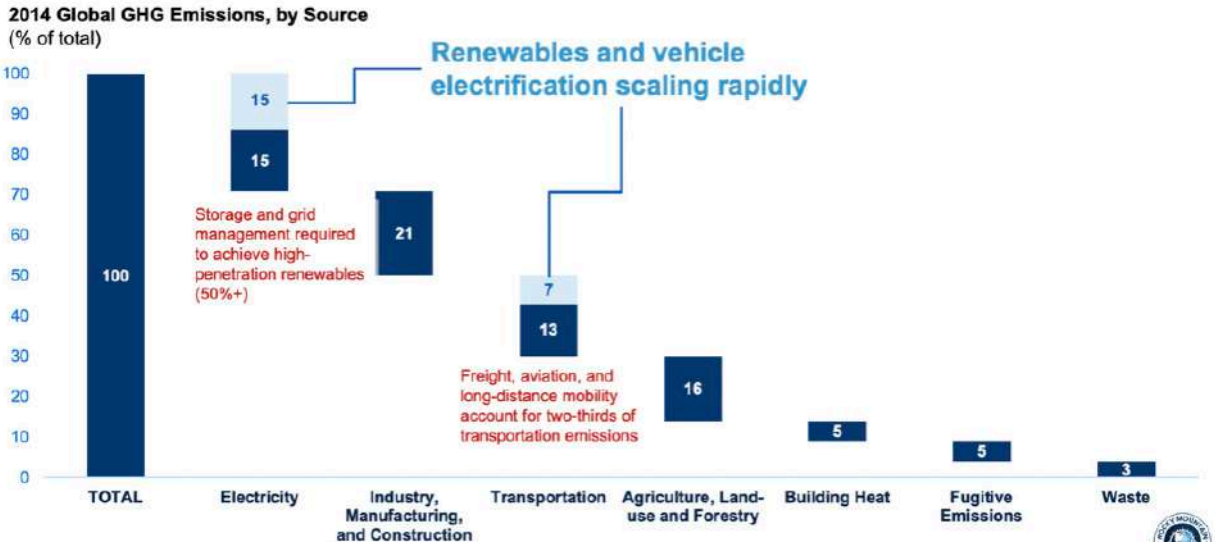


Fig 9: Almost two-thirds of global emissions fall in the "hard-to-abate" category which need technology interventions to deliver cost effective and scalable solutions. Source: WRI, CAIT, BNEF, RMI analysis, Third Derivative[30]

RES [renewable energy sources] sub-sectors is higher than that in the mobility sub-sector."[32]

Climate-tech is thus at an incredibly exciting crossroads with rapid advances in technology converging with positive policy and market shifts. The most important change, however, has come in the form of an industry-wide narrative disruption and a coterminous reorganisation of markets around climate conscious businesses. Consumer sentiment has reinforced itself to create a strong demand pull for climate conscious consumption. Investment flows are also unequivocally catalysing towards responsible and sustainable technologies, enterprises, and practices (see Figure 7). The shift marks tacit investor buy-in of what economists Gernot Wagner and Martin Weitzman wrote in their 2015 book Climate Shock, describing climate change as "almost uniquely global, uniquely long term, uniquely irreversible, and uniquely uncertain". To add to their claim, the returns from early backing of durable, field-tested, and socially acceptable climate-tech solutions should arguably turn out to be uniquely robust.[34]

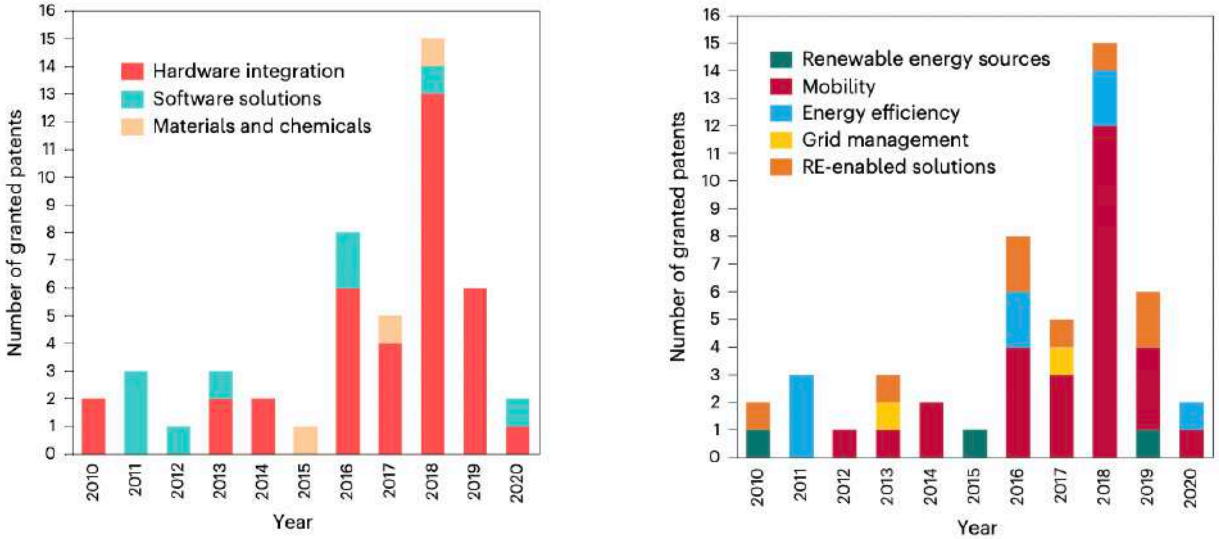


Fig 10: Annual patent grants to startups by sector and core-value creating activity. Source: Nature Energy[33]

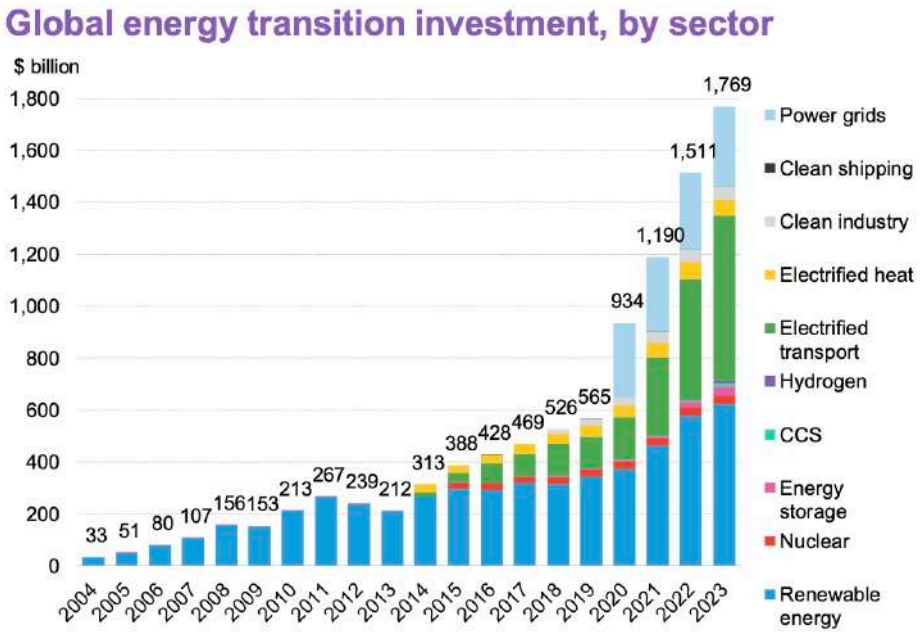


Fig 11: Global investment in the energy transition has been increasing consistently over the years.
Source: Bloomberg NEF[35]

Prominent Investment Themes

Climate-tech is at an exciting stage of development. While it may be unfeasible—and counterproductive—to granularly categorise climate-tech innovations into compact buckets given the internal diversity that exists in the sector, certain overlapping, non-exclusive themes can nevertheless be identified. At 3one4 Capital, we have classified our first set of focus areas within climate-tech innovations into three major themes based on the functions they cater to.

i) Sustainable mobility and transportation

ii) New-age Energy Solutions

iii) Promoting Smaller Footprints

SUSTAINABLE MOBILITY AND TRANSPORTATION

As previously noted, sustainable mobility has received a considerable share of VC funding within the climate-tech domain, and for good reason. Transport accounts for more than a fifth of global CO2 emissions with the road sector dominating the mix.[36] The road sector in India—including passenger and freight—makes up for more than 92 per cent of the country's transport emissions.[37] Moreover, greening transport, especially in the case of electric vehicles, additionally helps put progressive pressures to decarbonise other related fields such as the underlying grid. With time, however, the sub-sectoral boundaries must move beyond private ownership focused EV business models to accommodate micro-mobility, freight management, tailpipe emissions capture technologies, non-motorised transport (NMT) based innovations, among others.

Case Study: Yulu

Yulu: Pioneering micro-mobility solutions to make India's urban first and last-mile commute and hyperlocal goods deliveries seamless, shared, and sustainable.

Fig 12: Yulu's SDG Focus. Source: Yulu[38]

Impact Objectives: Yulu aims to build Mobility-as-a-Service (MaaS) solutions for 100 million urban Indians and help India in its mission to achieve Net Zero by 2070 by mainstreaming electric mobility which is smart, shared, sustainable, small, and safe. The company is targeting to grow its rental fleet to over 100,000 micro mobility vehicles (MMVs), up from the existing 30,000, and venture into 15 new cities before the end of FY 2024-25. It has also partnered with Bajaj and Magna to innovate on EV form factors and battery swapping technology respectively. These strategic partnerships will also accelerate mainstream corporate strategies in the sector to meet India's growing urban mobility demands for hyperlocal goods deliveries through more pragmatic products and form factors.

Problem Space: India is experiencing a massive surge in its urban population with an associated, yet disproportionate, growth in the number of private vehicles, urban congestion, and urban air pollution. Mumbai, Delhi and Bengaluru have consistently featured on TomTom's top 10 most congested cities in the world for traffic congestion.[39] Additionally, India has 63 out of the 100 most polluted cities on the planet, including ten in the top 15.[40] India's transportation demand has grown more than eightfold since 1980.[41] The country's existing transport system is stretched to capacity, and faces serious roadblocks in its attempts to improve accessibility and reduce emissions.

The Solution: Yulu is resolutely creating a category for 2W micro-mobility led mass urban commute by providing a highly scalable, affordable, efficient, and green mode of transport for short commutes and hyperlocal goods deliveries. Yulu presently offers three products: Miracle (light-weight, dockless electric two-wheeler powered by state-of-the-art IoT with a maximum speed of 25 km/hr), Dex (delivery-focused, smart, 100% made in India, dockless electric two-wheeler with a goods carrying capacity of 15kg), and Wynn (digital-first, ownership oriented electric two-wheeler with battery swapping based subscription plans). Each of these can be accessed through a mobile application and do not require a license to operate.

Progress: Yulu is India's largest shared electric mobility and Battery-as-a-Service (BaaS) company, maintaining the country's largest electric vehicle (EV) battery pool. It has enabled more than 425 million kilometres of green EV rides, mitigated more than 20,000 metric tons of carbon emissions, and saved more than 30 million productive hours in commute time.[42] In 2023 alone, the company empowered more than 1,20,000 delivery riders to complete over 70 million goods deliveries, unlocking cost savings of over 35% per delivery.[43] Its partner entity, Yuma, set up in collaboration with Magna, is operating more than 125 swap stations and has already completed more than 10 million swaps (see Figure 14).[44] Yulu's ownership focused e-2W, Wynn, is fast emerging as a cost-effective, value-driven, long-term mobility investment for discerning customers. It promises to potentially induce cost savings of nearly 40%-50% on a total cost of ownership (TCO) basis when compared to petrol two wheelers.[45]

425 +Mn	Green EV rides(in Kms)
20K Tonnes	Carbon emissions mitigated
30 +Mn	Commute hours saved
70 +Mn	Goods deliveries enabled in 2023

Fig 13: Left: The Yuma team celebrating 10 million swaps. Right: A snapshot of Yulu DeX's ridership numbers. Source: Yuma, Yulu

Industry Collaborations: Yulu partnered with Bajaj Auto in 2019 to procure specially designed electric two-wheelers from the auto giant.[46] These micro-mobility vehicles (MMVs) have been exclusively manufactured for shared micro-mobility purposes, carefully co-designed with Yulu to withstand Indian road conditions and use-cases. Bajaj will additionally facilitate the financing needs of Yulu for large-scale deployment of its MMVs.

With its IoT enabled, machine learning driven tech stack, Yulu has leveraged this partnership to give a fillip to its mission to continually increase operational efficiency, reduce traffic congestion, and bring high availability and convenience to its customers. Bajaj's expertise as a leading manufacturer of two-wheelers and three-wheelers will immensely help Yulu in consolidating its leadership position in the shared electric micro-mobility space.

Fig 14: Bajaj's strategic partnership with Yulu. Source: Yulu

"Succeeding in the shared micro-mobility business is incumbent upon creating winning partnerships to ensure assured supply of high-quality electric vehicles in large numbers. Bajaj Auto Ltd is the leading automaker of India and is respected globally for its quality and manufacturing capabilities at scale. Yulu is the leading electric micro-mobility service provider that requires reliable, durable and comfortable electric vehicles to serve its customers, hence a committed manufacturing partner is crucial to our success. In Bajaj, Yulu finds this strategic partnership and it is a win-win relationship. Yulu's electric two-wheelers will help Indian commuters with the first and the last mile connectivity option. This partnership aims to solve the mobility challenges of urban India in an eco-friendly manner."

Amit Gupta
(Co-Founder & CEO, Yulu)

Yulu also entered into a partnership with Magna—a leading global automotive components manufacturer, to build the requisite infrastructure and capacity to ramp up its battery swapping network.[47] Under the initiative, Yulu and Magna plan to open up their expanded battery swapping and charging network to other players and the public at large. The company is targeting a network of over 500 charging stations across multiple cities. Magna brings with it extensive capabilities in design, engineering and manufacturing to Yulu's cause. With its proven track record of operating in high volume production, Magna will substantively aid in managing the future buildup of the infrastructure required for undertaking millions of swaps every week.[48]

Fig 15: Magna's partnership with Yulu. Source: Magna, Yulu[49]

"We can clearly see a significant growth opportunity for Yulu in both the BaaS and MaaS businesses in the next three to four years. As the market leader in electric mobility, with a proven business model built on positive unit economics, our focus now will be to establish a robust and agile supply chain and scale-up our operations. We will go deeper and denser in our existing markets and explore new areas while delivering a great customer experience. We welcome Magna onboard with our shared vision to create a sustainable and scalable EV ecosystem in India and beyond."

Amit Gupta
(Co-Founder & CEO, Yulu)

Yulu continues to innovate on form-factor, range, business models, and strategic alliances to contribute meaningfully to solving this challenge at scale.

With respect to electric mobility in India, electric two-wheelers (E-2W)—and even electric three-wheelers (E-3Ws) in certain use-cases—are within touching distance of reaching the cusp of widespread adoption. E-2Ws have largely solved for total cost of ownership and product market fit with respect to mobility patterns conforming to the typical urban commute. While there have been scares with product malfunctions and even battery pack fires in certain instances, these are unlikely to make for a continuing feature as mandatory safety checks and government imposed battery testing standards get stricter over time, and consumer preferences shift to account for safety performance records as an essential product feature.

Financing requirements are, of course, onerous at present with an estimated USD 285 billion needed to transition the country's fleet of 2Ws and 3Ws. Capital pools comprising venture debt, green bonds, pension funds, sovereign wealth funds etc. are yet to be unlocked in any meaningful

way for the country's EV ecosystem.[50] Announcements from dedicated climate funds and multilateral banks have, however, been encouraging. The Green Climate Fund approved a USD 1.5 billion e-mobility financing program for India in May 2022.[51] This comes on the back of Global Environment Facility's (GEF) approved grant of over USD 160 million.[52] International finance organisations are also stepping up with the World Bank slated to set up a USD 1 billion fund with SIDBI as a de-risking/hedging mechanism by providing guarantees against default to lenders offering loans for purchase of E-2Ws and E-3Ws.[53]

Remaining issues such as charging point adequacy and convenience, building trust and credibility in the technology and its products, and upgrading existing models to cover for all internal combustion engine (ICE) use cases—are reliant on iterations of information and experience and will thus take some time. Besides, interventions to address large-scale infrastructural hurdles with regard to charging, for instance, are often the preserve of governments, urban local bodies, or even RWAs with limited opportunity space for start-ups.

Avenues for innovation exist largely around a set of backward and forward linkages based on the lifecycle of an EV. For the former, there are now a few start-ups in the cell manufacturing space competing alongside several established players who have stepped in after the government's invitation for proposals under the PLI scheme for ACC battery storage. To counter India's dependence on China for battery relevant metals, companies are innovating with cathode chemistries and alternative designs. To this end, there has also been interest in building aluminium fuel cells (Log9) as well as making permanent magnet free motors (Chara) to limit reliance on rare earth metals. Globally, several trends are emerging in parallel; OEMs looking to optimize for cost at the altar of density or range are going for Lithium Iron Phosphate (LFP) even as others look towards greater use of manganese or consider silicon based anodes. There is also an incredible amount of R&D taking place with sodium ion, silicon-air, and solid state batteries amid others competing for potential uptake across a variety of use-cases. Till now, India has seen limited cell manufacturing with a host of E-2W and E-3W OEMs assembling packs with imported, usually unreliable, cells. As cell manufacturing takes off in India, it will be interesting to see which chemistries take root in the domestic industry. For start-ups, secondary opportunities also exist in building battery management systems (BMS), innovating for pack design, bolstering pack safety, or managing battery cell heating.

Start-ups operating in this space will have to rely on focused, competent technical teams, ideally with past experience in power electronics and battery pack design at an OEM. Disaggregation of demand and trust, and absence of standardisation in charging and pack design will likely emerge as prominent challenges. While the industry for E-2W or E-3W should voluntarily shift towards interoperability and adoption of a uniform charging standard without blunt regulatory fiat, building credibility to elicit acceptance from OEMs may prove to be an uphill task. Since OEM requirements will often necessitate customisations or exclusive supply contracts, even those companies which are successful in entering into partnerships with OEMs will have to guard against revenue concentration risk emanating from a single whale client.

On the charging front, mass enablement of EV roaming should have an effect similar to that seen in the case of payments with UPI, or the one described in the report's section on ONDC. This is especially likely with the growing influx of DPI-based resource discovery and transaction solutions for India's energy domain such as the emerging Unified Energy Interface (UEI) backed by Beckn. Unbundling of value chains and their concomitant processes should open up a gamut of opportunities with ecosystem players offering varied and customisable service stacks, focusing on or combining functions and revenue streams as varied as aggregation, identity authentication, subscription-based or charging-as-a-service offerings, charging services' payments integration in MaaS or parking applications, among others. Over a substantial period of time, we could even see the mainstreaming of vehicle-to-grid (V2G) offerings once the necessary infrastructure and communication standards are put in place. By allowing owners to sell excess energy back to the grid, TCO can come down and EV owners may access new income generating streams such as energy arbitrage or indulge in frequency response to balance the grid, even though the latter will gradually face stiff competition from other fast response assets such as fixed battery systems.[54]

Till date, securing financing for the purchase of EVs, especially commercial EVs, has been one of the most roadblocks to widespread adoption. Paucity of historical data about battery longevity and performance under Indian conditions has led to banks charging higher EMIs and down payments with less forgiving repayment

terms on their loans for EVs when compared to loans for similar sized ICE vehicles. Data shortage, the lacklustre performance of certain EV freight models, and the absence of an organised resale market—re-sellers face the added unenviable task of offloading vehicles with older, and relatively inferior, batteries at a time characterised by rapid improvements in battery technologies—make it hard to properly underwrite the vehicle and ascertain its residual value. Small and mid-size fleet owners have had to bear the brunt of the banks' trust deficit in the asset class the most since large fleet owners such as major e-commerce players can often leverage their reach and market recognition to convince banks to underwrite the brand more than the asset itself and unit economics factors are also more amenable. The status quo is gradually changing with companies building for vehicles and use-cases which generate copious amounts of data. The use of real-time metrics based on regular measurement of a battery's state of charge, kilometres travelled, number of charging cycles utilised etc. allows for the emergence of innovative asset underwriting models premised on a battery's' energy throughput and parameters assessing vehicle performance. Other potential interventions in EV financing include the use of new financing structures and mechanisms, such as lease-to-own arrangements, or pay-per-use financing.

On the other end of the spectrum, we also have start-ups building to streamline access to asset ownership by specifically helping individuals—most often gig-workers—establish their creditworthiness to secure loans for purchasing EVs. They look at alternate data flows like records on mobile payments to evaluate the possibility of default. Additionally, a shift to more cash flow reliant lending methods for EV fleet owners can help them offset legacy obstacles like suboptimal familial credit history or the absence of higher-education credentials.[55]

To understand some of these prominent trends in the sustainable mobility space better, we take a deep dive into two, interrelated EV/battery linkages, namely, downstream applications in the automotive battery supply chain and end-of-life battery recycling.

Li-ion Batteries: First among Unequals

Batteries have been at the vanguard of advances in energy storage capabilities for well over the last two decades. Over this period, their prices have fallen by more than 90%, even as energy densities have increased multifold (see Figure 16). With continued advancements in technology and an ever expanding application set, many commentators insist we are living in the "decade of the battery".

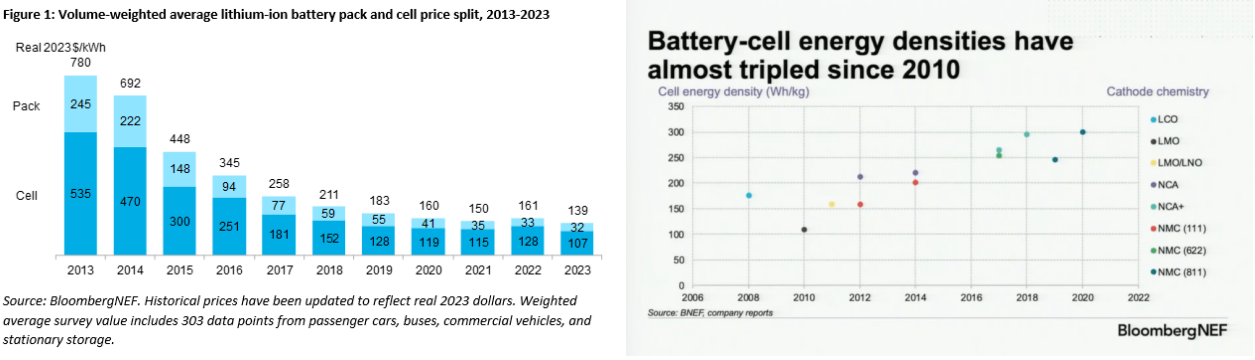


Fig 16: Left: Steep fall in battery cell and pack prices. Right: Increase in specific energy over time. Note that the two charts do not correspond to the same cell or pack type. Sources: BNEF[56], CleanTechnica[57]

Notwithstanding the impressive breakthroughs in the development of several other energy storage solutions, there are few, if any, which can match the versatility, deployment muscle, and learning curves that batteries offer (see Figure 17). Even at utility scale, solutions such as pumped hydro, which enjoy prominence in India, come with highly specific geographical siting requirements along with long gestation cycles and severe rehabilitation challenges. Moreover, even though the levelized cost of electricity for pumped hydro storage is often lower than most battery energy storage solution (BESS) applications, lithium-ion BESS solutions deliver higher power density and round-trip efficiency.

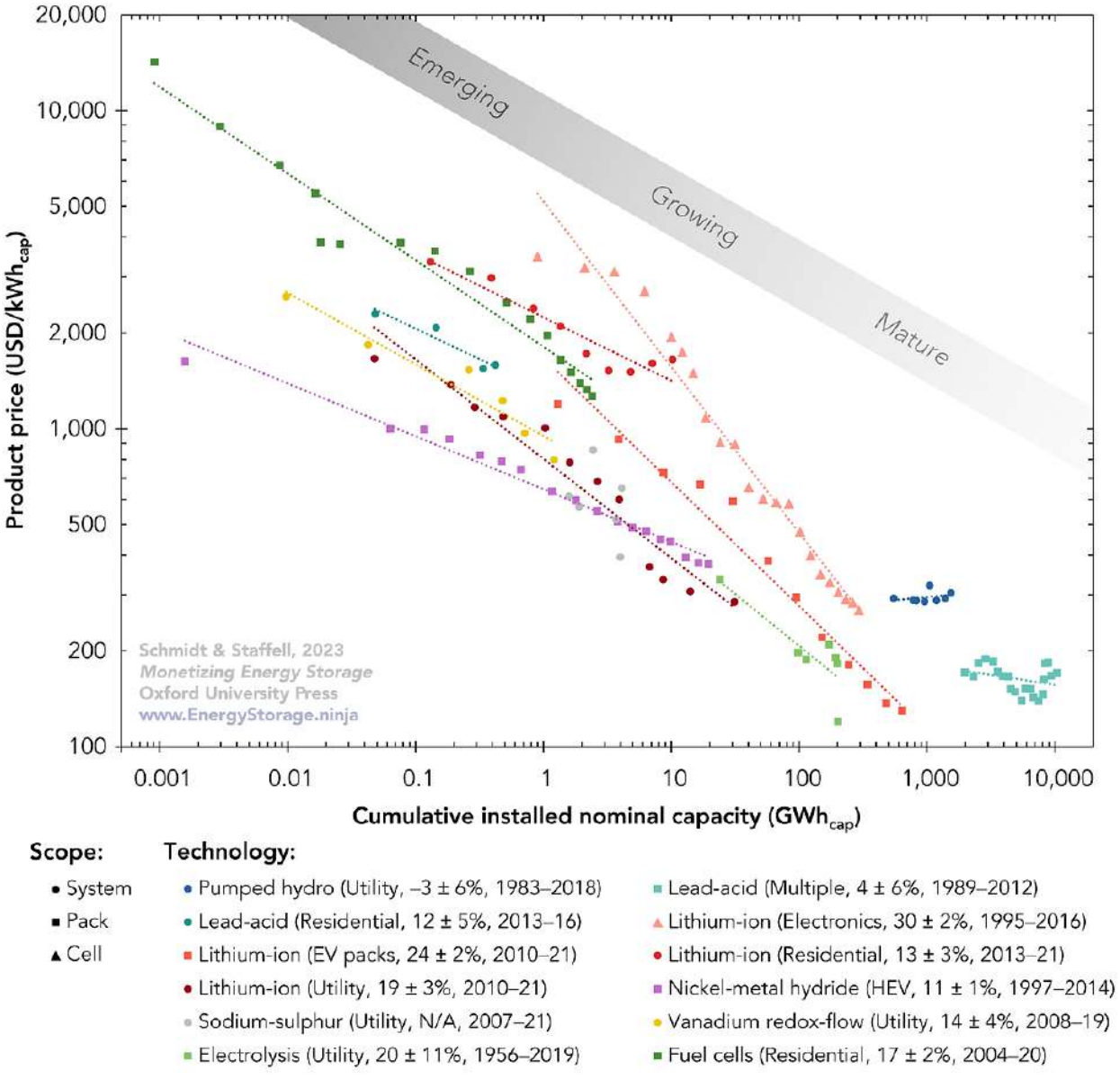


Fig 17: Product prices per unit of energy capacity for the most common electricity storage technologies as a function of increasing cumulative installed energy capacity. Experience rates are derived from the slope of experience curves and quantify the percentage change in product price with each doubling of cumulative installed capacity. Source: Schmidt & Staffell, Storage Lab[58]

This section, however, will primarily focus on EV batteries, and more specifically, on lithium-ion (Li-ion) EV batteries. There are two major reasons for that. Firstly, vehicular applications dominate overall battery storage deployment volumes. Despite the surge in interest, and correspondingly, the use of BESS for stationary applications—grid-scale battery storage installations, for instance, rose by 75% in 2022 compared to 2021—OEMs installed nearly 35 times more capacity in EVs in the same year.[59]

Secondly, the special emphasis on Li-ion is justified since it possesses considerable advantages in terms of volumetric energy density, capacity retention, and overall performance over older battery technologies. For reference, Li-ion batteries exhibit specific energy levels that are twice those of NiMH (nickel-metal hydride) batteries, three times those of NiCd (nickel-cadmium) batteries, and six times those of Lead-acid batteries at a discharge rate of 1C, where 1C represents a rate resulting in the battery being fully discharged after 1 hour.[60]

THE INDIA OPPORTUNITY

India has immense potential to be a hub for battery storage applications. According to an analysis by CEEW, the cumulative energy storage capacity required to decarbonise India's electric mobility and power sectors could touch 903 gigawatt hours (GWh) by 2030.[61] A majority of this demand is expected to be met by lithium-ion batteries, with EVs accounting for approximately 60%-70% of the total demand. On account of its ambitious renewable energy capacity addition targets, India will see the highest demand for battery storage of any country in the world.[62] The NITI Aayog estimates India's battery storage capacity to reach 600 gigawatt hours (GWh) by 2030 with a consolidated investment opportunity worth USD 47 billion between 2022 and 2030 (see Figure 18).[63]

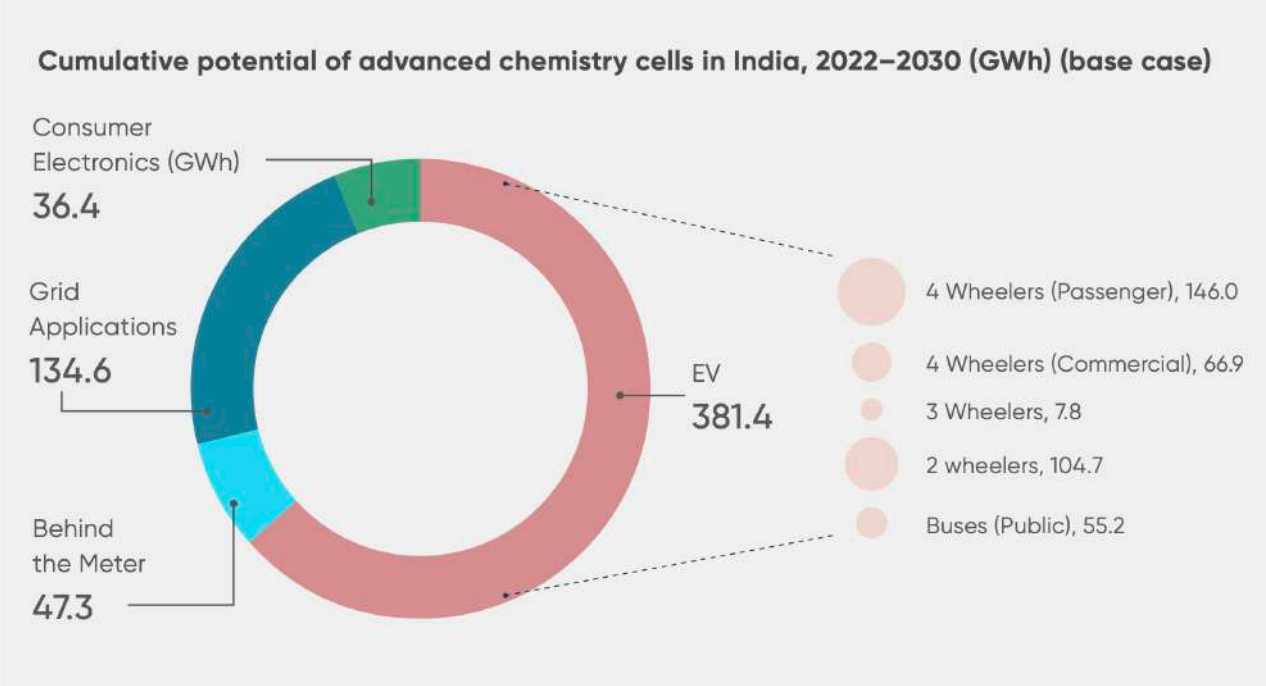


Fig 18: India's cumulative potential for Advanced Chemistry Cells. Source: NITI Aayog[64]

CHANGING PIVOTS OF INNOVATION

While innovations in cell manufacturing and pack engineering have undeniably played their part, Li-ion batteries have typically enjoyed cost and performance related improvements on the back of changes to the underlying cell chemistry. At present, the state of the art lies in cells with specific energy greater than 270 Wh/kg, commonly utilising a high-nickel, low cobalt cathode.[65] The NMC811, for example, uses far less cobalt than the older NMC622 batteries and thus offers impressive potential for raw material cost reduction. Gradually, however, cathodes from the current generation are nearing their theoretical performance limits, necessitating innovation and R&D shifts towards new generation cathode chemistries alongside other nodes and components in the battery value chain.[66] A few of these shifts have been covered below.

Innovations in Anode Development: Anodes predominantly use graphite, though battery makers have been using an increasing amount of silicon in the form of silicon oxide over the past decade.[67] Silicon compounds, even in small quantities of ~2%-10% by weight can allow for noticeable improvements in energy density. These improvements, however, have often come at the expense of cycle life. Silicon-dominant anodes, comprising 20%-100% of silicon by weight, promise substantial performance improvements, but are still a few years away from commercial deployment in terms of technological readiness.[68] Major challenges include— i) drastic volume expansion (up to 300%) during lithiation and corresponding contraction during discharge; ii) relatively lower ionic conductivity of Silicon when compared to graphite; iii) frequent damage to the solid electrolyte interphase (SEI)— a protective film that forms on the surface of the battery electrode to stabilise its interface with the electrolyte—leading to unwanted side reactions; and iv) irreversible capacity loss during cell formation or cycling.[69] These challenges are interrelated and the first one has proved to be especially intractable. While Silicon can hold almost 10x as many lithium ions by weight as graphite, lithiation can lead to mechanical stress and, eventually, even material fracture.[70] Several global startups are working to bring silicon dominant anodes to fruition by countering the issues mentioned above (see Table 3).

Innovation Category	Prominent Global Startups and their solution(s)	Technology Adoption and Scalability Considerations	Key Partnerships
Silicon Nanowires	**Amprius:** Pure silicon nanowires grown directly on the metal current collector substrate. Spacing between nanowires and their porous design helps accommodate silicon volume expansion without the need for binders.	• Record-high gravimetric energy density of 500 Wh/kg, enabling longer run-times and range. • Ions travel in a highly conductive, straight path resulting in high power capability and fast charge rate— a depleted pack can be brought to a 90% SoC in 10 minutes. • Production needs proprietary anodes which are typically incompatible with existing cell manufacturing facilities. • Presently best-suited for niche applications requiring high discharge times without compromising other key features. Eg- urban air mobility. • Currently expensive to produce and scale.	Airbus, BAE Systems
	OneD: Silicon nanowires infused within existing graphite particles. The approach makes silicon directly accessible to lithium ions without the inefficiencies of trapping silicon inside inactive carbon, as is the case with conventional approaches.	• Relatively affordable with low input costs addition— silicon processing costs less than USD 2/kWh. • Enables packs with high densities of nearly 350 Wh/kg. • Compatible with most large cell manufacturing facilities. • Offers lower energy density compared to some competitors, potentially limiting adoption in certain applications.	General Motors Ultium

Silicon based active materials with drop-in features	**Sila Nanotechnologies:** Micrometre-sized particles of nano-structured silicon surrounded by a porous scaffold. The nanostructured, porous material facilitates silicon expansion without damage and the scaffolding enables the passage of lithium ions while preventing unwanted reactions with the electrolyte.	• End product is similar looking to black graphite powder used in anodes today and can integrate into any cell assembly process • Compatible with all prominent cell design formats including prismatic, pouch, and cylindrical. • 20% energy density boost when compared to graphite. • Generates 50-70% less CO2 per kWh than graphite during production. • Potential challenges might emerge in maintaining the integrity of the porous scaffold in the case of extended cycling. Further testing and validation is needed.	Panasonic, Mercedes Benz, BMW
	Group14: Micrometre-size porous carbon particles containing vapour deposited amorphous silicon. The porous, carbon matrix provides space for volume expansion during lithiation, mitigating stress and potential electrode cracking	• Amorphous silicon is a highly stable form of Silicon, with high capacity and good cycle life. • Micrometre-sized silicon particles offer better structural stability compared to nanoparticles which are prone to larger volume changes. • 50% more energy density than conventional graphite for lithium battery anodes. • Modular model for manufacturing, using Battery Active Material (BAM) modules. Each module is self-contained with 2,000 t/y capacity. • Modular design enables plug-and-play expansion, with reduced build time, and little to no capex. • Amorphous silicon is less well-understood compared to crystalline, requiring further research to optimise performance and stability	Porsche, SK Materials
Porous, silicon films	**Enevate:** Ultra-thin, porous, silicon films deposited directly on copper to create binder-free, monolithic anodes. An active material film utilising a porous conductive matrix to store silicon, akin to "balloons" within a "concrete" structure, enabling volume changes without the expected levels of degradation.	• 30% range improvement over conventional batteries with strong fast charge capabilities. • Relatively low material costs • Up to 26% reduction of CO2 emissions during manufacturing • Safe charging with no lithium plating even at sub zero temperatures. • Their current thin-film deposition technology might not be easily adaptable for large-scale, high-volume battery production. • Research to optimise performance and stability	Lightning Motorcycles, LG Chem

Table 3: An overview of prominent startups working in the silicon anode space. Sources: multiple industry sources, respective company websites, 3one4 Capital analysis, IEEE Spectrum[71]

All startups mentioned in Table 3, while incredibly promising will nevertheless have to safeguard against three common risks. Firstly, scaling up these unique technologies and production processes from pilot-scale to gigawatt-scale will entail unforeseen technical and business oriented challenges, necessitating rigorous validation of claims through the gathering of more performance data. Secondly, the companies' offerings will have to demonstrate long-term cycle life with minimal degradation for mass market acceptance even as they compete against alternative battery technologies. And, finally, both the durability and exclusivity of their success will depend on their ability to secure and defend their IP.

Apart from silicon, there have also been some interesting developments towards commercialising lithium metal anodes. A variety of concepts are being trialled across the world. Among these, the most significant benefits from an energy standpoint are offered by "anode-free" concepts, where lithium is initially absent from the anode during assembly but is extracted from the cathode upon the first charge.[72] While these anodes offer the highest theoretical capacity, they too suffer from severe volume fluctuation concerns which can lead to intricate integration problems at the pack level. They are also prone to dendrite formation, presenting serious safety hazards and diminishing cycle life.[73] Additionally, these configurations require ultra-thin lithium foil, the production and handling of which is incredibly complex on account of the metal's soft, highly reactive nature and its mechanical properties such as ductility and adhesion.[74] Several firms are trying to overcome these challenges. Last year

itself, Northvolt & Cuberg unveiled a lithium metal cell for aviation with an impressive specific energy of 405 Wh/kg, with plans to increase it up to 450 Wh/kg over successive iterations.[75] We should witness announcements for automotive applications soon.

While innovations for other battery components may proceed incrementally, experts suggest substituting graphite-based anodes would constitute a step change, mandating a rethink of the entire system, necessitating changes with regards to cell components, systems integration, as well as manufacturing feasibility.[76] Understandably then, startups can play a big role in enabling the battery ecosystem leapfrog beyond graphite since they are relatively better positioned to "pursue high-risk projects and manage fast-paced development cycles, compared to large manufacturing and engineering firms."[77]

Case Study: Exponent Energy

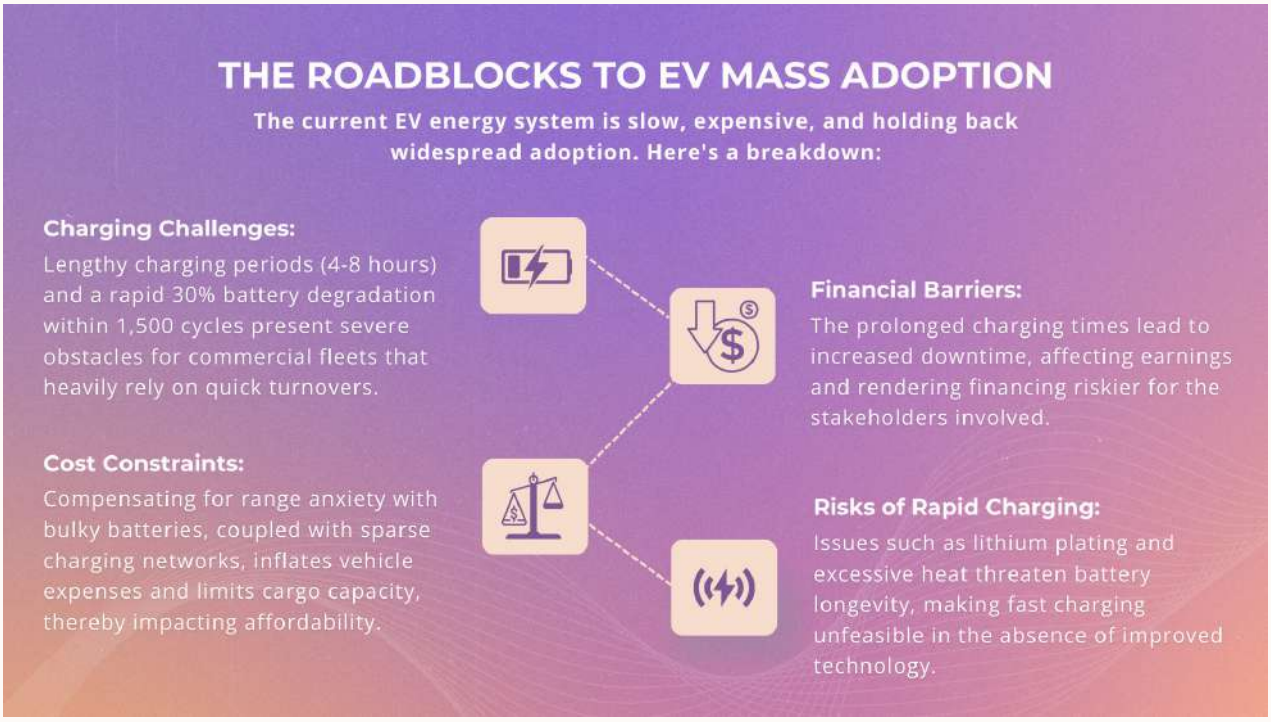
êxponent

Exponent Energy:
Spearheading the development of an affordable and reliable 15-minute rapid charging solution by using a scalable energy stack to unlock the true potential of commercial EVs in India.

SDG Focus:

Impact Objectives: EV adoption in India has completed the 0 to 1 journey. But to go from 1 to 100, it needs to tackle disrupted energy flows, short battery lives on contemporary EVs, issues emanating from a lack of designated parking spots for EV charging, cost concerns around large batteries, and slow and unreliable charging infrastructure. India's reality necessitates the adoption of small battery packs which can undergo rapid charging through publicly available infrastructure. Exponent aims to create large-scale impact by simplifying EV energy flows through its rapid charging energy stack. It further aims to unlock the market for driver-cum-owner (DCO) ownership and leasing models by enhancing access, flexibility and total cost of ownership (TCO) viability. Furthermore, by improving the quality of data available through its stack, Exponent can catalyse data backed EV financing for DCOs. After integrating with several OEMs across vehicle form factors, Exponent aims to expand its presence in the E-3W space and enter the intercity e-bus segment in 2024. It plans to deploy 1000 e^pumps and have 25,000 EVs powered by Exponent on the road by 2025.

Problem Space: The biggest bottleneck for electrification of commercial vehicles in markets like India is the availability and speed of charging – sparse charger networks and long charging times nullify any potential upside from EV adoption. Commercial vehicle owners earn by the hour, and it makes no sense to expect them to wait for 5-7 hours to fully charge their vehicles. These entrepreneurs also need flexible schedules and typically fuel up once a day to manage cash flows. Combine this with the cost of the pack and price sensitivity of emerging markets, and we are at an impasse for adoption at scale.



The Solution: Exponent Energy is a solution that lines up perfectly to tackle this problem. It offers cell-agnostic, 15 minute rapid charging capabilities by using a flexible, and highly programmable energy stack that employs a proprietary battery pack, charging station, and connector—aptly called the e^pack, the e^pump, and the e^plug respectively—to offer a seamless charging experience that promises to let you "recharge like you refuel". While they are currently focusing on LFP cells, their technology is scalable across cell chemistries, voltage, and capacity, and comes with a 3000+ cycle battery pack warranty. Exponent Energy has thus created an elegant solution which does not disrupt TCO requirements for commercial fleet operators. Further, enabling fast charging for vehicles plying within short circuit, well-defined routes means that they can use smaller battery packs, thereby reducing initial costs plus allowing for relatively greater load carrying capacity since large battery packs are both heavy as well as space inefficient.

In India, while commercial vehicles make up only 10% of all vehicles, they account for 70% of the energy used on the road. Rapid charging technology can be a crucial solution to tap into the market's possibilities, enhancing operational flow and efficiency. This approach mitigates concerns over battery range, allows for extended daily travel with fast recharges, and lowers initial vehicle expenses by enabling the use of smaller batteries.

Rapid charging technology works by delivering high currents (up to 600 A) directly to the battery which can produce significant heat and can accelerate its wear and tear. To facilitate rapid charging and still ensure a battery lifespan of 3,000 cycles at a cost-effective rate, Exponent has innovated a closed-loop system that integrates the battery with the charger in a single flexible, programmable, energy stack. With the fastest balancing BMS in the world with 10x better voltage sensing accuracy, its advanced thermal management allows it to offer peak performance even at 50 degrees Celsius

FASTER, GREENER, AFFORDABLE: HOW EXPONENT CREATES A THRIVING EV NETWORK

Scalable Energy Stack:
The e^pack (battery), e^pump (station), and e^plug (connector) seamlessly integrate for a flexible, cell-agnostic solution. Compatibility across chemistries, voltages, and capacities caters to diverse needs.

Virtuous Cycle of Growth:
Rapid charging fosters increased station utilisation, driving down costs per charge and boosting profitability for all stakeholders. This catalytic effect paves the way for a sustainable EV ecosystem.

Lightweight Efficiency:
Eliminating the need for bulky batteries, Exponent's technology reduces vehicle weight, enhances load-carrying capacity, and improves operational efficiency.

Extended Battery Life:
On the back of a 3000+ cycle warranty, Exponent's batteries minimise the total cost of ownership for fleet operators, unlocking significant financial benefits.

with minimal battery degradation. Additionally, Exponent utilises an off-board, "water-based" HVAC system housed in the e^pump which transfers refrigerated water at 10 degrees Celsius through the connector to cool every cell in the battery pack, thereby allowing Exponent to undertake 15 minute rapid charging at any ambient temperature. These breakthroughs have been made possible on account of a thorough reevaluation of the status quo and modifications to several fundamental components of the prevailing energy management paradigm, resulting in core IP that serves as the foundation for Exponent's technical advances.

Progress: Exponent's solution offers an unmatched proposition for commercial vehicles, with rapid charging capabilities allowing operators to run two shifts a day with a single vehicle thereby doubling the utilisation levels and galvanising significant cost reductions. Exponent powered commercial vehicles enjoy a 30% TCO advantage over comparable EVs, and a near 60% advantage over ICE vehicles. Further, Exponent's product stack eliminates the need for large charging hubs for parking and slow charging multiple vehicles. Additionally, as indicated earlier, the 3000 cycle warranty on the battery pack also opens up a host of financing opportunities, with Exponent's partnership with Alt Mobility, for instance, paving the way for widespread EV adoption through highly amenable terms on tenure and interest rates.

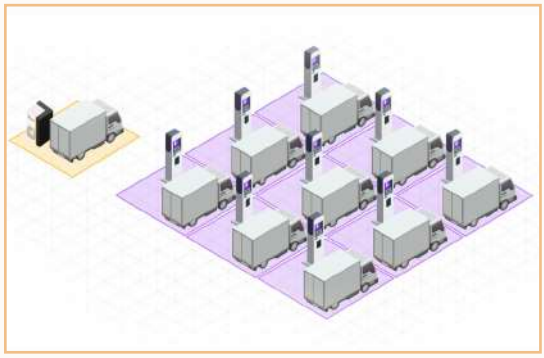
The world's fastest charging three-wheeler, Altigreen's neEV Tez, backed by Exponent's tech stack is delivering 30% more revenue on a daily basis compared to other EVs; 70% fuel cost savings against diesel; and 100% more flexibility to fulfil demand anywhere. The Exponent advantage for commercial vehicles is unambiguous and massive.

70% Charging cost reduction for Exponent powered EVs over diesel counterparts

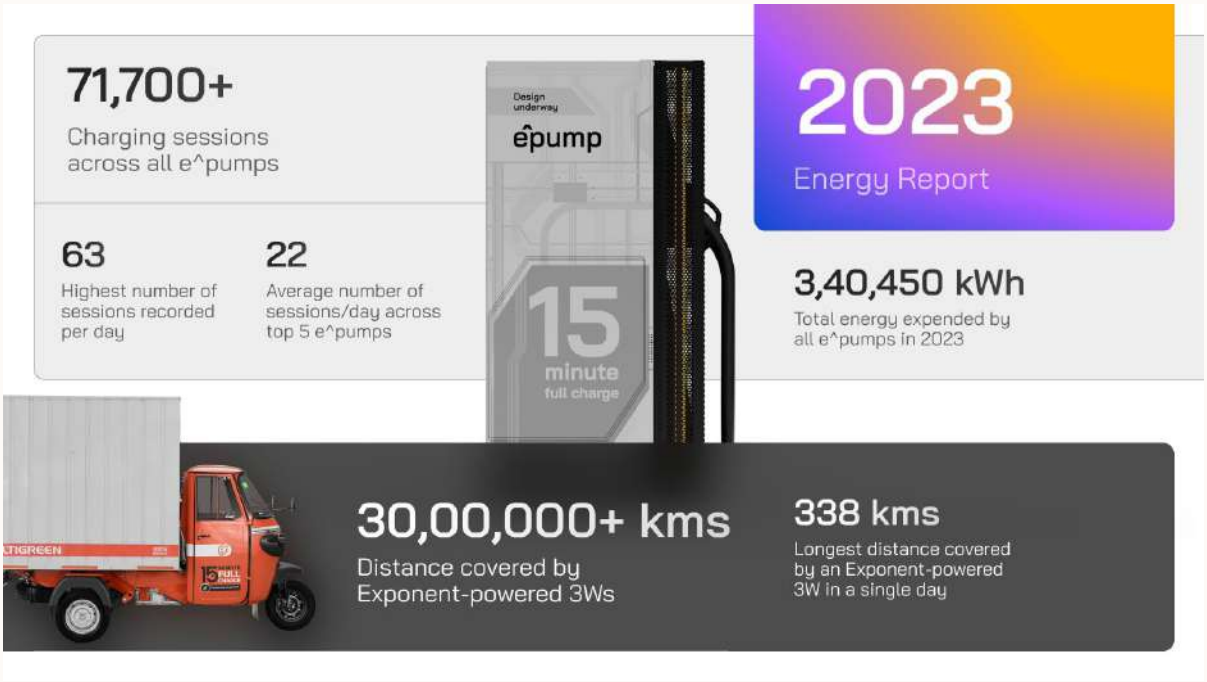
150+Km Average daily distance enabled for B2B fleets

30% Daily Revenue increase unlocked for fleet owners

30% TCO savings for fleet owners compared to traditional EVs



Exponent's proprietary energy stack affords industry leading cost metrics and energy throughput, with some of the highest daily utilisation levels in the world. It has helped initiate a virtuous cycle with faster charging leading to higher charging station utilisation, lower costs per unit of charging, and higher energy throughput. This translates to improved cost savings for end-users and improved margins for charge point operators.



In June 2023, Exponent deployed 30 e^pumps across Bengaluru, setting new records for charging station utilization. On average, there are over 22 charging sessions per day per charging station on their network. Furthermore, the record for distance covered over a single day by an Exponent-enabled EV is an impressive 338 kilometres.

Prominent Industry Partnerships: Exponent Energy entered into a partnership with Altigreen, an electric cargo vehicles manufacturer in August 2022 to create a fast charging LCV solution engineered for Indian conditions. In 2023, the partnership announced the launch of its first collaborative product– the three wheeler neEV Tez. The vehicle deploys Exponent's proprietary liquid-cooled battery built using a regular LFP architecture. The breakthrough achievement of delivering a 0-100% charge within 15 minutes marks an industry milestone. This feat is made possible by the innovative e^pump, which channels an unprecedented 600A of current to the e^pack, surpassing the industry standard by 15-fold. Crucially, the system adeptly manages the unique characteristics of individual cells, including thermals, ensuring safety, longevity, and consistent performance even under extreme conditions, such as temperatures reaching 50 degrees Celsius.The neEV Tez offers a vehicle warranty of 5 years/ 1,00,000 kilometres and a battery warranty of 5 years/1,56,000 kilometres, with an unprecedented guarantee of 3000 fast-charge cycles.

Altigreen launches the world's fastest-charging EV in partnership with Exponent

neEV Tez is the first product to emerge from Altigreen's partnership with Exponent Energy announced in August 2022 since they announced their partnership in August 2022.

"We're proud to launch the world's fastest charging 3-wheeler – The neEV Tez, in partnership with Altigreen. While the neEV series already has best-in-class volumetric load capacity and ground clearance, the neEV Tez with a 15- minute full charge and 3000 cycle life warranty is an unbeatable proposition. Beyond everything, mobility is about freedom and that's what neeV Tez stands for. Along with the e^pump network, customers will experience unmatched flexibility and freedom to do more, earn more and keep going

Arun Vinayak
(Co-founder and CEO, Exponent Energy)

Exponent has also partnered with Park+, a super app for car owners, to deploy 1,000 charging zones across India, starting with Bengaluru. The collaboration will assist Exponent in establishing a comprehensive e-pump network, utilizing the available real estate and public parking spaces accessible through Park+, thereby enhancing accessibility and coverage at a time when range anxiety is slowly giving way to charging anxiety. Exponent and Park+ are committed to solving this problem together.

Exponent Energy partners with Park+ to set up 1,000 15-minutes rapid charging stations across India

"We've already established the new norm for a seamless charging experience through our 15 minute full charge. The next step is to make finding an e^pump as easy as a petrol pump. With Park+ and its nationwide network of structured parking spaces, we aim to achieve just that, starting with Bengaluru. Rapid charging unlocks a much higher vehicle throughout on the same piece of land. More vehicles equals more energy, making the e^pump a far more profitable network."

Arun Vinayak
(Co-founder and CEO, Exponent Energy)

Exponent has partnered with:

OEM	FLEET PARTNERS	FINANCING
ALTIGREEN	fyn, magenta	alt. mobility

CPO's: BOLT, ZEON CHARGING, PARK+, charzer, ElectricFuel

Over 2023, we've supported Exponent's transition from research and development to the launch of more than 500 vehicles equipped with Exponent technology in a remarkably short period. Initially focusing on three-wheeler cargo vehicles in Bangalore and Delhi, Exponent has collaborated with top original equipment manufacturers (OEMs) such as Altigreen and Omega Seiki. Key achievements include vehicles that can cover over 300 km daily on a single charge and some charging stations hosting more than 40 charging sessions daily. Looking forward, there are plans to broaden their presence to additional cities and extend their offerings to include three-wheeler autos, buses, and four-wheeler light commercial vehicles (LCVs). This marks a significant milestone in the expansion of their network.

Exponent Energy will lead the category creation for fast charging infrastructure in India. By continually innovating across the components and processes relevant to the charging cycle, Exponent is primed to irreversibly tilt the TCO balance in favour of electric for light commercial vehicles, thereby drastically improving their prospects for mass adoption. Rapid uptake of electric commercial three wheelers can act as the driving force for India's pursuit of widespread mobility electrification. 3one4 Capital is excited to continue its partnership with Exponent Energy as it scales its impact across form factors and geographies.

NEGATIVE THESES IN SUSTAINABLE MOBILITY

Standalone Battery Swapping

3one4 Capital has a couple of negative theses in the sector. The first relates to standalone battery swapping for consumer or commercial use.

Batteries are expensive, bulky, and resource-intensive. Creating vast networks of swappable packs which must be stored, kept charged, and maintained is a drain on capital and resources, and also results in a larger carbon footprint. In the absence of data on route patterns or usage frequency, the swapping model relies on surplus batteries that are essentially waiting to be utilised by customers. Ultimately, customers would have to absorb these additional costs. Swapping also results in additional infrastructure challenges like rebalancing of batteries across swap stations. Lastly, packs are not designed to be swappable across OEMs or even vehicle models. In the absence of a common standard, every battery pack type would eventually require its own swapping network.

Battery swapping is appropriate in cases where fleet owners operate docked or dockless short-route, circuit-bound, EVs and the fleet owners/operators themselves oversee and undertake the swapping process, keeping the end customer offering free from the travails of the exercise. This would also require a closed-loop approach, where the technology and operating expertise is acutely focused on delivering low latency and high availability of swaps for the specific use case of the EV network. Yulu is a pertinent example of a company successfully utilising swapping in this manner. Alternatively, swapping may potentially also work in cases where E-3Ws freight fleets have exclusive, data-led servicing arrangements with swapping station operators. The swapping station could leverage real-time data on the vehicles' location and better predict their specific timings for a swap. Predictability with demand should allow them to avoid stocking up on more charged batteries than required. However, this is also an expensive overhead that is an active deterrent to commercial EV adoption.

As an overarching electric mobility mainstreaming strategy, innovations in cell chemistry, pack design, and fast charging are much more likely to deliver a reliable and superior charging experience to customers. Moreover, as fast charging becomes more easily accessible and the time taken to charge a vehicle falls further, there will be few, if any, remaining practical use-cases for swapping.

Linear Recycling Paradigms

Another one of our negative theses lies in non-adherence to the oft-cited, near linear model of dealing with battery degradation: deployment in EVs repurposing for stationary use recycling for retrieval of precious metals. A predefined, rigid path in the case of EV batteries is unhelpful. Batteries are typically considered unfit for use in EVs once they lose about 20-30% of their original energy capacity. That means they still have a lot to offer after their first life. Even with a lifetime range of about a hundred or two hundred thousand miles, batteries are already outlasting the cars they have been put into. With multiple OEMs working to introduce "million-mile batteries", batteries—including in the first life—will last substantially longer than they do today, expectedly with slower and less damaging degradation, higher number of charging cycles, and with a greater propensity for designs which are more malleable to the demands of repurposing and secondary usage.

A wide variety of parameters need to be taken into consideration when devising ways to deal with batteries through the entirety of their lifecycle. Repurposing used EV batteries for stationary energy-storage applications presents a massive economic opportunity albeit the underlying processes remain cumbersome, labour-intensive, and technically complex. Regulatory uncertainties and divergences in pack design and cell chemistry render building interchangeable, modular, or plug and play infrastructure difficult. Additionally, analysis from McKinsey has shown that, "as new batteries become cheaper, the cost differential between used and new diminishes, given that the rate of decline in remanufacturing cost is expected to lag the rate of decline in new manufacturing cost."[78] McKinsey estimates that the 30-70% cost advantage that second-life batteries are likely to enjoy till the middle of this decade could drop to around 25% by 2040. For the repurposing industry to remain competitive, the cost gap outlined above needs to remain "sufficiently large to warrant the performance limitations of second-life batteries relative to new alternatives."[79]

The industry faces further stress on account of the opportunity cost that comes with batteries containing valuable metals such as cobalt being used for stationary

storage rather than being recycled straight up to retrieve these metals for them to be redeployed in fresh batteries. Indeed, rapid growth of the EV industry could put pressure on the supply of a few battery relevant metals. Even as OEMs strive continually to create cathode chemistries that rely on more commonly available metals, the new chemistries—barring the exception of a few—are presently struggling to match established chemistries in energy density, resting self-discharge rates, or tested performance on safety and longevity. Add to this the long lab-to-market gestation journey and prevailing long-term procurement agreements for mined produce, and battery manufacturers' demand for critical metals should remain elevated for the foreseeable future. In such a scenario, a uniform, assembly-line approach is suboptimal.

In certain cases, in fact, it might be prudent from an economic or circularity standpoint to directly recycle batteries with chemistries comprising substantial amounts of metals such as cobalt or nickel. While the end-products of urban mining will strengthen the supply pool, the prevailing techniques and operations are currently not mature enough to attain scale or be cost-competitive with virgin mining. But the technology curves and unit economics will improve once the underlying base for recyclable batteries increases and appropriate regulations come into force.

On the other hand, chemistries such as LFP—which do not have noteworthy quantities of valuable metals—are almost always well positioned to be repurposed for stationary energy storage given, of course, that the battery's health, capacity, and self-discharge rates are satisfactory. Alternatively, as batteries last longer, automotive reuse could emerge as a viable use-case for partially degraded batteries. A "million-mile battery" which loses 20-30% of its original capacity after about 400,000 miles or so could, for instance, spend its first hundred thousand odd miles inside a demanding sports car, and then be transferred to an electric taxi for the next three hundred thousand miles.[80] Options for repurposing for stationary storage afterwards still remain on the table, but the shift from one automotive use-case to another means that the adjustments required to be made to the battery are possibly less demanding and the process more straightforward.

Looking Forward

In the medium to long term horizon, intense activity should follow in the peripheral or ancillary services domain. The ongoing wholesale move to EVs constitutes a near true paradigm shift in that not only is the new paradigm better, it invalidates many fundamental premises that animate the operational realities of the ICE age. As the number of EVs on the roads increase, India will need a skilled workforce to handle their manufacturing, servicing, repair, maintenance, and recycling. EVs typically have fewer moving parts than their ICE counterparts which means the maintenance and servicing burden per vehicle is much lower. Vehicle servicing stations may have to reorient their value chains and stack up on additional revenue streams. Similarly, with motors being attached directly to the wheels, there is no true neutral for EVs. Commonly used towing setups will correspondingly have to undergo changes. In the rare case of a fire, conventional fire extinguishers are of limited assistance. And so is water. While water can put out EV fires, the quantity needed could be 20-30x more than that required for dousing ICE fires.[81] From roadside assistance to tyres, as well to denting and painting workshops, EVs will herald an era marked by irreversible and wholesale transformation.

Green Hydrogen

Green hydrogen refers to hydrogen generated using renewable energy or low carbon power. It is substantially cleaner than the more commonly encountered grey hydrogen which is produced using natural gas or methane without any carbon capture (see Figure 19). The resource is currently in its nascent stages of development with relatively high infrastructural and technological costs, thereby occupying a minuscule share in the world's total hydrogen output. At present, less than 1% of the world's total hydrogen is produced with renewable energy.[82]

Despite the current prevalence of grey hydrogen, the share of green hydrogen is expected to increase drastically over time, and so is its contribution to meeting global energy demand (see Figure 20). It thus becomes imperative to identify and support promising application areas where green hydrogen can make a significant mark in global decarbonisation efforts.

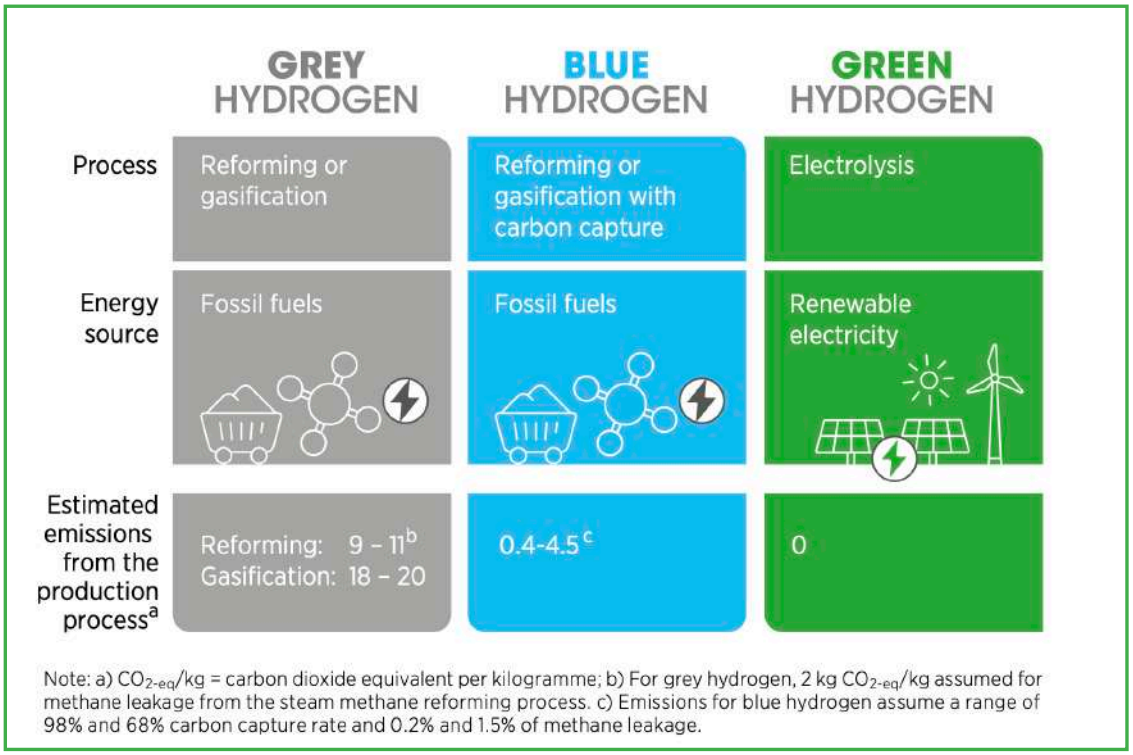


Fig 19: Different shades of Hydrogen. Sources: World Economic Forum[83], IRENA.

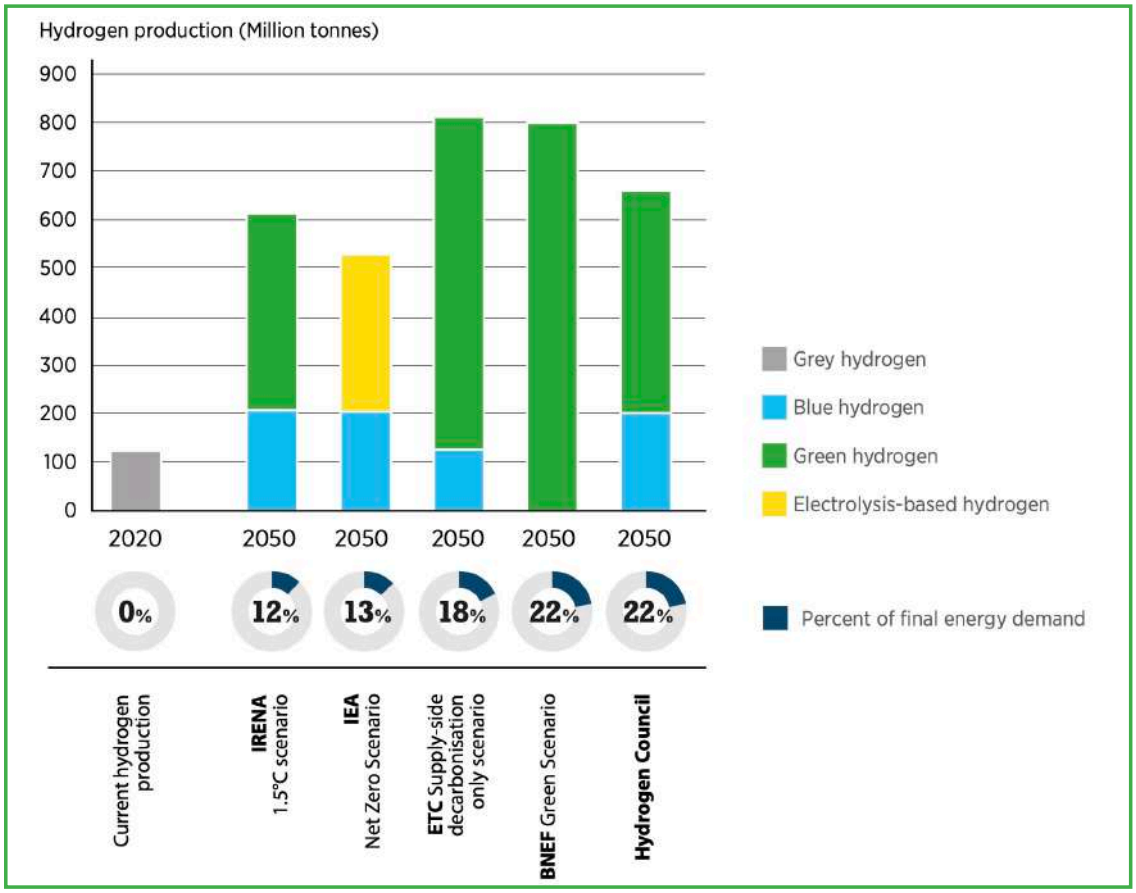


Fig 20: Global hydrogen production estimates and forecasts. Source: IRENA.[84]

Notwithstanding the popular mind share that hydrogen fuelled cars enjoy, hydrogen is particularly unsuitable for passenger cars. In addition to higher costs, their well to wheel efficiency is only about 25% as against a near 70% figure for battery electric vehicles (BEVs). Even if the costs were to come down, the high energy losses coupled with coterminous improvements in battery technologies will mean that hydrogen-based passenger cars will remain uncompetitive against their BEV counterparts for the foreseeable future (see Figure 21).

Where hydrogen, and especially green hydrogen, can be a gamechanger is in tackling certain "hard-to-abate" sectors by utilising certain obvious, "no regrets pathways". Notable examples include— decarbonising the production of steel, methanol, fertiliser, and ammonia; providing a means for long term energy storage; and greening hard to electrify transportation lines (see Figure 22).

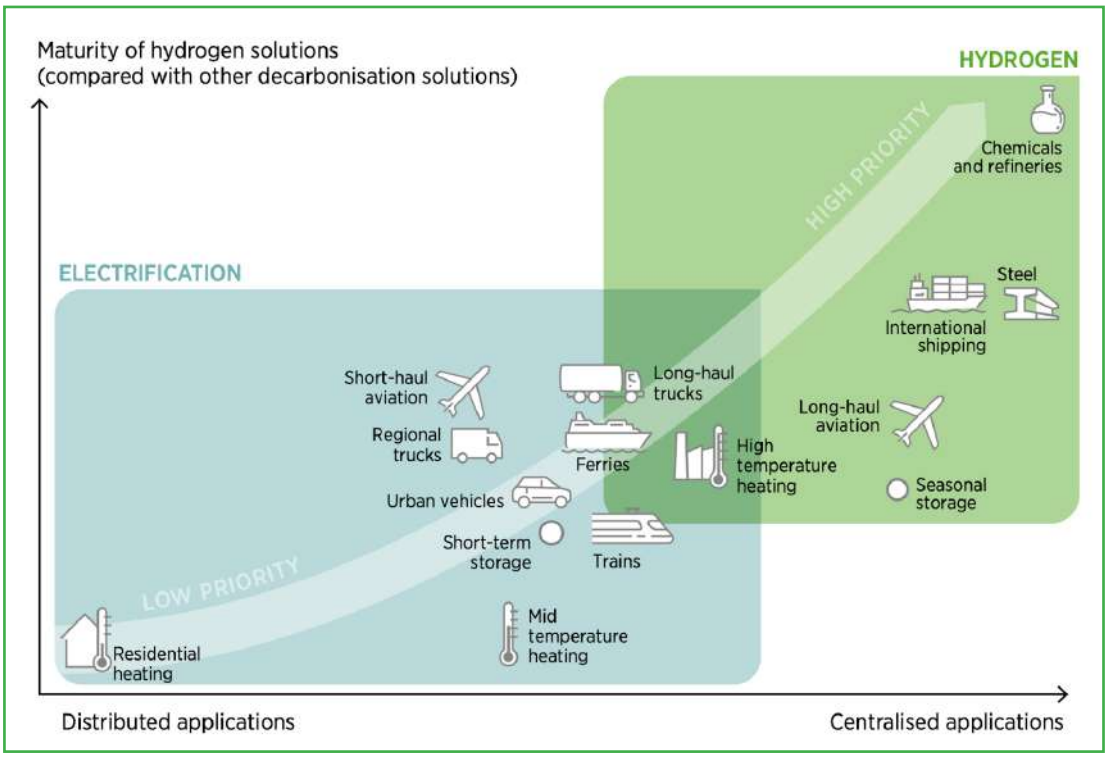


Fig 21: Electrification is more suitable for passenger vehicles. Source: IRENA[85]

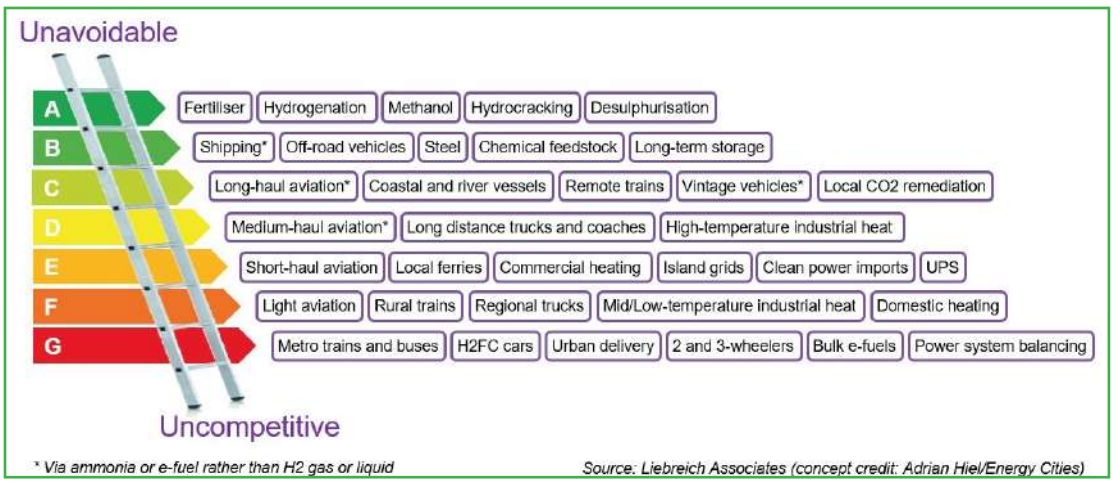


Fig 22: Ladder of suitability for hydrogen applications. Source: Liebreich Associates[86]

There has been a strong push by the Central Government to make India into a hub of green hydrogen production and a net exporter of the same, with the NITI Aayog forecasting a fourfold increase in the total hydrogen demand for India by 2050.[87] The National Green Hydrogen Mission has recently been approved with the same vision. With India producing some of the cheapest renewable energy in the world, an expected fall in electrolyser prices should position it well to achieve this goal (see Figure 23).

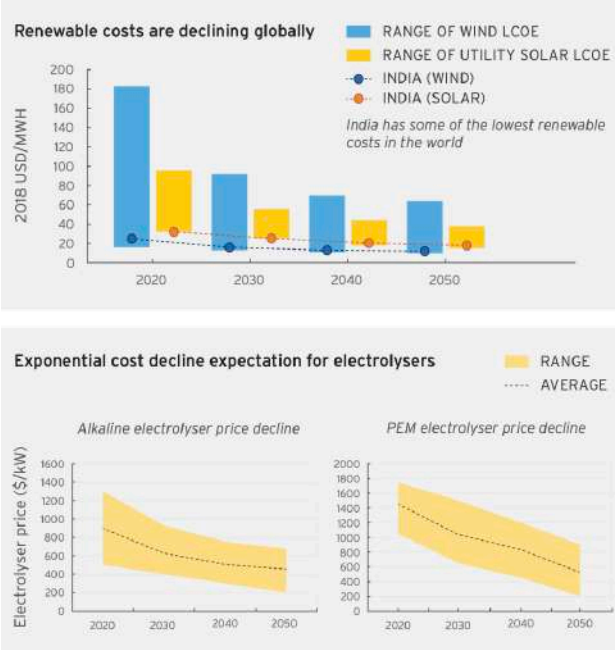


Fig 23: Predicted cost declines for renewable energy and electrolysers make for strong tailwinds for green hydrogen. Sources: RMI[88], NITI Aayog, IRENA, BNEF, IEA

According to an analysis by RMI, adoption of green hydrogen will result in 3.6 giga-tonnes of cumulative CO2 emissions reductions between 2020 and 2050.[89] Energy import savings within the same period could range from USD 246 billion to USD 358 billion in addition to stabilising input prices for India's industries.

Prominent energy players including Reliance, the Adani Group, NTPC, Indian Oil Corporation, among others have already outlined green hydrogen in their Net Zero or decarbonisation plans. The most feasible near-term use cases involve-

i) refining, wherein predominantly grey hydrogen can be replaced by green hydrogen in the desulfurization of crude oil;
ii) fertiliser production with a focus on substituting imported ammonia with domestically produced alternatives;
iii) retrofitting ships to run on hydrogen-based fuel.

Despite steel being an industrial mainstay for India, its shift to green hydrogen is slated to occur over a longer period. The major imperatives for such large scale projects with respect to deployment led innovation include: securing and streamlining the feedstock—in the case of electrolysers for generating green hydrogen this takes the form of grid integrated or off-grid renewable energy; fleshing out offtake arrangements for the generated fuel; and sourcing and maintaining professionals and tools to handle operations at the facility. There are a number of avenues for startups to play a role as well. Prominent opportunity streams have been covered in different sections below.

Electrolyser design for producing low-cost hydrogen

A number of companies are experimenting with a range of different electrolyser technologies. While the most common ones are Proton Exchange Membrane (PEM) electrolysers and alkaline electrolysis cells, solid oxide electrolysis and anion exchange membrane (AEM) based electrolysers are also steadily gaining ground. At present, alkaline electrolysers account for about 60% of the installed capacity, and PEM makes up for another 30%.

Electrolyser Type	Deployment Status	Technology Readiness Levels (TRL)	Approximate Efficiency Ranges	Stack Lifetime (in thousand hours)	Approximate Investment Costs (USD/kW)	Major Development and Deployment Considerations
Alkaline	Mature	TRL 9	55%-78%	60-100	500-1400	Advantages– low-cost electrolyte; simple system design; proven longevity; low-cost production. Disadvantages– lower H2 purity; limited dynamic response; high minimal load; prone to corrosion.
Proton Exchange Membrane (PEM)	Commercial, fast growth	TRL 8-9	60%-83%	30-90	700-2100	Advantages– high H2 purity; compact design; fast dynamic response; high efficiency at partial loads; low maintenance. Disadvantages– high costs of membrane and catalysts; catalyst used is susceptible to carbon monoxide poisoning
Solid Oxide Electrolysis Cell (SOEC)	Demonstration Plants	TRL 5-7	55%-84%	20-60	> 2000	Advantages– extremely high efficiency; low minimal load; well suited for constant base load hydrogen production; inexpensive catalysts. Disadvantages– high operating temperatures (800-1000°C); complex system design; low durability (brittle ceramics); low production capacity at present.
Anion Exchange Membrane (AEM)	Limited deployment	TRL 3-5	57%-74%	< 30	N.A..	Advantages– low-cost catalysts and membrane; non-precious metal catalysts; high H2 purity; lower chances of electrolyte leakage. Disadvantages– High minimal load; uncertainty on overall durability and technological maturity; decreasing ionic conductivity of the membrane over time; extreme sensitivity to carbon dioxide intrusion.

Table 4: Overview of common electrolyser types. Sources: IRENA[90], Oxford Institute for Energy Studies[91], IEA[92], WRI[93], multiple industry sources, 3one4 Capital analysis.

The primary fulcrum for innovation in this space relates to reducing capital costs and critical minerals intensity while improving systems efficiency and overall durability. Like most long gestational, physical infrastructure based technological pursuits, however, the upfront capital requirements are often demanding, R&D imperatives onerous, and returns long drawn. Further, materials intensity remains high, especially for PEM which needs rare-earth metals in addition to gold and platinum. Testing and validating the technology and securing investor and institutional buy-in are additional obstacles.

Having said that, electrolysers are going through an exponential learning curve similar to those experienced by solar PV and lithium-ion batteries (see Figures 24 and 25). According to the IEA, global electrolyser manufacturing capacity increased by more than 25% in 2022 over the previous year.[94] The realisation of all projects in the pipeline could "lead to an installed electrolyser capacity of 170-365 GW by 2030."

Costs should come down drastically in the coming years. Moreover, capital requirements should not necessarily forestall enthusiasm in the sub-sector with tech licensing opportunities posing as viable revenue generation options with demand expected to stay high for the foreseeable future; India could catalyse electrolyser demand of over 20 GW till 2030, with expectations of a further swell to 226 GW by 2050, and an internal market worth a substantial USD 31 billion.[95] M&A and technology collaboration/transfer activity in this space has also been promising. In late 2021, for instance, Reliance's new energy arm signed a deal with Danish firm Stiesdal to mass produce the company's ultra-low-cost electrolyser in India.[96]

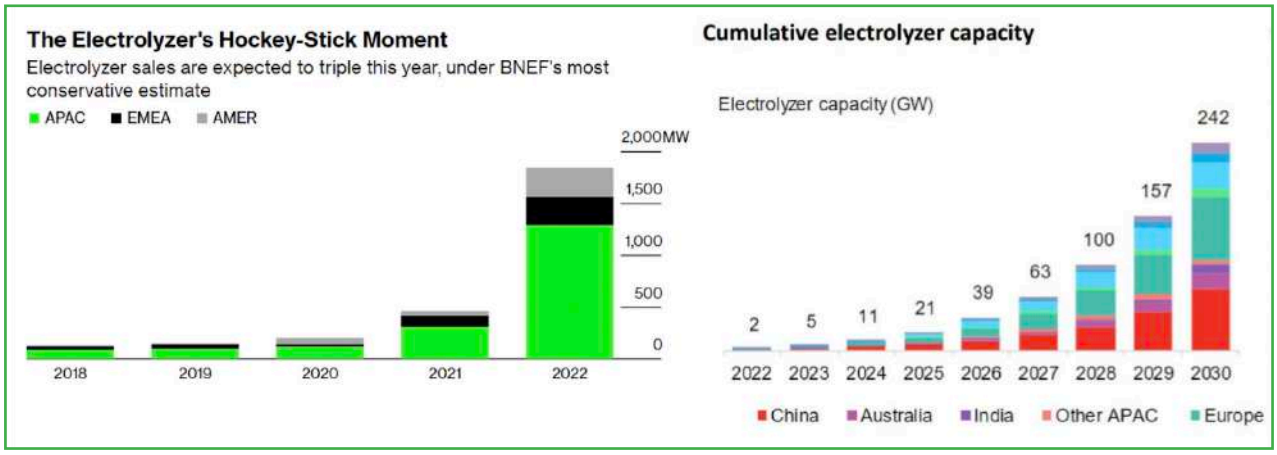


Fig 24: Global Electrolyser sales estimates and projections. Source: BloombergNEF[97]

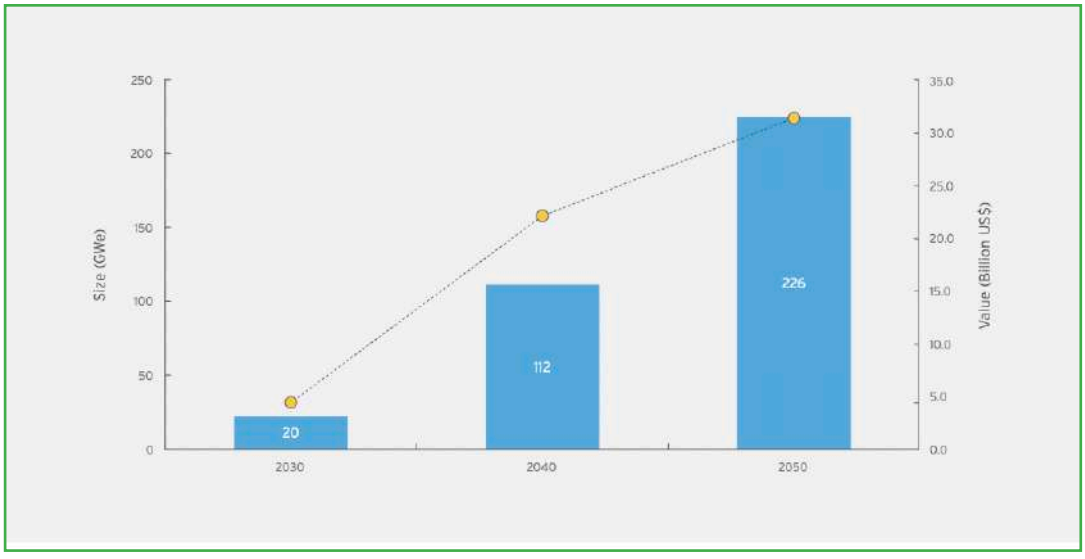


Fig 25: Potential electrolyser market in India. Sources: RMI[98], NITI Aayog

Globally, there has been a spate of activity in this domain with startups continually pushing the boundaries for improved cost and efficiency outcomes. Sunfire's SOEC electrolyser achieved 84% efficiency at a steel plant for Salzgitter AG in April last year.[99] Around the same time, Australian startup Hysata's alkaline 'capillary-fed electrolysis cell' recorded 95% cell energy efficiency in producing green hydrogen from water.[100] While quoted efficiency figures are not always directly comparable across technologies, the past few years have seen new electrolyser designs attain extraordinarily high efficiencies across the board.

Startups are also working to reduce, and even eliminate, the use of precious or rare-earth metals. New Zealand's bskpl is working to commercialise catalyst coated membrane (CCM) production at scale, furnishing a 25x lower catalyst metal load compared to traditional PEM designs.[101] In the UK, Clean Power Hydrogen has developed a membrane-free electrolyser which does not use any platinum group metals (PGM).[102]

Closer to home in India, Newtrace is building modular and scalable electrolyser systems with 3x lower capex costs, and zero usage of rare-earth metals.[103] Its technology allows for the use of an abundant-earth metal based electrocatalyst and relatively less expensive auxiliary components. Yet another interesting company in this space is Ossus Biorenewables.[104] They have built a bioreactor for on-demand, on-site hydrogen generation. The startup's retrofittable hardware device uses select electroactive microbial communities to target carbon-rich, industrial effluent streams for biohydrogen production. This can drastically reduce the electricity input needed— from an average of 50-55 kWh for every kilogram of hydrogen produced by traditional electrolysers to less than 2 kWh/kg.[105] It can additionally lower costs by eliminating the need for iridium or platinum as catalysts as well as that for ultra-high purity water. Where hydrogen, and especially green hydrogen, can be a gamechanger is in tackling certain "hard-to-abate" sectors by utilising certain obvious, "no regrets pathways". Notable examples include— decarbonising the production of steel, methanol, fertiliser, and ammonia; providing a means for long term energy storage; and greening hard to electrify transportation lines (see Figure).

Fuel Cells and Applied Forward Linkages

Fuel cell development has been a mainstay for hydrogen-based startups for quite some time now. Functionally, they run counter to electrolysers in that instead of splitting water into hydrogen and oxygen using electricity as is the case with electrolysers, fuel cells house an electrochemical reactor that uses natural gas or hydrogen as the primary source to produce electricity.

While fuel cell electric vehicles (FCEVs) have garnered the most amount of attention, non-automotive use-cases are in all likelihood more promising. These include stationary power generation to power buildings, homes, and other stationary applications; backup power applications for hospitals, data centres, and other critical infrastructure; aviation and urban air mobility; and most importantly, industrial material handling and remote power applications. Fuel cells have extraordinary potential in powering forklifts, pallet jacks, and other material handling equipment at factories and warehouses, especially in areas where grid power may not be the most reliable. In such areas, they could additionally be used to power remote equipment such as those for telecommunication.

Fuel cells can also play a big role in catalysing green hydrogen powered micro-grids. A lot many companies, including several in India, are innovating with regard to the underlying stack technologies, in an attempt to bring down their costs. Proton exchange membrane (PEM) fuel cells are the most commonly used on account of their compact design, relatively lower costs, flexibility in input fuel, lower operating temperature requirements, and fast startup.[106] Unlike PEM electrolysers where material costs constitute the preponderant drain, PEM fuel cell costs are dominated by manufacturing costs, and the cost share of materials is much lower.[107] This implies that fuel cell manufacturing is more amenable to economies of scale (see Figure 26). Indeed, investments in advanced manufacturing machinery and aggregated procurement can enable manufacturing scale and bring down fuel cell costs drastically— by as much as 45% when increasing output from 10,000 to 200,000 systems according to an estimate.[108]

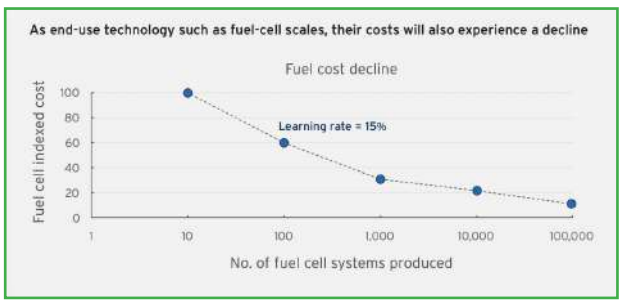


Fig 26: Projected Fuel Cell Cost Decline. Source: RMI[109], NITI Aayog, IEA, US Department of Energy.

There are also a bunch of applied forward linkages that usually present themselves as opportunities at the post-production stage— at the intersection of industrial and technological applications which need to be primed to operate in a hydrogen dominated economy. Retrofitting long distance trucks and off-road vehicles, creating new electrochemical processes and catalytic pathways for refining iron or manufacturing steel, and constructing hydrogen-powered irrigation or refrigeration systems are just some avenue streams which have seen intense startup activity across the world in recent years.

Hydrogen Storage Applications

One of the most exciting use-cases for hydrogen is long-term energy storage, especially when combined with intermittent solar or wind. And while batteries are getting better and cheaper by the day, they cannot be entrusted to store energy to cover for an entire season, say winter, when the intensity of sunlight incident on panels is less than ideal. If an electrolyser and a hydrogen gas storage site were to be positioned close to a solar plant, surplus solar energy could be used to make hydrogen, gradually building a resilient reserve, and solving the "last mile" of decarbonisation.

Together with hourly storage from batteries, hydrogen could help intermittent solar—or wind, as the case may be— functionally replace fossil fuel plants.[110] But storing hydrogen comes with issues of its own. Though hydrogen has high energy per unit of mass, its volumetric energy density is low. Developing cost-effective storage technologies with improved energy density is thus a key challenge. Most solutions revolve around high-pressure compressed storage or materials-based storage technologies. The former often innovate along the axis of secure containment systems, storing hydrogen in gaseous form. Maintaining hydrogen at high pressure, however, is infrastructurally demanding and largely unfeasible for renewable energy farms thereby necessitating storage either in the form of cryo-cooled liquid or by utilising materials which react with hydrogen to enable its storage at ambient pressure. Chemical storage in the form of ammonia and methanol is gaining traction even though energy conversion costs remain high and efficiency losses can be severe. Of late, solid-state nanocomposites have also emerged as viable solutions for high capacity, low cost, space efficient, and low-pressure hydrogen storage. While startups will undoubtedly find it hard to undertake large-scale deployment on account of the steep costs and stakeholder coordination imperatives involved, designing technologies to safely store and transport hydrogen, and creating software backed hydrogen storage and transport management systems will nevertheless remain attractive opportunity spaces in the medium to long term.

Looking Forward

To conclude, green hydrogen currently requires substantial new infrastructure to scale and considerable amounts of investments into the distribution value chain. Global VC interest has up until now been concentrated on the production side. "Compression, storage, dispensers, meters and contaminant detection and purification technologies", should gradually come to command a greater share of the available capital pool for hydrogen.[111]

As discussed in the preceding sections, several promising use-cases and opportunity streams exist for hydrogen enabled interventions in select domains. Innovation in the coming years should coalesce around making green hydrogen production—

i) less expensive: electrolysis is presently nearly four times more costly than steam reforming;
ii) less energy intensive: green hydrogen currently requires about 50-55 kWh of electricity to produce one kilogram of hydrogen; and
iii) more efficient: producing green hydrogen entails significant energy losses at each stage of the value chain. According to an IRENA report, "about 30-35% of the energy used to produce hydrogen through electrolysis is lost.[112] In addition, the conversion of hydrogen to other carriers (such as ammonia) can result in 13-25% energy loss, and transporting hydrogen requires additional energy inputs, which are typically equivalent to 10-12% of the energy of the hydrogen itself."
Production techniques must substantively move the needle on the abovementioned fronts for green hydrogen to expand its set of use-cases beyond a few specialised areas. The good news is that innovation and advancements in technology are happening at an astonishing pace. With each passing day, companies, including early stage startups, are finding new ways to streamline the hydrogen production process, harness renewable energy sources more efficiently, and develop safer and cost-effective transportation and storage solutions. These are exciting times for the green hydrogen industry, and the path ahead is filled with immense potential.

Promoting Smaller Footprints and Closing the Loop

In the pursuit of a more sustainable future, the imperative to minimize environmental footprints has become increasingly paramount across industries. This section of the report delves into innovative strategies aimed at promoting smaller footprints, with a particular focus on two key areas: sustainable cement and agritech. Cement production stands as a significant contributor to carbon emissions, while agriculture faces challenges related to land use, water consumption, and chemical inputs. However, through groundbreaking advancements in technology and practices, both sectors offer promising avenues for reducing their environmental impact. By exploring the latest developments in sustainable cement production and agritech solutions, this section seeks to illuminate the path towards more eco-friendly and resilient practices, essential for fostering a greener and more sustainable future.

SUSTAINABLE CEMENT

Cement—along with its derivatives like concrete—constitutes the literal adhesive that holds much of our built environment together. Globally, almost half a ton of cement is consumed per person per year, with cement production alone accounting for 3% of the total energy consumption and 8% of anthropogenic CO2 emissions.[113] [114]

With specific reference to India, the country's per capita energy use and emissions numbers for cement output are currently less than half of the global average despite it being the second largest cement manufacturer in the world.[115] Having said that, India's building stock is projected to double by 2040, necessitating a surge in both the use of construction materials, most notably cement, as well as their accompanying emissions. Resultantly, India is expected to see one of the largest increases in cement manufacturing output till 2050, growing by a staggering 2.6x from 2019 levels (See Figure 27). Decarbonising the cement industry is thus a first-principles driven imperative towards achieving Net Zero for the built environment.
Several Indian cement companies have announced operational mandates to reduce carbon emissions from their production activities. Dalmia Cements has committed to becoming carbon negative by 2040 by engaging carbon capture, utilisation and storage (CCUS) while ACC has pledged to reduce its Scope 1 GHG emissions per tonne of cementitious material by 21.3% till 2030 with respect to 2018 as base year. [117] [118]

Over the years, Indian manufacturers have undertaken

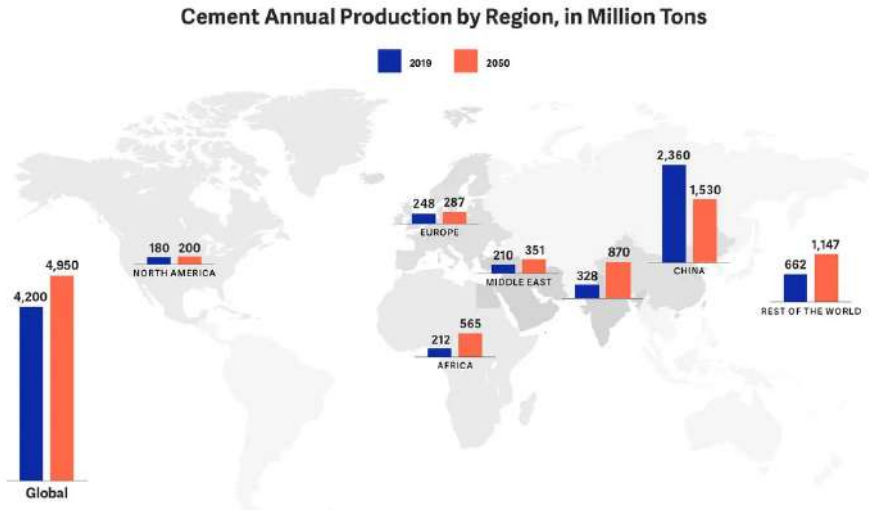


Fig 27: Cement Annual Production by region (2019 vs 2050)
Source: Energy Transitions Commission, IEA, Statista, Third Derivative[116]

a range of voluntary steps to stay significantly ahead of the curve. India's cement facilities are already among the most energy and emissions efficient in the world, having reduced average CO2 emissions by 36% between 1996 and 2017.[119] A lot more, of course, needs to be done, especially since the rate of decoupling production volumes with emissions increase in the cement sector has been relatively tardy. The RBI estimates an investment requirement of USD 29-50 billion to decrease the prevailing carbon intensity of cement production by half till 2050.[120]

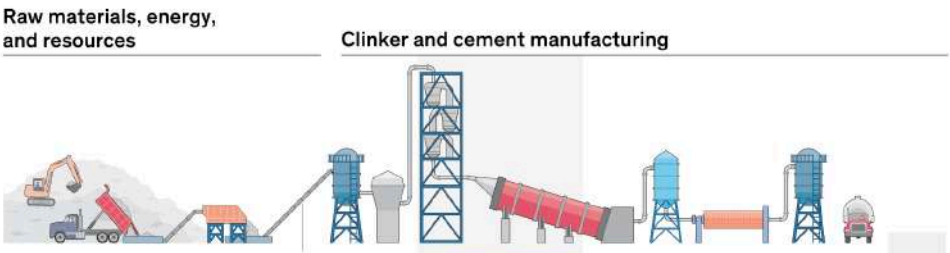
To better understand the decarbonisation imperatives in the sector, it is useful to delineate the two major sources of emissions production: the energy use powering the heat production for the kilns, and the chemical processes responsible for the conversion of limestone into calcium oxide. The primary environmental gravamen with cement's manufacturing process relates to the latter, and, more specifically, to calcination: the thermo-chemical process through which limestone is mixed with certain other raw materials, ground to a fine powder, and heated to 1400-1500 degree celsius in a kiln to form lumpy nodules called "clinker". Clinker calcination produces about 60% of all emissions released during cement production and substituting or greening the process has proved to be incredibly difficult.[121] While processes relating to heating, crushing, storage, and transportation lend themselves to greater integration with greener pathways, such as by the use of renewable energy or electric freight transport, altering the underlying chemical basis is much less straightforward.[122]

Despite the challenges, however, serious technological attempts are being made to decarbonise the industry. According to the Third Derivative, scalability and acceptability are the two major axes on which the successful adoption of an intervention will eventually depend.[124] At present, three broad pathways exist—

Carbon Capture, Utilisation and Storage (CCUS)

Carbon capture has gained prominence for its potential to significantly address process based emissions for a host of manufacturing and energy production industries. As the name suggests, CCUS includes a suite of technologies which capture carbon emissions at source—often exhausts of manufacturing plants—with the intention of either reusing them in the production of various chemicals or fuels, or storing them deep underground to prevent their entry into the atmosphere. Arguably, CCUS offers the most promising long-term bet to reach Net-zero or near Net-Zero emissions for the cement sector. It can address both the emissions emanating from heat generation as well as those from chemical processes without having to make any drastic changes to the prevailing processes and equipment stock. Carbon capture could, therefore, be used "either as a single decarbonization route for all emissions from cement plants, or for process emissions only combined with a switch in fuel to mitigate emissions from heat production."[125] Indeed, studies have shown that carbon capture combined with a low-cost, high biogenic fraction alternative fuel such as one derived from municipal solid waste can secure the largest reductions in CO2 emissions.[126]

Cement manufacturing is a highly complex process.



	Quarry	Crusher	Transport[1]	Raw mill	Kiln and preheater/ precalcinator[2]		Cooler[3]	Cement mill	Logis-tics[4]	Total
Energy, mega-joule/ton	40	5	40	100	3,150		160	285	115	3,895
CO_2, kilogram/ton	3	1	7	17	479 Calcination process	319 Fossil fuels	28	49	22	925

[1]Assumed with 1kWh/t/100m.
[2]Assumed global average, data from the Global Cement and Concrete Association, Getting the Numbers Right 2017.
[3]Assumed reciprocating grate cooler with 5kWh/t clinker.
[4]Assumed lorry transportation for average 200km.

Fig 28: Cement manufacturing value chain with associated energy usage and emissions numbers.
Source: McKinsey&Company[123]

There are, however, a clutch of issues that currently plague the deployment potential of CCUS in cement production. Firstly, costs associated with carbon capture are higher for cement when compared to other hard-to-abate sectors such as ammonia or steel. Carbon capture costs are inversely related to the concentration of CO2 in exhaust streams. Exhaust emissions from cement production usually contain just 20% carbon dioxide by volume, more than what is produced in thermal power plants (~12%), but significantly lower than, say, process emissions resulting from ammonia production wherein steam methane reforming emits a relatively pure and concentrated stream of CO2 which is better suited for carbon capture.[127] [128] [129] Elevated costs also stem from the relatively steep capital expenditure incurred to deploy viable capture mechanisms which, in turn, inevitably results in higher final costs for the end consumer. Secondly, transporting and storing the captured carbon in cement's case is both more cumbersome and expensive than in other sectors. Unlike steel or petrochemical industries which depend on heavy clustering, cement facilities are usually a lot more dispersed since transporting a "heavy low-value product" beyond a certain distance threshold is both costly and logistically complex.[130] This also partly explains the unusually high degree of market fragmentation in cement's case with different states and regions in India being dominated by different players. And, lastly, the storage of captured carbon is an uphill task with the need for necessary geological formations which are neither common nor evenly distributed across geographic landscapes.[131]

Learning curves and the development of technologies that help produce a purer, more concentrated exhaust stream of CO2 should allow for costs to fall over time.[132] Fortunately, the utilisation potential for captured CO2 and its byproducts is incredibly high in the built environment space. Captured carbon can be absorbed into concrete or into aggregates, most notably during the curing process—a set of techniques that helps maintain satisfactory temperature and moisture conditions to aid cement hydration for the orderly development of desired concrete properties—wherein carbonated concrete has been shown to demonstrate "rapid early strength gains, reduced curing times, overall greater strength, and improved freeze/thaw durability."[133] [134] [135] Unfortunately, the process currently requires the use of specialised curing chambers which ramps up the costs and severely limits widespread application.

CCUS is thus a promising long-term bet, but its underlying cost structures and current technological unsuitability for cement exhaust streams effectively render it unfeasible for immediate large-scale deployment.

Low Carbon Cement

Low carbon cement remains the venerable holy grail for innovations in the cement space by directly targeting process emissions related to clinker calcination. According to Third Derivative, these innovations generally try to achieve one of the following[136]— i) reduce the amount of clinker used; ii) readjust the clinker making process by decreasing the amount of limestone in the feedstock or modifying the calcination process; or iii) reformulate the underlying chemistry through the development of novel binders and use of low-carbon processes. Table 1 gives an overview of the different categories and Figure 29 looks at the emission reduction potential of certain low-carbon cement chemistries.

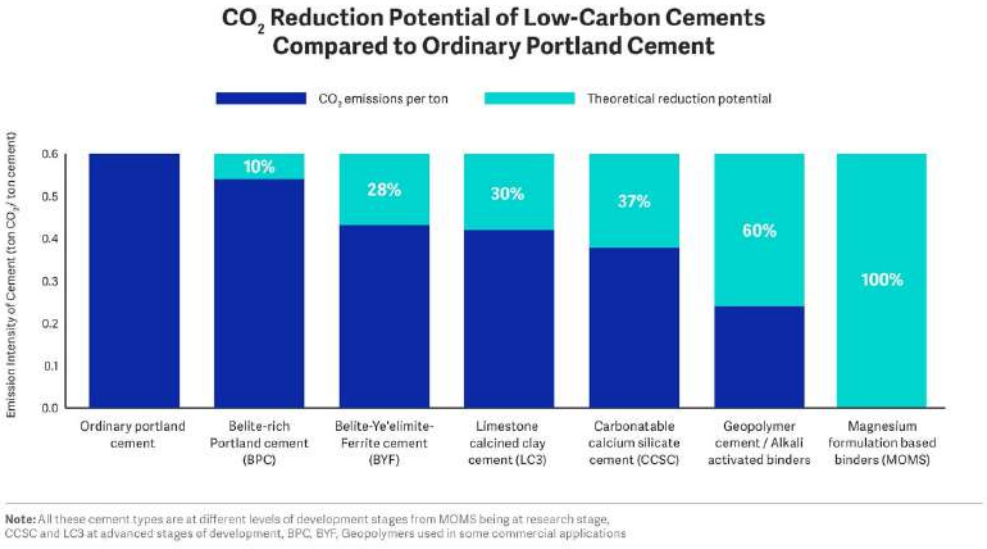


Fig 29: CO2 reduction potential of various low-carbon cements
Source: Third Derivative[137]

Intervention type	Advantages	Challenges	Opportunity space for new entrants	Acceptability and scalability potential
Reducing the amount of clinker used in cement by substituting a portion of it with supplementary cementitious materials (SCMs) which are materials such as fly ash, granulated blast furnace slag (GBFS), or clay that can chemically react with clinker.	• No changes required to the cement equipment or manufacturing processes. • Policy and regulatory tailwinds are aligning for SCMs.	• Reducing the clinker to cement ratio below 60% by 2050 in line with IEA's roadmap will be hard since common SCMs like fly ash from coal plants and GBFS from iron and steel plants will get harder to procure over time as decarbonisation efforts intensify.	Development of new SCMs, including engineered SCMs, with a view to lower costs.	The maturity and familiarity of the approach makes it highly acceptable to the producers. The relative abundance of SCMs and fillers makes it scalable as well.
Readjusting the clinker making process by reducing the amount of limestone in the feedstocks or modifying the calcination process. The latter entails shifting away from traditional heating-based calcination methods and employing alternative processes such as those reliant on hydrothermal or electrochemical calcination.	• Limestone reduction in feedstocks is usually compatible with existing kilns and does not require significant changes to current processes or equipment. • The resulting product exhibits properties similar to ordinary portland cement (OPC). • Modifications to the calcination process result in clinkers which can "increase the rate of strength development of cement and emit a concentrated CO2 stream in the exhaust, making the carbon capture process more economically viable."[138]	• Materials capable of partly replacing limestone are usually low in supply or used extensively in competing industries which can adversely impact costs. • Efforts to modify the calcination process are at early stages of R&D and involve complex manufacturing processes.	Startups can innovate to design cost-effective, energy-efficient calcination processes that avoids high temperatures and produces fewer emissions.	Acceptability need not be a big concern since the industry is familiar with several approaches under this lever which are also compatible with existing equipment and processes. The readjustment based approach offers a robust short to medium term solution until CCUS becomes mainstream.
Reformulating the underlying cement chemistries to remove clinker from the production process in its entirety. This can be done by developing new binders, for instance, by using materials innovation. Examples under this approach include alkali-activated binders, geopolymers, and magnesium-based cements.	• Alternative binding materials or non-clinker-based cements can significantly reduce emissions from the cement making process, and over the long run, even deliver carbon-negative cement.	• Scepticism regarding the use of alternative binders. • Limited data on energy use and costs of the manufacturing process. • There are concerns about the consistent availability of high-quality raw materials. Alkali activators, for instance, which are mixed with fly ash and slag to create alkali-activated binders and geopolymers are currently not available in sufficient quantities for global cement production. • For magnesium based cements, the process to develop magnesium oxide-based clinker using magnesium silicate rocks is yet to be demonstrated at scale.	Large opportunity for startups to develop novel materials and/or demonstrate low-energy production processes to produce new binders cost-effectively.	This approach has immense potential, especially when it comes to delivering carbon-negative cement and offering long-term decarbonisation options for the sector. Scalability and acceptability will inevitably depend on the nature and quantum of investments made to research programs and pioneering startups which help develop exciting new products.

Table 5: An overview of the three major approaches to producing low-carbon cement.
Source: Third Derivative[139], 3one4 Capital analysis

California-based startup, Brimstone, is an interesting company in this space.[140] The startup has pioneered the development of conventional portland cement using a proprietary carbon-negative production process that uses carbon-free calcium silicate rocks instead of limestone.

Downstream Applications

This category looks at interventions which seek to lower or eliminate emissions emanating from cement production from the value chain post clinker calcination. Process

emissions, as mentioned earlier, are dominated by the clinker making process, yet incremental improvements in other aspects can still deliver sizeable decarbonisation gains. Efficient packing of aggregates and cement into concrete, for instance, can reduce cement use and consequently the accompanying emissions. Similarly, the use of "chemical admixtures — a class of materials that can improve concrete's performance when used in small amounts — combined with adoption of artificial intelligence and digital tools in cement and concrete production allows producers to optimise cement use by improving the consistency of cement and concrete and predicting the performance of the final product, all while reducing emissions."[141]

Further downstream, second-life applications can be probed for unhydrated cement at the end of life of the structure it once helped buttress. Concrete is usually made by mixing cement with water, gravel, and sand. A portion of the cement, however, remains unhydrated and can potentially be re-used to make concrete or even as a substitute for limestone in a kiln. For both these use-cases, however, considerations regarding cost and retrieval efficiency will remain paramount.

Challenges for Early Stage Startups

Notwithstanding the array of opportunities, the cement industry's operational characteristics offer some rather peculiar challenges to early stage companies looking to build in the space. Foremost among these hurdles is the necessity to develop a cement variant that not only matches the cost efficiency of OPC but also satisfies the stringent performance demands of the construction industry.[142] Yet, the industry exhibits considerable resistance towards solutions that mandate the redesign of existing production facilities, primarily due to the capital-intensive nature of this sector.

Moreover, cement, despite its massive consumption, remains a low-value product, requiring raw inputs that are not only inexpensive but also reliable and abundant. Introducing new manufacturing processes could potentially escalate material and energy costs or necessitate further investments in storage capacity and material processing, thereby straining already narrow profit margins.[143] The challenge further compounds as the cement market is highly commoditized and price-sensitive, making it difficult to transfer these increased costs to end-users.

On the demand side, consumer resistance, stemming from a lack of awareness or scepticism regarding new cement variants, stands as a significant barrier. This resistance is exacerbated by the industry's fragmented supply chain, hampering the streamlined adoption of innovative products across construction markets. Additionally, stringent testing standards further complicate market entry, necessitating rigorous compliance to secure acceptance of novel cement formulations.[144]

The biggest challenge, however, as mentioned earlier, is the fact that a preponderant share of cement's climate impact comes "not from energy use, but as process emissions, a byproduct of a fundamental chemical reaction which is difficult to reformulate."[145]

Conclusion: Key Takeaways

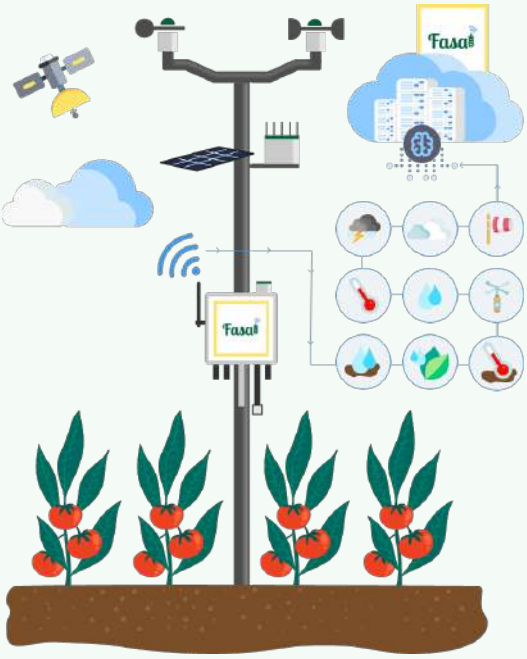
Global cement production emits as much CO2 as India. There are thus few industries, if any, with comparatively higher ceilings for large outcomes, both in terms of their decarbonisation potential and the prospects of investor returns. With regard to the latter, a few basic heuristics can be laid down. Startups which can devise solutions that leverage existing infrastructure and value chains are likely to find it easier to scale in light of the challenges discussed above, namely, the "industry's maturity, high costs of entry, and low margins."[146]

Given the need for abundant and cheap raw materials, those that can establish less energy and resource intensive end-product pathways utilising prevalent supply chains, easy to source base compounds, and established production ecosystems are more likely to protect their margins and necessitate buy-in from incumbent stakeholders.[147] Partnerships and demand offtake agreements with large cement producers can help in this regard. Despite the relatively capex-heavy nature of the exercise, the cost curves for the production of novel low-carbon cement formulations should follow Wright's law—falling at a consistent rate as a function of cumulative production.[148]

Understanding the intricate balance between cost differentials and market incentives is pivotal, alongside validating technical equivalency and, if applicable, patent defence strategies.[149] Ultimately, successful investments in this sector hinge on teams adept at amalgamating technological prowess with an astute comprehension of the cement industry's nuances, paving the way for impactful innovations and a sustainable future.

Case Study: Fasal

Fasal:
A full-stack, precision agriculture platform catalysing farm-level actionable intelligence on irrigation, fertigation, disease and pest control, soil parameters, microclimatic forecasts, and agricultural expense management among others to help farmers practise predictable, profitable, and sustainable cultivation.



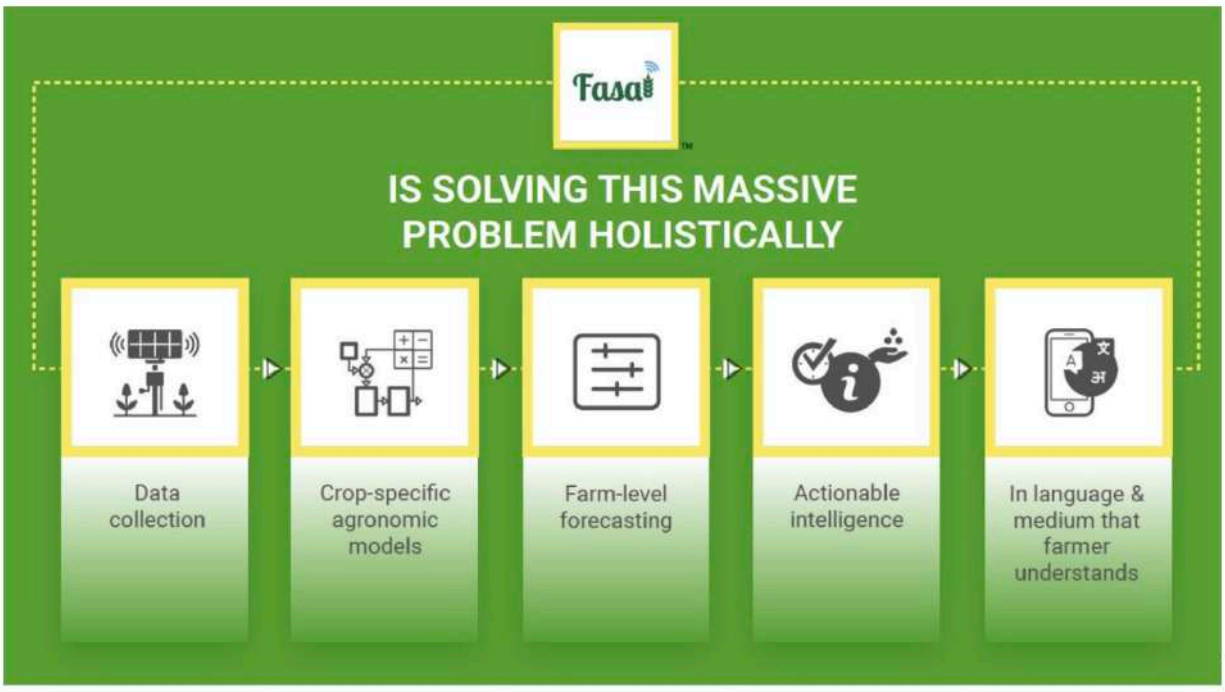
SDG Focus:

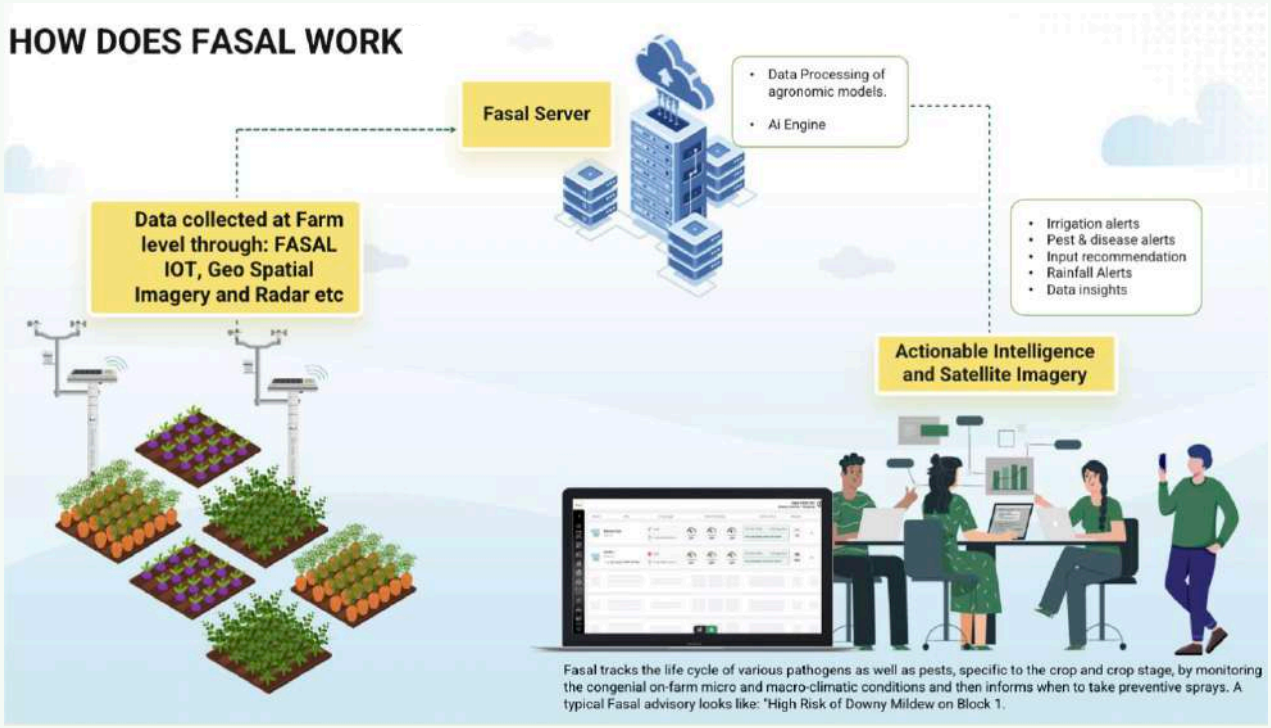
Impact Objectives: Fasal aims to take the guesswork out of cultivation, especially in the case of horticulture. Agriculture in India is an enterprise marked by uncertainty at multiple levels. Farming decisions continue to be contingent on anecdotal, experiential, or context-detached factors even as the climate, soil conditions, and agri-input routines have changed substantially over time. Given the rapidly changing cultivation environment underpinning agriculture, Indian farmers continually find themselves second guessing their decisions. What is the ideal time to irrigate a particular crop? How much and which pesticide spray should be used? Definite answers to questions of this sort are currently hard to find for a majority of the country's farmers. Fasal aims to provide science-backed, evidence-based, data-driven actionable insights to optimise each stage of the pre- and post-harvest cultivation processes by pinpointing exactly what works and what does not. By using technology as an enabler, Fasal is keen to transform Indian agriculture by foregrounding precision in all cultivation related decision-making and facilitating easier access to sustainable crop inputs, farm-level insurance support, and working capital requirements at reduced interest rates.

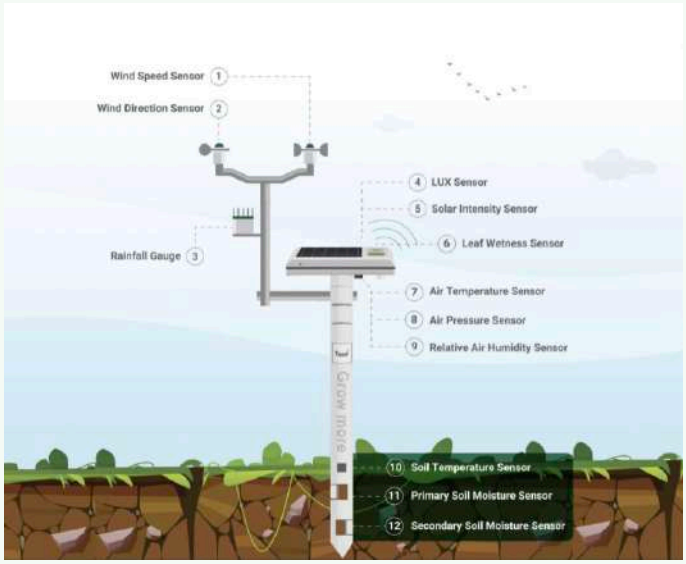
Problem Space: The Indian agriculture sector is paradoxical: the sector is among the largest contributors to national employment and global output across multiple categories but has yet to shift productivity to top decile levels. Cultivation in the country continues to take place in the perennial backdrop of structurally entrenched issues such as fragmented landholdings, inaccessibility to institutional credit, high food price volatility, and climate change induced disturbances. Furthermore, the Indian demography is evolving rapidly and consumption is rightly shifting towards more calories and higher nutritional value. As a result, the projected demand for food commodities, especially fruits & vegetables, is expected to rise greatly by 2050. Horticulture is routinely viewed as a means to improve farmer income while also solving domestic demand. Horticulture already contributes a third of the agricultural GDP while occupying just 20% of the cultivated area. However, this practice comes with its own challenges—cultivation is more technical and has less room for error in terms of managing variables like weather, irrigation, nutrition, and pest control. As mentioned earlier, cultivation today is done based more on approximation and experience as opposed to sensors and science. As a result, resources are wasted, yield is suboptimal, and farm incomes tend to suffer. Moreover, inordinate use of pesticides can sicken consumers, and hamper export prospects.

The Solution: Fasal offers pathbreaking agricultural intelligence and life-cycle crop cultivation support by developing environmentally sustainable and climate resistant new-age farm technology, facilitating both backward and forward market linkages, facilitating access to credit, and addressing post-harvest distribution and procurement bottlenecks. The company has built crop-specific agronomy models for farm-level actionable intelligence, powered by plug-and-play solutions that farmers can install themselves.In India, while commercial vehicles make up only 10% of all vehicles, they account for 70% of the energy used on the road. Rapid charging technology can be a crucial solution to tap into the market's possibilities, enhancing operational flow and efficiency. This approach mitigates concerns over battery range, allows for extended daily travel with fast recharges, and lowers initial vehicle expenses by enabling the use of smaller batteries.

Fasal's proprietary IoT device along with its associated software offering—appositely called "Fasal Kranti"—plays a big role in the pre-harvest stages. The IoT system is solar-powered, portable, can be installed on any farm, and is fitted with multiple sensors capable of monitoring farm-level macro and microclimatic conditions. The system empowers farmers with farm-specific metrics for the entirety of the growth cycle. The collected data is then processed through Fasal's proprietary agronomic models and ML modules to generate valuable advisories as output which can guide upcoming operational decisions. The advisories serve to both reduce the cost of cultivation and significantly increase yield. As a result, the product pays for itself within a season of implementation.







The system is capable of detecting disease and pest outbreaks, generating warnings for the same, and recommending the application of preventive sprays among other measures. Based on the device's real-time alerts, farmers can secure the necessary farm supplements such as fertilizers or pesticides through the company's "Fasal Connect" platform to timely address crop damage. The Irrigation Alert System similarly allows farmers to track their irrigation needs and precisely supply the requisite amount of water at the most suitable time. Farmers are additionally empowered to avail credit and insurance facilities through the data-driven "Fasal Finance" platform.

At the post-harvest stage, Fasal helps connect buyers with farmers and vice-versa. "Fasal Fresh " is the company's solution to rationalise and streamline the post-harvest sales and procurement processes. At present, farmers in certain regions often find themselves at the disposal of various middlemen to offload their produce. These middlemen yield an immoderate amount of influence at agricultural *Mandis*, and thus routinely exercise distortionary, price-setting power to tip the scales against small farmers. In the absence of comprehensive knowledge about the state ordained Minimum Support Price (MSP) stipulations and corresponding government policies, farmers frequently sell their produce to

these agents at a price lower than the one set by the government. Even *Arhtiyas*—commission agents—who broker the sale transaction between the farmer and the buyer by facilitating a range of services such as unloading the produce for auctioning, getting the produce cleaned and packed, as well as arranging for the final loading of the produce for despatch, have been known to delay payments and indulge in wrongful weighment, which farmers are usually unable to contest.

On the side of procurement, buyers face obstacles of their own in obtaining a tender, following up, and managing the actual process of procurement. Due to substandard post-harvest management, antiquated farming techniques, and delays in reaching the Mandi and negotiating the sale, buyers often have to contend with produce which has had its quality compromised. These factors further exacerbate the issues with the buying experience which inevitably includes the payment of a cost premium when sourcing from middlemen.

"Fasal Fresh" solves for this collectively sub-optimal status quo by provisioning a platform for farmers to directly interact and transact with buyers with complete end-to-end traceability. The solution eliminates the need for intermediaries and creates a fair, orderly, and functional marketplace with clear avenues for price-discovery.

Progress: Fasal has taken giant strides in its mission to revolutionise agriculture in India. With the recent grant of a patent for "Fasal Kranti", Fasal has become the first company in India to offer a patented precision farming device for horticulture farmers. At present, the company has a presence in more than 13 Indian states, covering over 15 different kinds of crops. Fasal has helped farmers realise reductions of up to 60% on expenses for pesticides while increasing their yields by nearly 40%. Fasal's initiatives have delivered on all three thematic buckets relevant for small farmers, namely, loss minimisation, farm management, and quality improvement.

Its impact has been cogently captured in hundreds of testimonials from farmers whose convenience, earnings, pest and disease control capabilities, and water usage patterns have improved multifold.

Its impact has been cogently captured in hundreds of testimonials from farmers whose convenience, earnings, pest and disease control capabilities, and water usage patterns have improved multifold.

Some impact metrics for the company are given below–

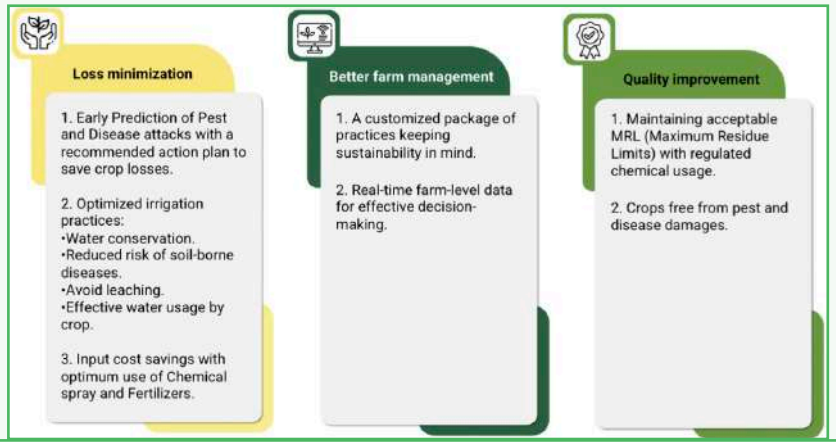
75,000 +Acres
Farmland coverage

82.8 +Billion litres
Water saved through irrigation

127,000 +Kg
Reduction in pesticide use

54,000 +MT
GHG emissions mitigated

67,000 +MT
Yearly traceable supply of fresh produce



"I have 9 acres of vineyard. I have been doing grape farming for the last 10 years. Earlier there was no system as such which could give us any information beforehand around the irrigation parameters, soil moisture levels, leaf wetness, evaporation, weather forecast, etc. on a real-time basis. Fasal's system completely changed the scenario. It's been 5 months now since I have installed the Fasal system in my plot. Fasal's system helped me in prudent water management across my farm leading to a lot of water savings, its predictions and alerts were super helpful for me in controlling thrips attack, Mealybugs, powdery mildew & downy mildew attack."

— Vaibhav Aringale (Grape grower in Nashik, Maharashtra)

"I own 30 acres of land where I grow all kinds of vegetables. I've been associated with Fasal for the last 3 years. In the initial days I had installed the Fasal's system in my Ivy Gourd plot, post-installation I started receiving Fasal's crop-stage specific irrigation-related advisory which was really helpful for me to plan out a precise irrigation schedule. Initially, we used to irrigate for 2-3 hours regularly, post-installation I started observing the primary & secondary soil moisture sensor readings more carefully and the Fasal's system advised me that for my soil-type I shouldn't be irrigating for more than 1.5 hours regularly, accordingly, I started irrigating my fields in a phase-wise manner for a cumulative duration of 1.5 hours, this prevented leaching of nutrients and resulted in a lot of water & fertilizer savings."

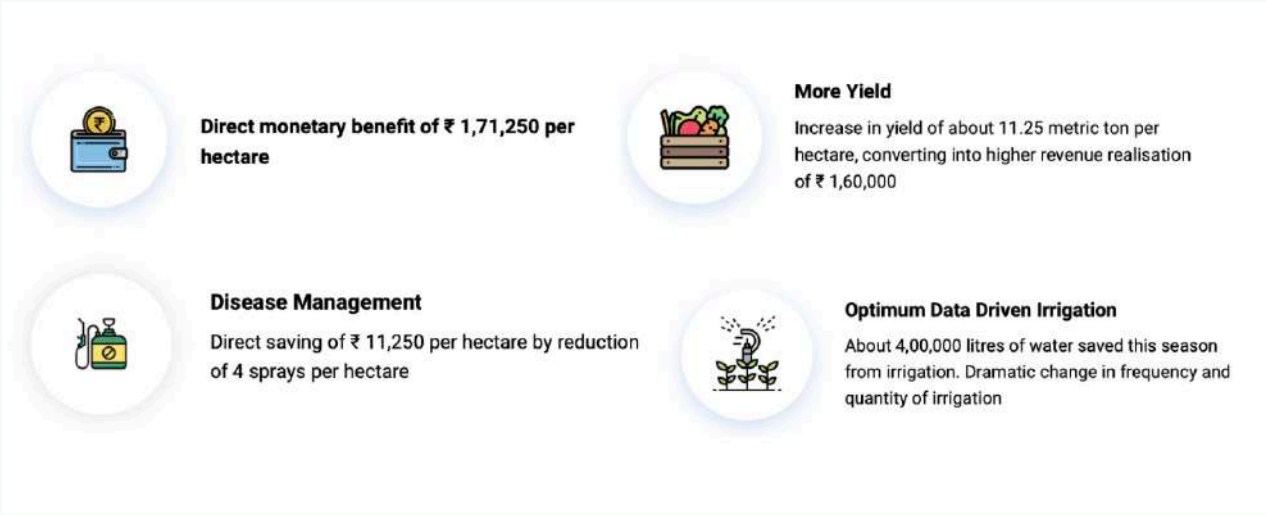
— Bhushan Rathor (Cultivator in Durg, Chattisgarh)

3one4 Capital is thrilled to have brought BII and Dozee together to launch this important initiative. As a significant investor in 3one4 Capital's funds, BII's dedication to delivering measurable impact at population scale is a powerful support vector of our ability to converge tech towards these imperatives. We look forward to building this fabric of intentional capital and dedicated resources that will support Dozee's role in transforming vital infrastructure in India.

Impact Case Study: Chilli Cultivator in Chhattisgarh

Shri Prashant Maru, a progressive chilli farmer from Rajnandgaon, Chhattisgarh has been a beneficiary of Fasal's interventions since June, 2018. Chilli is an irrigation sensitive crop and is adversely affected by over irrigation. Mr. Maru realised he was employing more water than necessary. Using Fasal's intelligence inputs, he decreased both the frequency as well as the quantity of water. Consequently, Mr. Maru was able to deliver 24.5 tons of produce per acre vis-a-vis the 20 tons he had produced in the earlier seasons. His earnings increase and other improvements are mentioned in the image below.

Encouraged by his experience Mr. Maru has installed Fasal at his other farms as well. He strongly recommends Fasal to his friends and believes that each horticulture farmer should have access to Fasal's path breaking technology.



Impact Case Study: Tribal women in Darbha

Darbha is an insurgency affected area in Bastar district of Chhattisgarh. For a considerable period of time, paddy cultivation was the sole source of income for the tribal cultivators of the region. The average household income hovered around INR 30,000-40,000. And that too was contingent on the region receiving adequate rainfall. The women of Darbha stepped up to improve their livelihood conditions and worked hard to get ""Maa Danteshwari Papaya Utpadak Samiti " established with support from the Bastar District Administration and the Bastar Kisan Kalyan Sangh (BKKS). The Samiti was set up on the lines of the Bastar model of "Horticulture for Rural Development", an initiative to bolster inclusive development that aims to transform barren land with a view to empower women and double farmers' income.

The tribal women from Darbha, received training in horticulture farming from BKSS and developed the 10 acres of land allotted to their self-help group into a successful papaya growing parcel. They had to overcome a host of challenges including making the barren land palatable for cultivation by manually removing 200 trolleys of rocks. On account of their dedication and hard work, the tribal women have been able to radically change the contours of the region by successfully growing papaya using modern agricultural techniques such as drip irrigation, fertigation system, and mulching. Fasal is also playing a small role in empowering these women by providing accurate, real-time, microclimatic-forecast based crop intelligence and irrigation advisories.

Over time, all members of the group have been able to double their income and significantly improve their quality of life. One of the major individual success stories from the initiative pertains to Hembati Kashyap, a tribal girl from Darbha who had to leave her studies due to familial financial constraints. Today she supervises and manages farm activities. She "managed to resolve her family's financial issues and has also rejoined her BSc course. She is an inspiration and role model for other tribal women."

Prominent Partnerships:

Fasal partners with SBI to financially empower farmers with easy access to collateral-free loans

Fasal has partnered with India's leading public sector bank, State Bank of India (SBI), to provide farmers with easy access to quick, convenient, and collateral-free loans at highly affordable rates.

This partnership will address critical cash-flow challenges and allow farmers to invest in modern agricultural practices, purchase quality seeds, procure fertilizers and machinery, and adopt sustainable farming techniques. The loans will be provided under the Kisan Credit Card (KCC) scheme, renowned for its lowest interest rate among credit facilities for farmers. Fasal's new service will initially be rolled out in Maharashtra, Karnataka, Chhattisgarh, and Madhya Pradesh, with plans to expand to other states in the future.

With its wide network of branches and robust infrastructure, SBI brings a wealth of expertise in rural and agricultural banking to this partnership.

Fasal signs MoU with the Indian Meteorological Department (IMD) for research collaboration

Under the agreement, Fasal and IMD will collaborate closely on sharing hourly short-range models regarding rainfall probability, precipitation levels, temperature, and humidity.

Most weather forecasting services in operation are incapable of providing granular coverage to farmers. Fasal endeavours to change this by utilising its IoT and AI capabilities to develop "precipitation nowcasting models" with the IMD, focusing on ultra short-term, two-hour period forecasts. Fasal will additionally use its historical IoT data and hourly forecasting data.

The geographical scope of this agreement currently covers five districts in Karnataka, five districts in Maharashtra, one district in Telangana, and two districts in Andhra Pradesh.

"With day-to-day weather playing an important role in agricultural production, accurate prediction of weather can significantly help with increasing crop growth and yield, controlling pests, water and fertilizer needs."

Shailendra Tiwari
(Founder, Fasal)

Industry Recognition: Fasal has received widespread acclaim for its category defining, full-stack agri-tech solution. The company was included in HolonIQ's 2022 list of "the 100 most promising Climate Tech startups from South Asia." Fasal has previously won the "Best use of AI in Agriculture" 2021 award by GAISA; the "Next Gen Product of the Year 2021" award by NASSCOM; as well as the IMARK 2021 award by India Design Mark for Fasal Kranti. Fasal was also a recipient of the prestigious "Startup India Award 2022" presented by the Government of India. Fasal was awarded for its work in the "Agriculture" sector under the "Productivity" category. Recently, Fasal was featured in LinkedIn's Top Startups India 2023 list.

The company additionally counts amongst its customers some of the biggest names from the F&B and hospitality sectors, along with several other corporate powerhouses. Some of Fasal's prominent corporate partners have been mentioned below.

Fasal is revolutionising agriculture in India and catalysing standard setting impact across multiple categories for diverse stakeholders. By increasing farmers' income, reducing water usage, preventing crop damage, and providing a market-linked, full-spectrum solution for distribution and credit, Fasal is charting a new path to inclusive, profitable, and sustainable agriculture in the country. We are eager to continue our partnership with the company in its pursuit of realising outsized social and economic returns for the sector which continues to employ the largest working population in the country.

India's Achievements

India has made commendable progress across the climate change space in the recent past including the commitment to reach Net Zero by 2070. A summary of India's recent CoP commitments as well as some of its climate relevant initiatives can be found in the "India's sustainable growth story: The next USD 10 trillion economy" section of this report. India occupies a top five rank, and the highest among G20 countries, on the global Climate Change Performance Index. According to a study by the Institute for Energy Economics and Financial Analysis, India's renewable energy space catalysed investments worth USD 14.5 billion in 2021-22. This figure is 125% higher when compared to the previous year and 72% higher than the pre-pandemic number from 2019-20. The government is also eager to explore new-age energy avenues; the recently launched National Hydrogen Mission, for instance, aims to make India a green hydrogen hub, relying on a slated increase in production and uptake of green hydrogen over the coming decades.

Other arms of the Indian State are also playing a pivotal role in ensuring a speedy transition. The Supreme Court for India, for instance, facilitated the prompt shift to BS-VI fuel norms. The RBI has joined the Central Banks and Supervisors Network for Greening the Financial System (NGFS) and even set up a Sustainable Finance Group (SFG) internally. Sustainability concerns figure even in India's bilateral investment treaty (BIT) negotiations today.

The markets have been receptive to the changes taking place. The assets under management (AUM) for domestic thematic ESG funds increased more than 4x between 2019 and 2021. With specific reference to sustainability and climate related debt markets, India's cumulative green, social, and sustainability (GSS) debt volume has almost doubled over the last two years to hit USD 19.5 billion in cumulative issuance according to a joint report by the Climate Bonds Initiative, Climate Policy Initiative and others.[151]

Citizens and civil society have also taken the lead on adopting climate sensitive measures and technologies. Government initiatives such as the solar pump focused PM-KUSUM scheme or the FAME I and II schemes for electric mobility adoption have borne success. The latter has helped catapult sustainable mobility to leadership status within the climate-tech pack in terms of funding and sub-sectoral prominence.

In certain jurisdictions such as Delhi, electric vehicle (EV) sales as a percentage of total vehicle sales have crossed 10% in certain months thereby affirming the growing shift towards increased customer adoption of zero tailpipe emission vehicles.

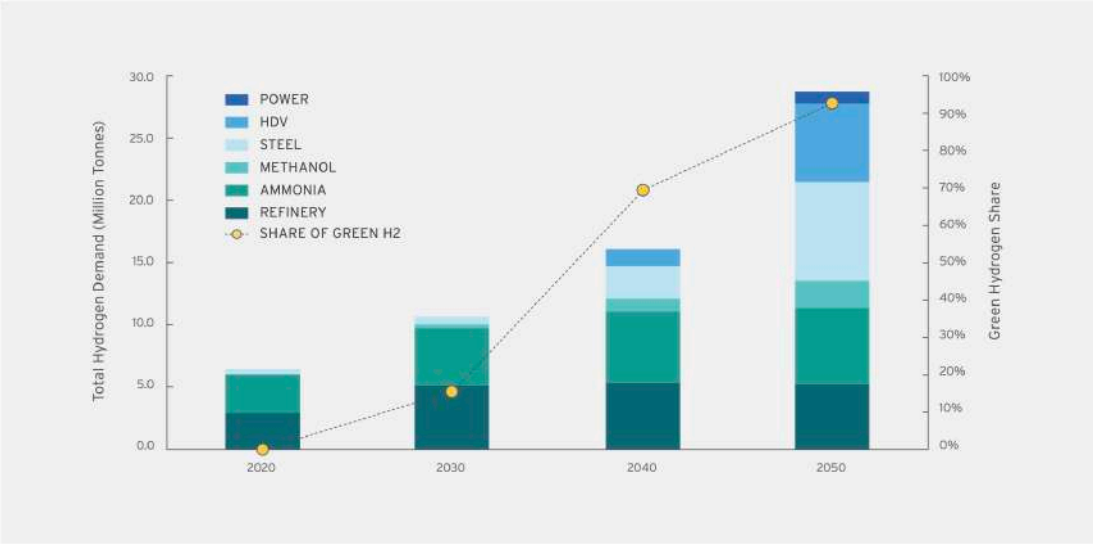


Fig 30 : Hydrogen demand outlook and potential green hydrogen share at cost parity (without policy intervention) till 2050. Source: RMI and NITI Aayog[150]

Fig 31: EV adoption in certain states has moved from the 'innovators' stage to the 'early adopters' stage on the technology adoption curve and is on the cusp of "crossing the chasm". Source: Vecteezy[152]

Notwithstanding India's achievements, there is still a long way to go. The Council on Energy, Environment and Water (CEEW) estimates that India needs to galvanise cumulative investments worth USD 10.1 trillion to achieve net-zero emissions by 2070.[153] Meeting the country's 2030 solar and wind capacity targets alone will require around USD 223 billion—almost 3x the amount invested in solar and wind between 2014-21—in funding between 2022-29 according to analysis by BloombergNEF (BNEF).[154]

THE PATH BEING LAID

Over the past few years, a number of factors have converged to lay the path for potentially disruptive, step-function characterised climate-tech growth. Consumer sentiment has reinforced itself to create a strong demand pull for climate conscious consumption. We are quickly moving away from the model of fast, expedient consumption commonly associated with the throwaway cultures dominant in certain developed economies. The consumption shift has propelled concomitant changes in industry processes and practices, namely the growing discourse around the significance of accounting for Scope 3 emissions; the pursuit of cleaner manufacturing, production and distribution; as well as the decision by certain large global conglomerates to set net-zero targets for themselves voluntarily.

Technological advancement has also played a role, as mentioned earlier, especially in the fields of energy storage and renewable energy generation, with the costs of advanced chemistry battery packs and solar PV modules both declining by approximately 90% over the previous decade. The most important change, however, has come in the form of an industry-wide narrative disruption and a coterminous reorganisation of markets

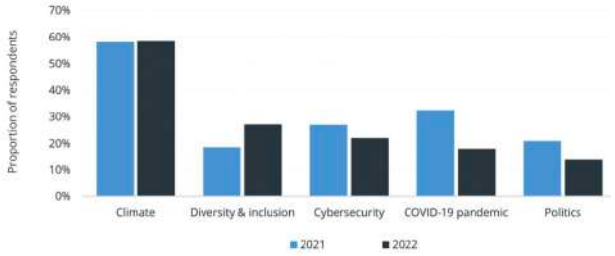


Fig 32 : An investor survey conducted by Preqin in November 2021 had 59% of the investors citing environment-related issues as their top ESG concern. Source: Preqin

around climate conscious businesses. Investment flows are unequivocally catalysing towards responsible and sustainable enterprises and practices.

Substantial challenges remain, of course, most notably in the context of securing and de-risking long-term climate finance for India and its enterprises. There is also the question of shifting public support away from fossil fuels and towards clean energy and doing so gradually while building consensus among all stakeholders. Over USD 77 billion currently flows to the energy sector every year in terms of public support according to one estimate by IISD, CEEW and the Global Subsidies Initiative.[155] Related concerns also exist regarding potential revenue losses for the government with a shift away from fossil fuels and India's continued reliance on coal—made most conspicuous by regular announcements of capacity addition and its enhanced use to counter the recent heatwave-induced blackouts in the summer of 2022—which is still responsible for fulfilling 70% of the country's energy needs.

In the current environment of heightened geopolitical tensions, however, the most serious challenge comes in the form of the need to ensure a steady supply of transition-relevant critical minerals. Commodity prices have risen dramatically since the beginning of the year resulting in, among other things, what Zoltan Pozsar from Credit Suisse has called the 'great commodities collateral crunch'. Clean energy technologies tend to use a higher proportion of critical minerals and prospects for substituting the same are scarce. China currently dominates the value chains for most critical clean energy relevant minerals. Streamlining a reliable, affordable, and diversified supply chain for these resources will be crucial in India's, and the world's, fight against climate change.

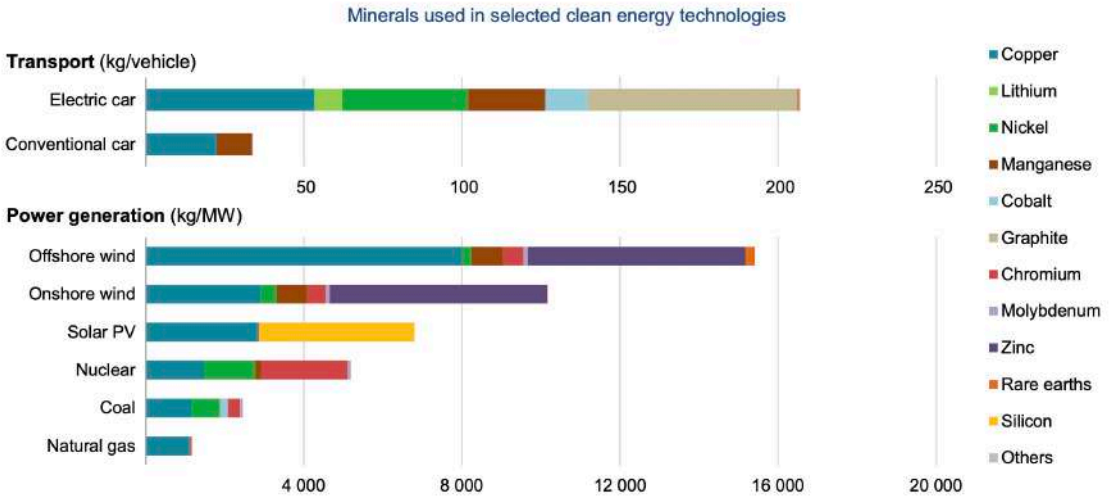


Fig. 33: Minerals used in select clean energy technologies. Source: IEA[156]

Conclusion

Discussion on deployment and scaling of climate-tech solutions has often been restricted to their potential to mitigate or capture emissions. This is, however, a highly reductionist account of what these solutions offer. This does not usually capture the economic argument and the leapfrog potential for emerging economies, especially through the use of indigeneously developed IP. The use of technology to achieve global Net Zero—accompanied by the provisioning of substantive and meaningful energy access for all—presents itself as the greatest business opportunity of this decade.

Just like historical infrastructural and technological precedents, solutions which offer the most significant gains to citizens' quality of life, with falling cost profiles and widespread use-case versatility should see the fastest adoption at scale. In many ways, the climate-tech revolution simply continues the "long arc of energy history: efficiency beats waste, technologies beat commodities, and economics beats ideology."[157]

Fortunately, the learning curves for most of the building blocks of the climate-tech revolution are in conformity with Wright's Law: costs fall at a consistent rate as a function of cumulative production as feedback loops get shorter and quality improvements are expedited. The fall in costs is thus non-linear. Indeed, solar PV installations and battery deployment have repeatedly outpaced their respective yearly forecasts based on linear projections.

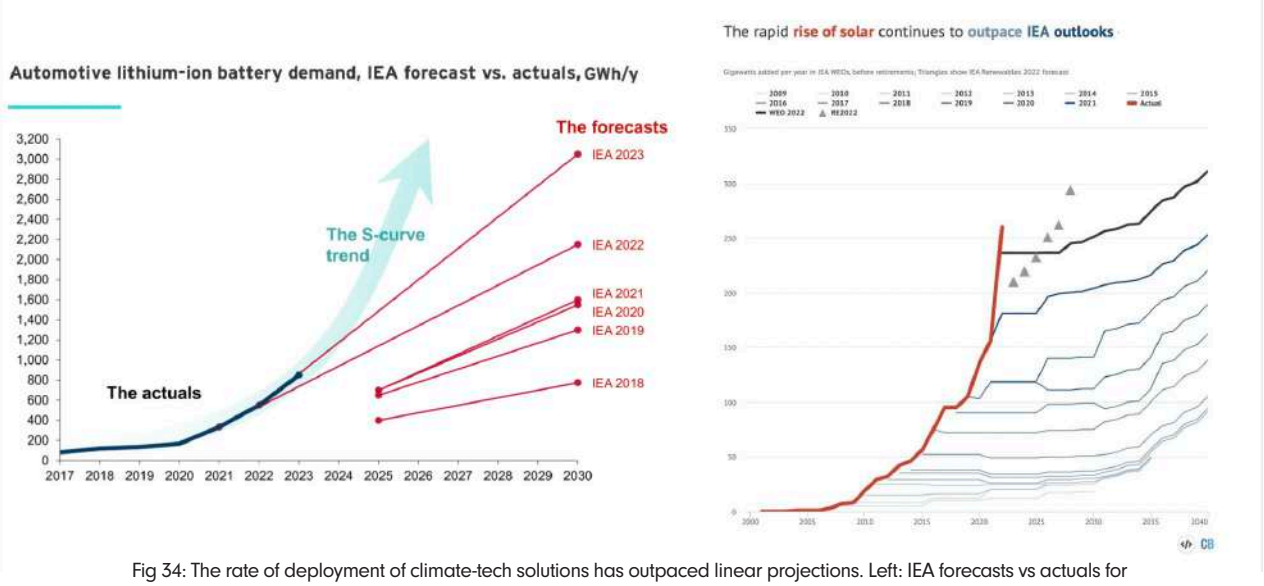


Fig 34: The rate of deployment of climate-tech solutions has outpaced linear projections. Left: IEA forecasts vs actuals for automotive Li-ion demand. Right: Solar PV additions vs IEA Outlooks. Sources: IEA, BNEF, RMI, Carbon Brief

The S curves for solar PV, battery packs, electrolysers etc. are strengthening with each passing year, even as prices for mature energy resources such as coal, oil, and gas have essentially stagnated over a long term horizon. The faster we deploy new-age climate technologies, the cheaper they get. In 1990, renewable energy sources played a minor role in global power generation, accounting for only 1%. It took a significant amount of time for their contribution to grow, reaching 2% by 2005. However, the pace of growth has accelerated dramatically since then. It only took eight years for renewables to double their share to 4%, and then just six years to double again to 8%.[158] Interestingly, the rapid expansion of renewable energy does not necessarily demand a surge in spending. "As fossil fuel capex falls, the net growth in capex is only 2 percent per year, in line with the past seven years, and much lower than in the decade after 2000."[159]

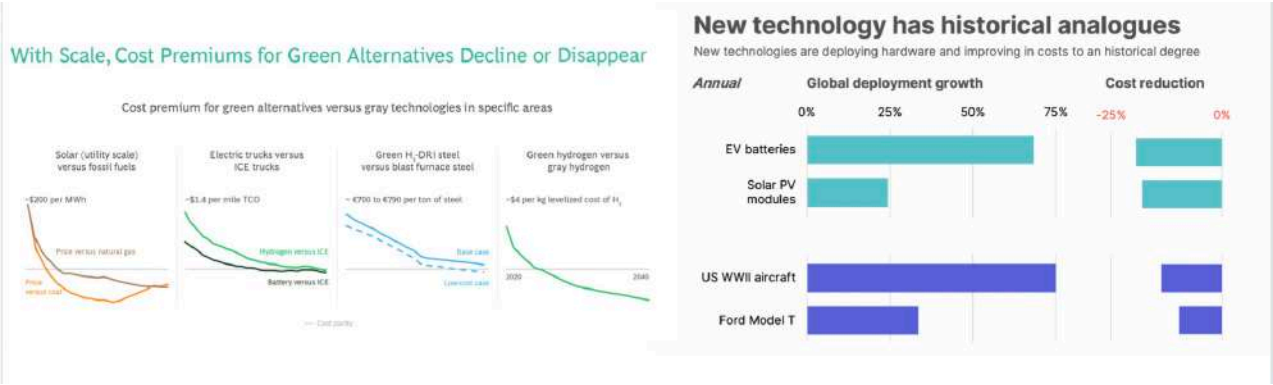


Fig 35: Climate-tech building blocks are getting cheaper with increased deployment. Left: Cost premium for green alternatives. Right: Historical analogues for select climate technologies. Sources: US Department of Energy, Lazard, IRENA, IEA, BCG, Nat Bullard.

As we look ahead, the potential for efficiency gains in various sectors looms larger than ever before. Despite significant strides in the past, there remain considerable untapped opportunities to enhance energy efficiency further, extracting more output from fewer resources. Advancements in material science, integrated design approaches, and increased digitalisation are poised to usher in smarter, more streamlined energy systems.

Furthermore, transitioning from inefficient fossil-fueled electricity generation to renewable sources like solar and wind can reduce primary energy consumption by approximately 60%. Similarly, replacing oil-based transportation with electric vehicles can slash primary energy usage by about 75%, while the adoption of heat pumps over thermal boilers can achieve similar reductions. As these technologies mature along their growth trajectories, they are expected to amplify the annual rate of efficiency improvements significantly.[160]

Consequently, the goal of doubling efficiency gains by 2030 appears much more feasible than commonly perceived, given the accelerating pace of technological advancement and adoption. While there remains an active debate on how base load will move off coal and other fossil fuels, there is alignment that investing in renewables for incremental generation is becoming more economically efficient every few years. This is substantial progress, and we expect economies to build on top of this consensus going forward.

Over time, deployment of renewables alongside other technologies that enhance equitable energy access should usher in a world of "distributive abundance", potentially becoming the principal driver of investment and economic growth as there is incremental evidence from industries adopting new technologies every year. With time, climate-tech will come to enjoy a stronger presence in the investment and GDP contribution matrices of most nations, especially countries like India with a burgeoning talent pool and a thriving entrepreneurial ecosystem.

India truly stands at the precipice of a transformative era in climate-tech innovation and technology-driven development. The nation's remarkable progress in embracing renewable energy sources and fostering sustainable practices underscores its potential to emerge as a global leader in this pivotal field. With a strong commitment to tackling climate change, evidenced by ambitious targets and policies, India is poised to leverage its burgeoning economy to drive meaningful change on a global scale.

As India's economy aligns ever more closely with the imperatives of the climate transition, the role of startups

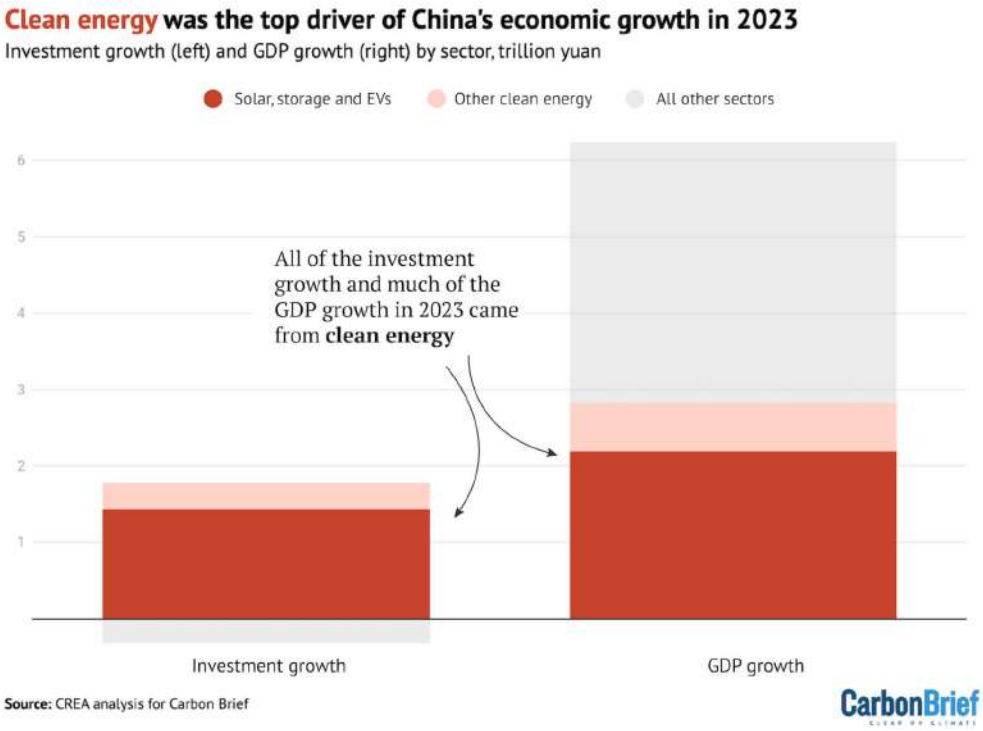


Fig 36: Clean energy was the top driver of investment and GDP growth in China in 2023. Sources: CREA, Carbon Brief

emerges as pivotal. These agile, innovative entities are poised to catalyze the development and adoption of cutting-edge climate technologies, propelling India towards a greener, more sustainable future. Moreover, India's capacity to export climate-tech solutions to the wider world presents an unprecedented opportunity, underscoring the vast potential for economic growth and leadership in the global arena.

Looking ahead, it is imperative that we marshal greater resources—be it financial investments, human capital, or research and development efforts—towards accelerating the climate transition. The magnitude of the challenge demands nothing less than a concerted, collaborative effort from all sectors of society. By harnessing the collective power of innovation, entrepreneurship, and strategic partnerships, we can build towards in a future where climate-tech not only mitigates the impacts of climate change but also drives inclusive, sustainable prosperity for generations to come.

Digital Public Goods in India:

ONDC and the next digital commerce evolution

Digital public goods such as ONDC will expand the market and accelerate inclusion across the value chain

3one4 Capital organized a session on *Exploring Digital Public Goods* in the Indian Context in May 2022, where attendees were privy to a decidedly insightful conversation on entrepreneurship in the age of DPGs. Having delivered their talks and presented their slides, the esteemed panellists from ONDC, Beckn Foundation, and EkStep Foundation were fielding questions from the audience. One startup founder, while earnestly supportive of the giant strides India has made in the recent past on account of public technological rails, nevertheless asked, **if an ever increasing number of digital goods are publicly provided for, what role is left for entrepreneurs to play?**

It is an interesting question, one that brings into sharp relief an oft-neglected and under-discussed aspect of digital public goods (DPGs). It could be argued that public provisioning of a non-essential good constitutes encroachment into what should have been a preserve of the entrepreneur/private sector. After all, there is little precedent for any other nation's democratic government building such infrastructure as a public utility. Over the past few years, the justifiably optimistic fervour surrounding DPGs such as UPI has perhaps obfuscated, or maybe even drowned out, critical issues around the private sector's fundamental objective to drive cutting-edge innovation and derive market-level profit margins for services built on these rails. But such an argument would be ignoring the reality of the Indian economy.

To begin with, several large-scale, era-defining global technological innovations and innovation facilitators over the past half a century have either been publicly provisioned or publicly supported through extensive grants, at least during their initial stages of development. Examples include the internet, GPS, jet engines, and touch screens. Government support for these innovations has acted as a force multiplier for private sector participation and allowed for a 100x multitude of innovative solutions to subsequently be built on top of them. The same can be said for Aadhar and UPI as well. Sujith Nair, a co-founder at Beckn.org, offered a response along similar lines when answering the question posed earlier. To take his reasoning forward—notwithstanding, of course, the awe-inspiring potential of private innovation—there are wholly understandable causes as to why advancement of such technologies would have had to be disproportionately dependent on public/State support. Extraordinary R&D prerequisites both in terms of monetary and human resources, long-gestation growth cycles, large-scale convergence and coordination imperatives, and massive uncertainties regarding the prospect and robustness of returns would have effectively foreclosed the possibility of a private player owning the entire development cycle of such infrastructure.

Sure enough, times have changed and generation-defining technological developments are now being undertaken by private entities as well. Venture capital has played an indispensable role in enabling this massive surge in private innovation. But DPGs remain acutely significant for technological advancement due to their ability to compound possibilities for innovation by broadening access to sophisticated digital infrastructure, support knowledge sharing and ideas exchange through open-source and collaborative frameworks, and help build highly scalable common-use utilities that can necessitate buy-in from incumbent stakeholders with varying objectives. They additionally play an outsized role in furthering a myriad of socio-economic objectives including financial inclusion, improved access to healthcare, learning augmentation, and other State priorities.

This piece, however, is less about the merits and desirability of DPGs—on which terrific commentaries exist[1]—and more about an insightfully provocative statement made by Pramod Varma in response to the

startup founder's question. For the uninitiated, Pramod Varma is a co-founder at Beckn Foundation and has additionally served as the chief architect and technology adviser for Aadhar. He is also the architect of various India Stack layers such as eSign, DigiLocker, and UPI. In other words, he is someone you should listen to on these matters.

After emphasising the sheer scale of opportunity that India offers, and the possibilities for value capture that emerge for private enterprises as DPGs become mainstream, Mr. Varma touched upon the role that DPGs, especially the Open Network for Digital Commerce (ONDC), can play in creating a level playing field for enterprises and encouraging greater innovation by bringing in some semblance of unification. Something like a lingua franca for the digital economy, built on open-source protocols, and interoperable, modular, and scalable architectures. This will surely result in a degree of commoditization, he argued. But such commoditization is imperative. **"If we don't commoditize, your competitors will."** This singular sentence has served as the prompt for this piece. What role, after all, will commoditization play in the digital commerce industry? And how will it impact businesses' profitability?

Commoditization refers to the conversion of a business offering or product with unique, distinguishable characteristics, and possibly even elements of proprietary value, to one that is essentially interchangeable with others of the same type. Of late, there has been a growing chorus of concern around businesses' ability to create and sustain profits when building on, or competing alongside, open-source DPG driven solutions. Much of the brouhaha has been around the UPI and its expected impact on the revenue potential of digital payment applications. The underlying fear is that democratisation and access enabled by DPGs can lead to industry-wide commoditization which could render value creation and product differentiation difficult, if not impossible. This could, in turn, limit margins and stifle growth.

As mentioned earlier, a certain degree of commoditization is inevitable when businesses start building for the same stakeholders digitally. But does commoditization necessarily lead to attractive profits vanishing across the value chain? Or do they merely shift over time? And should commoditization in a value chain be seen as being diametrically opposed to value chain integration?

In most value chains, modular and commoditized architectures often simultaneously coexist with more integrated or interdependent ones. Taken together, they constitute a continuum rather than a strict binary. They work in tandem to optimise the weakest link in the chain - the aspects of the product which are as yet not good enough to satisfy consumer demands for improved functionality, low latency, and high reliability. Attractive profits are thus usually contingent on the nature and extent of proprietary value add, attributable to a large degree, of course, to interdependent architectures. Businesses tend to prefer building such architectures in-house, deploying proprietary technologies and expertise with an aim to achieve product differentiation by leveraging their existing competitive advantages. The likes of UPI and ONDC may not give businesses a lot of room for manoeuvrability in this regard by democratising the underlying infrastructure and laying down the technological rails for all to use. But again, does that mean that the pursuit of attractive profits will prove to be a mirage? Most certainly not.

As the remainder of this piece will show, DPGs can potentially make proprietary value, and correspondingly the associated profits, shift to a different stage in the value chain but attractive profits are conserved. In fact, the swell of inclusive, and accessible innovation enabled by DPGs such as ONDC will lead to a massive net increase in revenue and profit numbers for the industry at large. This network has a high likelihood of opening floodgates of opportunity for an aspirational class of merchants and service providers who have up until now been denied entry to various rent-seeking, "walled garden" platforms making hay out of India's astounding digital growth story. The normative contract for DPGs in India is underpinned by tenets emphasising democratisation, equitable access, promotion of autonomy, sustainable and inclusive wealth creation, and a broadening of the community of beneficiaries of India's ongoing digital revolution.

Clayton Christensen—author and former professor most famous for developing the concept of disruptive innovation—has done some of the most fascinating work on how profits shift across a value chain over a period of time. Much of what has been conveyed in this paragraph as well as the previous one comes from his book with Michael Raynor, *The Innovator's Solution*. He argues that once proprietary, interdependent architectures undergo disintegration and eventually become commoditized—mostly on account of businesses responding to altered consumer preferences for speed, convenience, or lower power usage rather than continued functional improvements—attractive profits do not just disappear, they merely shift to a different

stage in the value chain. Christensen christened this the law of conservation of attractive profits: "in the value chain there is a requisite juxtaposition of modular and interdependent architectures, and of reciprocal processes of commoditization and de-commoditization, that exists in order to optimize the performance of what is not good enough. The law states that when modularity and commoditization cause attractive profits to disappear at one stage in the value chain, the opportunity to earn attractive profits with proprietary products will usually emerge at an adjacent stage."[2]

A few examples should make this clearer. Consider the case of the microprocessor industry. With the onset of the smartphone revolution, consumer, and consequently business, preferences moved away from core processor performance to lower power consuming systems in order to support the entire gamut of features on modern phones without them running out of charge. While Intel had dominated the pursuit of pure processing power in the PC space by continually pushing boundaries through its integrated architectures, the shift described above necessitated a move away from integrated architectures to more modular and low-power ARM (Advanced RISC Machine) processor-aligned architectures. Intel continues to enjoy a healthy presence in the PC and cloud space, but Arm Ltd., the firm that develops and licenses ARM architectures for companies such as Apple to build on, powers 95% of premium smartphones today and posted record profits in FY21.[3] The microprocessor industry as a whole has undergone multiple instances of commoditization in the past without closing the doors on attainment of attractive profits. Figure 1 illustrates this well.

FIGURE 5 - 2

The Transition from Vertical Integration to Horizontal Stratification in the Microprocessor-Based Computer Industry

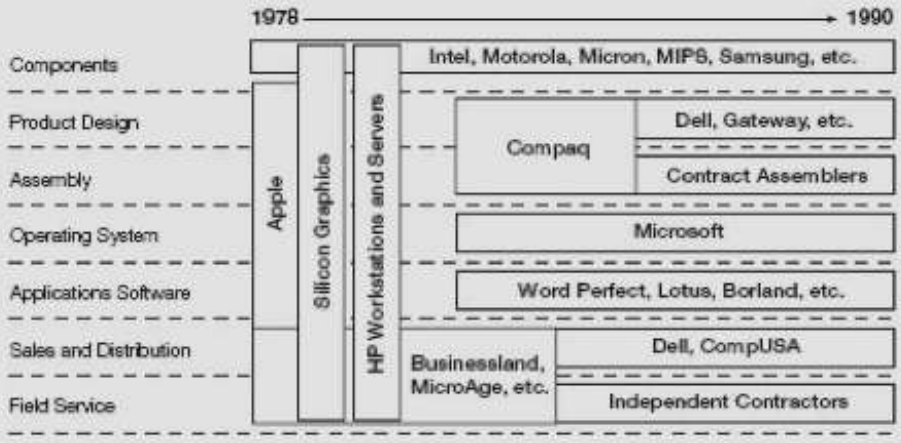


Fig 1: The transition from vertical integration to horizontal stratification in the Microprocessor-based Computer Industry.Source: The Innovator's Solution. Image taken from onepointmore.com[4]

Ben Thompson, the author of the popular blog *Stratechery*, gives several contemporary examples to portray how profits shift in a given value chain once modular and integrated architectures are rejigged. Consider the cases of Airbnb (Figure 2), Uber (Figure 3), and Netflix (Figure 4).

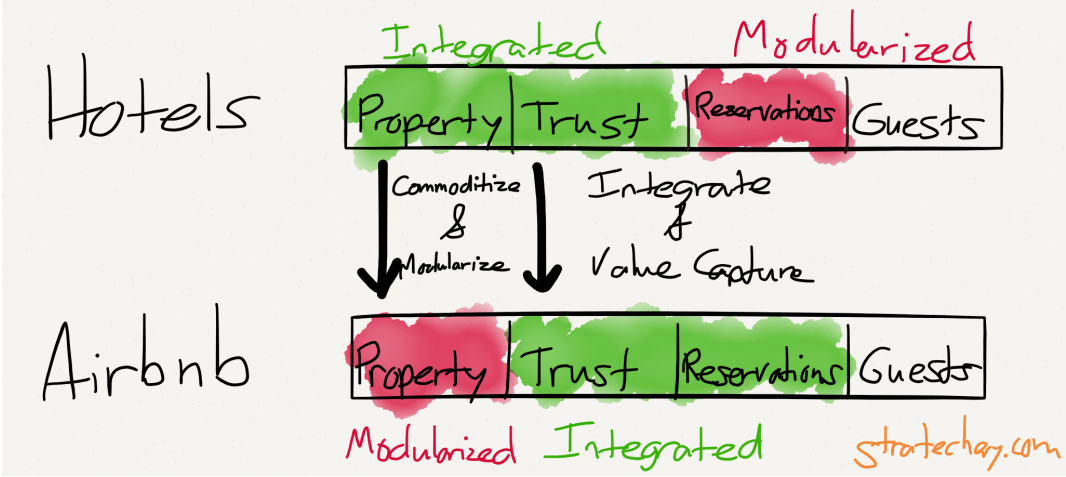


Fig 2: Rearrangement of integrated and modularised architectures in the case of Airbnb. Source: Stratechery[5]

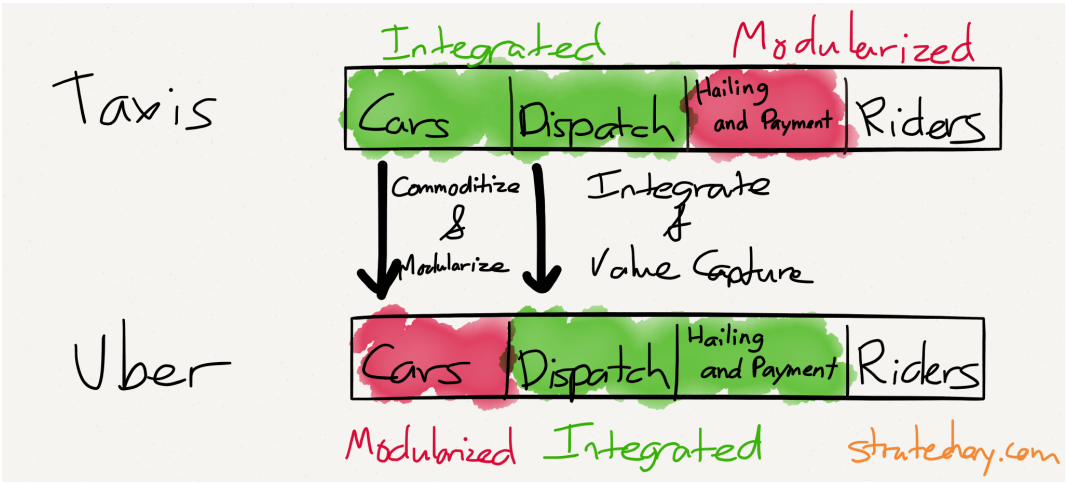


Fig 3: Rearrangement of integrated and modularised architectures in the case of Uber. Source: Stratechery

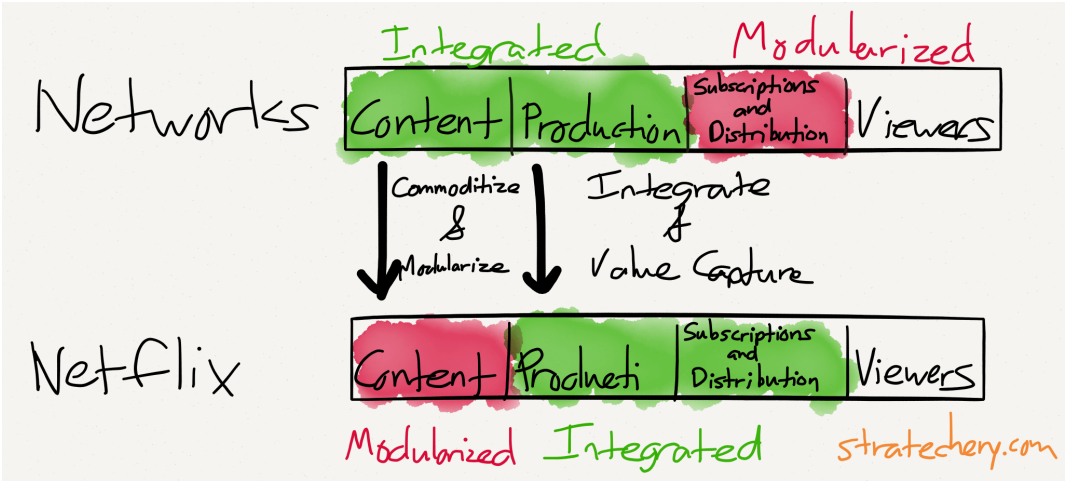


Fig 4: Rearrangement of integrated and modularised architectures in the case of Netflix. Source: Stratechery.

Rearrangement of modular and interdependent architectures is a recurring theme in the tech business landscape. **Periods alternating between commoditization and integration dominance are cyclical, endemic, and deeply entrenched in tech value chains.** Modular PC hardware designs broke IBM's hegemony with respect to mainframes. Gradually, Microsoft figured out ways to make software the source of proprietary value, with a particular emphasis on the OS. Open-source software backed by the internet and the early world wide web was able to break the stranglehold of proprietary software. Within a few decades, however, the likes of Google and Meta among others have been able to achieve attractive profits, monopolies even, by creating proprietary value through the harvesting of big data.

So then, what has the law of conservation of attractive profits got to do with ONDC, or DPGs in general? To understand this, it's imperative to comprehend what ONDC is and what it seeks to achieve. For reference, ONDC is revolutionising digital commerce in the country by enabling an open network built on non-rivalrous and non-excludable public digital infrastructure using open protocols, and interoperable yet scalable building blocks. It intends to democratise digital commerce in India by bolstering inclusivity, interoperability, discoverability, and scale. Once implemented, it will allow for consumers and sellers to interact even if they have accounts on different platforms, much like UPI in the case of payments. In a similar vein, it will allow different entities to take up logistics, buyer, or seller side activities for the same transaction. The scope of the associated open network concept goes way beyond retail e-commerce. Productive use cases exist across domains as varied as mobility, logistics, travel and tourism, and even food delivery.

ONDC can be the most seminally disruptive digital initiative in India's economic history. By unbundling the e-commerce value chain in India, it will - i) onboard thousands of hyperlocal players existing gatekeepers have denied entry to, ii) mitigate concentration risk for both buyers and sellers, iii) allow for portability of trust, and iv) delink platform membership from product and seller discovery. According to the ONDC Strategy Paper, it aims to achieve these objectives by holistically bringing about a "paradigm shift from an operator-driven monolithic platform-centric model, to a facilitator-driven, interoperable decentralized network."[6] The image below gives an idea of this vision.

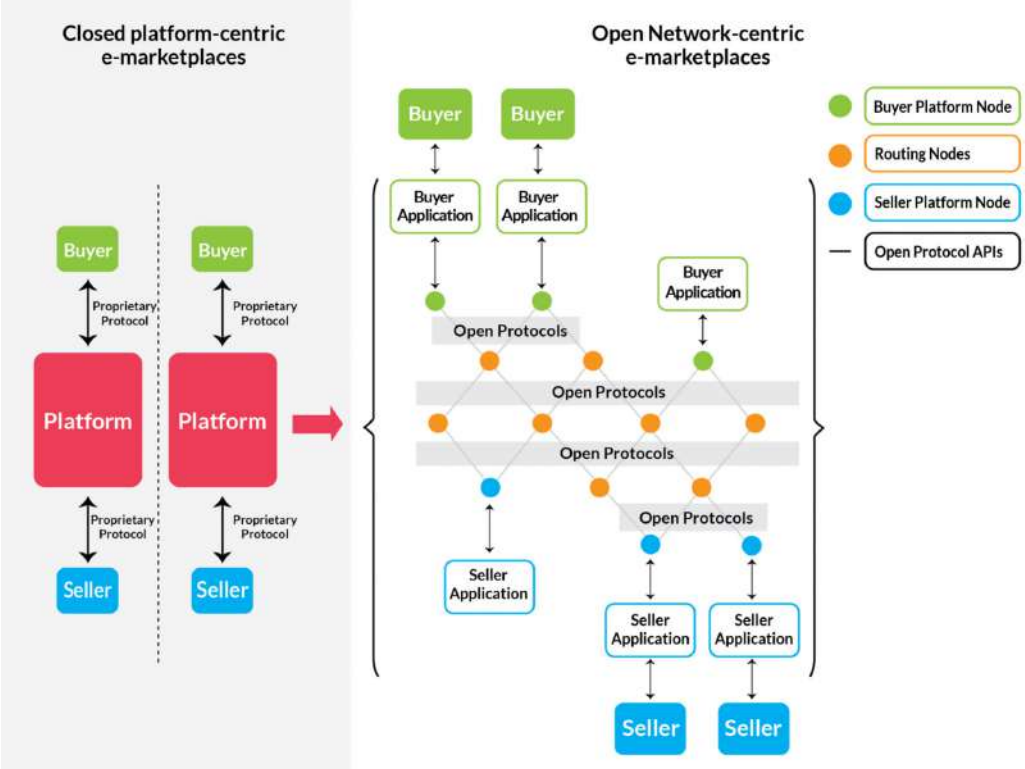


Fig 5: ONDC's platform to network approach. Source: ONDC[7]

The unbundling shown in the image above will, in addition to anchoring the positives mentioned in the previous paragraph, undeniably break open platform monopolies and modularise existing integrated e-commerce architectures. The resulting commoditization of complex digital infrastructure should prove to be vital in ensuring equitable access to e-commerce innovation. Legacy players may find their dominant positions under threat. But this will give a fillip to new entrants looking to build on commoditised, interoperable digital rails and establish niche value generating avenues for themselves. ONDC will thus emerge as a catalyst *par excellence*, enabling a combinatorial explosion of ingenious solutions, encouraging a playground view of innovation, and promoting seamless, "unhindered, free-to-scale 'flow of value' that a fair and efficient market should have."[8]

This should entail a substantial rearrangement of the existing modular and interdependent architectures in the e-commerce value chain. Trust, for instance, is currently maintained and enforced through the integrated architecture developed by the marketplace platform. Even though individual sellers on the marketplace often have their own ratings, end consumers would buy products from a specific marketplace only if it enjoys their good faith. With ONDC allowing for portability of trust, it could be delinked from the platform and integrated directly with the architecture and identity of the seller. A plethora of opportunities for devising customised offerings open up once the entire value chain is unbundled/modularised. Players can curate their specific suite of solutions by handpicking the activities they wish to participate in. Physical kirana stores, online retailers, buyers, service providers, and logistics players can deliver on activities across the value chain depending on their respective competitive advantages. An online direct-to-consumer retailer could offer its previously proprietary method of integrating digital wallets as a solution to other retailers. Specialised payment processing firms could expand their footprint and converse directly with buyers and sellers without worrying about putting in place an entire platform by themselves.

The image below showcases this dynamic by illustrating the different components of an open network enabled by ONDC and how it will interact with other networks/ players. The number of possible permutations for rearrangement of the sort witnessed in Ben Thompson's charts for Netflix et al. is truly extraordinary.

Through all of this, attractive profits will not vanish for businesses participating in this revolution. Overall, revenues, profits, transaction counts, volume of exchange, and innovation can all increase multifold at the industry level on account of the increased participation and reduced friction facilitated by an open network. To echo

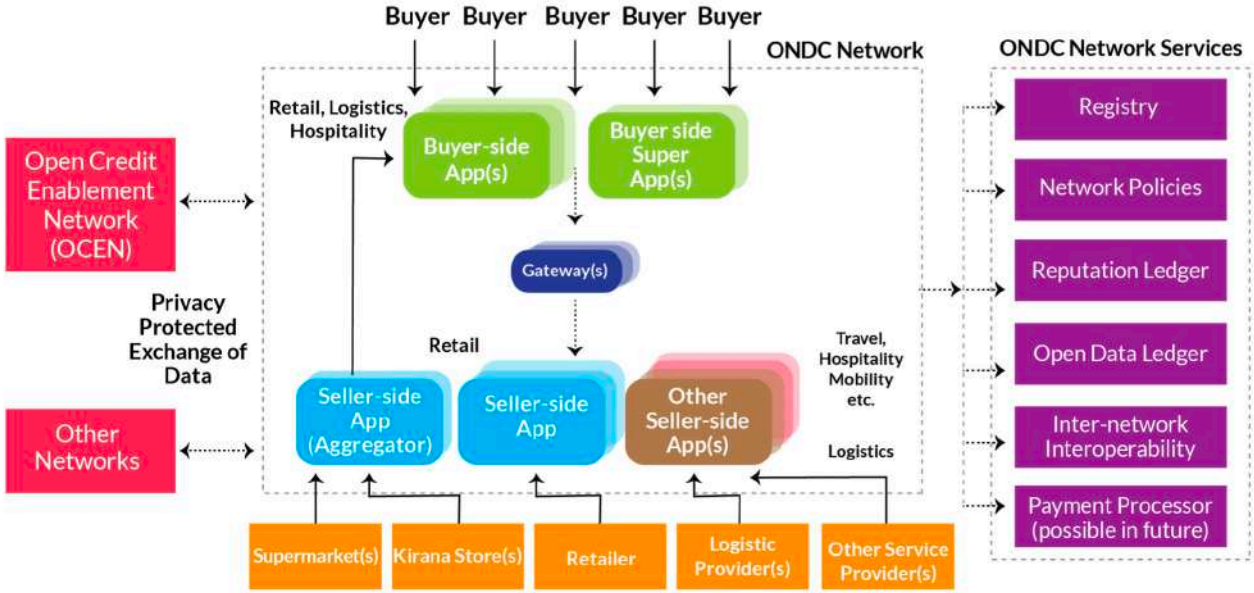


Fig 6: Components of an open network enabled by ONDC. Source: ONDC

Christensen, profits will most likely shift to a different stage in the value chain over a period of time. Where exactly that might be and which solutions and offerings would become the next source of proprietary value might be a little hard to pinpoint with certitude at this stage, but improved user experience; orderly, responsive, and convenient sorting of the catalogue; seamless retrieval and presentation of data across platforms; proficiency in provision of specialised services such as accounting solutions for B2B transactions; furnishing of enhanced features by utilising advanced technology stacks and tools such as AI/ML; and transparency and higher trust for SME lending could emerge as strong contenders. As one of the panellists at 3one4 Capital's event explained, once access to the pool of buyers, sellers, and products is universalised, the axis of value creation in the digital commerce industry will shift away from "what" utility is delivered to the end consumer to "how".

There is another frame of reference for scrutinising ONDC's relation to attractive profits. DPGs in general, and ONDC in particular, have been designed with an unequivocal normative commitment to ensuring equitable access and helping ecosystem participants repel incumbent monopolistic forces. In its Strategy Paper, ONDC has explicitly called out existing marketplaces and their adverse impact on healthy competition- "The rapid growth of these platforms has limited the competitiveness of new sellers coming online except as part of an established end-to-end service provider. Although more platforms can and do come online, the extent of investment required to establish such integrated solutions limits the number of players."[9] Elsewhere, while discussing concentration and its corresponding facets the same Paper states, "the platforms become 'operators' within the market and the small and medium businesses lose the choice and freedom of participation at their own will or terms."[10]

Numerous instances from the past have made it clear that the mere presence of DPGs is not enough to ward off monopolistic impulses within a given sector.[11] Having an open-source framework surely helps; it is, however, a necessary but not sufficient condition to prevent market capture. Similarly, having multiple actors with varying objectives and interests—a scenario taken for granted in the case of DPGs—cannot by itself ensure optimal provisioning of the good in question. In such a scenario, it becomes increasingly pertinent to consider two other questions in addition to the one on the conservation of attractive profits. Firstly, how quickly do attractive profits emerge, or reemerge, once unbundling takes place? And secondly, is the resultant period dominated by open-source, modular architectures durable? In other words,

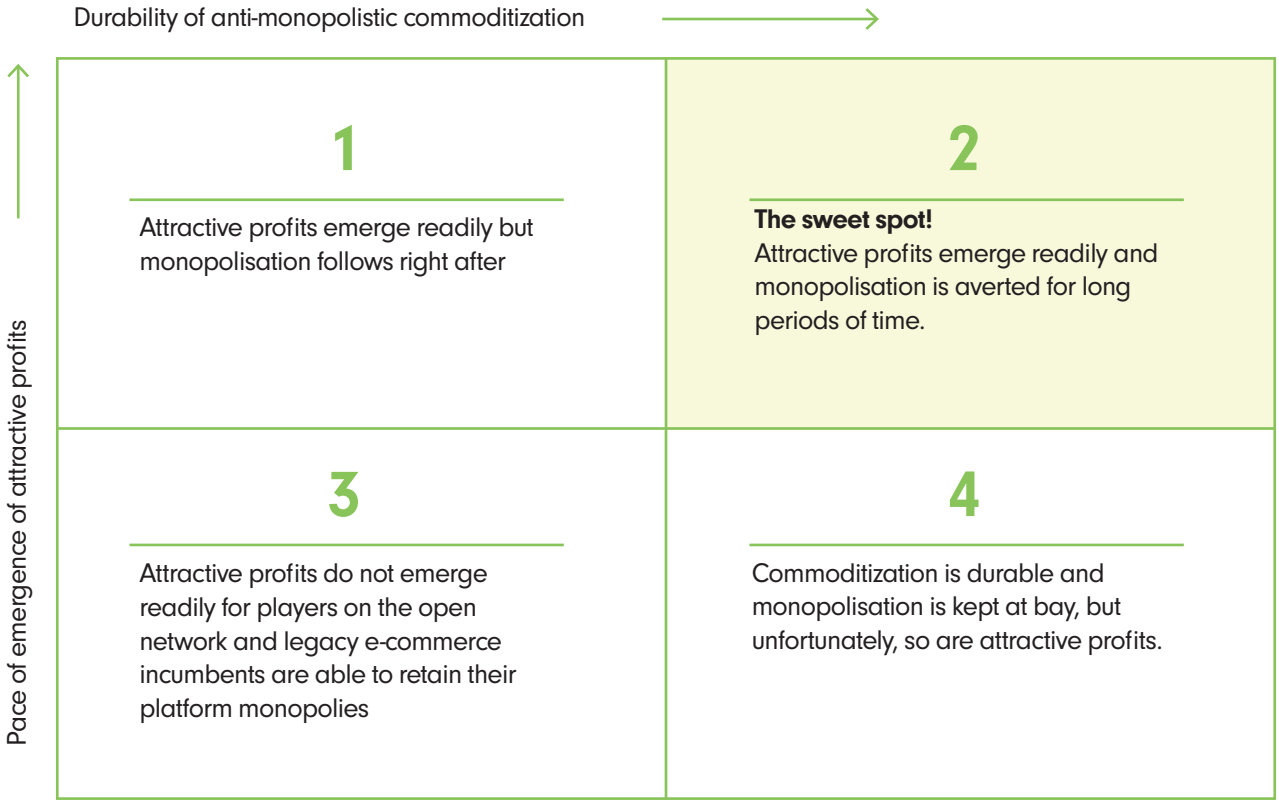


Fig 7: Scenario matrix for ONDC. Source: 3one4 Capital Analysis

can ONDC successfully stave off monopolisation for long? It would be premature to draw out clear-cut, linear growth trajectories for ONDC or network(s) enabled by it given that its implementation is still at a nascent stage. Regardless, some degree of speculation will not be unwarranted. Several different scenarios can play out, but they can still be mapped out, albeit in a highly simplistic and rather rudimentary manner, along the matrix given in Figure 7.

ONDC must be designed and implemented in such a way that its outcomes are compatible with the situation described in the second quadrant. Suitable building blocks are already in place; the use of open protocols and early signs of widespread participation should bode well in this regard. The exact trajectory it takes will undoubtedly depend on a host of factors including continued cooperation from existing players; appropriate alignment of incentives; suitable regulatory provisions and their proper enforcement; ease of understanding and use by end consumers; seamless flow of value and information across the network's constitutive interfaces; and smooth functioning of common network services such as the regular maintenance of a compatible reputation ledger, common registry etc.

ONDC has the potential to irreversibly disrupt the digital commerce setup in India by facilitating a momentous transformation of the rules of the game and levelling the playing field. A reasonable degree of initial hesitancy around its functioning and potential impact is natural given the paucity of understanding about the kind of changes it will beget. Yet, efforts must be undertaken to build confidence among e-commerce stakeholders and the community at large. Businesses must be persuaded to recognise the absolutely gargantuan size of the opportunity that an open network backed by ONDC presents.

To circle back to Christensen again: yes, the locus of the ability to differentiate will shift as new waves of disruption wash over the industry. ONDC is indisputably the biggest wave of disruption India's digital commerce sector is likely to witness in the near future. Businesses would do well to prepare to ride it.

3one4 Capital's Contribution to Policy

Given the fast-moving nature of the startup ecosystem and, subsequently, the venture capital and private equity industries, policy and regulatory frameworks must keep pace with the developments and respond with the necessary changes to keep the momentum going. Drafting the required regulation and policy falls under the ambit of the government and the various regulatory bodies. However, it is incumbent upon capital providers and industry experts to aid the government and regulators by providing them with the latest industry updates, sharing their know-how and suggesting frameworks and remedies that support the sustainable growth of the ecosystem.

India's startup ecosystem is just over a decade and a half old and is molded by the regulations that never conceived of this volume of digital-first, innovative businesses. Some of this operational friction has resulted in startups choosing to domicile overseas as opposed to staying back in India. Early-stage ventures are particularly vulnerable to drastic regulatory changes as they lack the cushion of capital or processes to absorb such shocks. The Economic Survey of 2023 has also highlighted this issue of "flipping" or moving the headquarters overseas due to concerns over the ease of operations, regulations, taxation, and more.

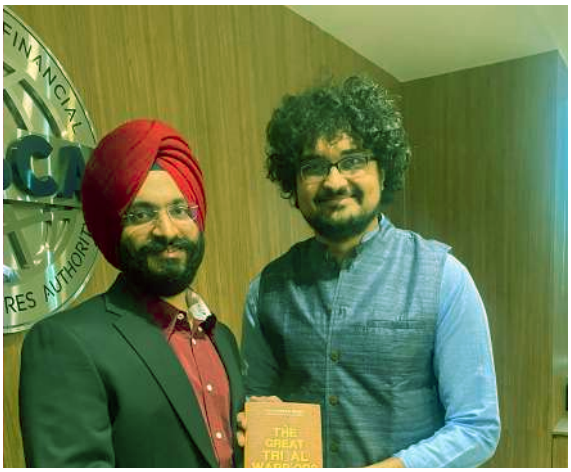
FY 2022-23 was the year in which regulations finally caught up with innovation. The funding winter was exacerbated by a slew of regulatory actions, circulars and notifications aimed at formalizing various sectors like fintech, gaming, and more. Amidst these circumstances, we're glad to report that 3one4 Capital's no-compromise approach to governance and regulatory adherence helped our portfolio companies to navigate the regulatory dislocation.

Since its inception, 3one4 Capital has taken the lead in working with regulators and government bodies to create a favourable regulatory clime for entrepreneurship to flourish in India. This has happened through a combination of working with government and regulators on various panels and committees and publishing regular thought leadership pieces and reports on matters concerning entrepreneurship and the formation of a robust domestic capital base.

Participation from industry in regulatory fora is essential to ensuring that the regulator takes into account the voices of all stakeholders before issuing the final draft. In this, the lack of industry participation has often resulted in a regulatory framework that may not account for all operating models, leading to unintended consequences. In this regard, we have always advised our portfolio companies operating in regulated sectors to approach the sectoral regulator to seek clarity or regulations on business models. These should always be principal-led discussions as opposed to being delegated out to third parties. We have also encouraged our portfolio companies to create industry bodies to engage with the regulatory machinery such that they can represent the interests of their entire ecosystem. The recent push by the regulator for Self Regulatory Organizations is a testament to this thought process. The policy vacuum created by industrial inaction is counterproductive to the growth of any nascent industry.

3one4 Capital's work on this matter ranges across the following sections:

1. Op-eds on matters related to investors and startups
2. Playbooks, reports and knowledge series developments
3. Industry and stakeholder representation and consultations
4. Participation in regulatory committees, working groups and fora



1. OP-EDS ON MATTERS RELATED TO INVESTORS AND STARTUPS

ANGEL TAX

Angel Tax (Section 56(2)(viib) of the Income Tax, 1961) was a section inserted in 2012 to prevent the laundering of funds via investments into shell companies. Unfortunately, this section was misapplied to Indian startups who raised capital from investors, leading to capital getting taxed as income. Siddarth Pai has written extensively about the issue for years and has been part of several delegations to the government and the tax department on the matter. He was also part of the committee to examine the section and create safeguards for Indian startups, leading to the Form 2 exemption from Angel Tax for Indian startups.

BUDGET 2023

The annual Indian Budget speech is the articulation of the Indian government's fiscal stance for the year. It also espouses a variety of policy initiatives for various sectors, including Startups and Investors. Siddarth annually breaks down the Union Budget for startups and investors, adding commentary on the measures as well as making representations on the same. The presentation of the Budget document by the Union Finance Minister is a watershed event for all stakeholders, especially with regard to matters dealing with taxation, public capital allocation, and industry promotion schemes. 3one4 Capital has been an active

Siddarth Pai, founding partner, 3one4 Capital & co-chair, Regulatory Affairs Council, IVCA

Opinion

Budget 2023: Tax Rates Need To Be On Par For Listed Companies & Start-ups

By Siddarth Pai

January 04, 2023 at 4:04 PM

AS THE WORLD LOOKS UP to India to be the engine of growth for the coming decade, showing the highest growth rate amongst G20 nations, for New India — consisting of the innovation economy of start-ups and investors, the budget expectation is two-fold.

Unlocking Rupee Capital

The Indian stock markets demonstrated resilience during the global bloodbath. Global fund managers left their Indian positions as it was the only island of gains in a sea of despondence, allowing them to offset global losses. Indian indices could only show such resilience due to the "mutual fund moment" for Indian capital markets, which can be described as the convergence of factors — TEAM — that deepened retail participation in listed equities. It includes:

* Technology (Aadhaar, UPI for verification and frictionless investments)

* Economics (liquidity and favourable tax regime)

* Access (low ticket size, zero-cost brokerage)

* Market (falling stock prices, rising interest post Covid)

OPINION

Budget 2023: Tax Rates Need To Be On Par For Listed Companies & Start-ups

Despite funding to start-ups going towards asset creation and jobs, tax rate and holding period are twice that of listed securities.

By SIDDARTH PAI, Jan 4, 2023 | 4 min read

BUSINESS

Budget 2023-24: Setting the tone for the next 25 years of sustained growth

January 9, 2023, 2:34 PM IST / TV Mohandas Pai and Nisha Holla in Voices, Business, TOI

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Home / Finance / Budget 2023 Fails To Deliver For Startups And Investors

Budget 2023 Fails To Deliver For Startups And Investors

By - Siddarth Pai
01 Feb 2023

Budget 2023: An opportunity to make the Indian tax regime globally competitive

The government must seize the opportunity to resolve long-standing taxation issues in Budget 2023. The personal income tax regime needs to be simplified for all classes of taxpayers, capital gains taxes streamlined and policies made less litigious

TV MOHANDAS PAI & NISHA HOLLA | JANUARY 11, 2023 / 07:49 PM IST

Budget 2023: Startups fear angel tax provisions will repel foreign investors

Grappling with a funding winter, startups worry that the angel tax on foreign investors will aggravate their problems

SIDDARTH PAI | FEBRUARY 01, 2023 / 05:39 PM IST

Budget 2023 must lower barriers that chase out startups from India

Budget 2023: The lack of policy penetration, legacy artefacts in Indian regulations and restrictions on operations are pushing Indian innovation overseas

SIDDARTH PAI
JANUARY 03, 2023 / 11:55 AM IST

contributor to discussions and debates surrounding the Budget and has continually pushed for streamlined taxation structures and industrial policies. For instance, investors in Indian startups are taxed at twice the rate as listed markets despite such investments being considered to represent a risky avenue due to the high degree of uncertainty. The investments into startups are mostly primary investments which go into new asset creation, hiring, product development, etc – all economically accretive. The call for "One Security, One Tax" has been a long standing ask for Indian investors and entrepreneurs. 3one4 Capital has pushed for it on multiple occasions. The annual Indian Budget speech is the articulation of the Indian government's fiscal stance for the year. It also espouses a variety of policy initiatives for various sectors, including Startups and Investors. Siddarth annually breaks down the Union Budget for startups and investors, adding commentary on the measures as well as making representations on the same.

JOB CREATION

3one4 Capital has often drafted policy recommendations to boost employment and job creation, especially in areas with relatively lower development levels.

CREATING JOBS

BUDGET FY24 MUST PROVIDE TAX INCENTIVES FOR 'SPECIAL EMPLOYMENT ZONES' IN BACKWARD DISTRICTS THAT HARNESS THE EMPLOYMENT POTENTIAL OF PLI & OTHER SCHEMES

Need a new 'SEZ'

TV MOHANDAS PAI & NISHA HOLLA

Respectively, chairman, Aarin Capital, and technology fellow, C-CAMP

Job creation between FY19 and FY23

Financial year	Subscribers: Net new EPF	Net new ESI
2018-19	1,12,50,314	24,95,592
Ages 18-25	50.1%	48.3%
Women	21.0%	16.6%
2019-20	9,47,268	15,345,263
Ages 18-25	53.4%	48.6%
Women	22.8%	17.9%
2020-21	9,454,119	11,909,202
Ages 18-25	51.4%	46.4%
Women	22.8%	16.3%
2021-22	13,820,141	14,913,698
Ages 18-25	52.4%	48.2%
Women	25.4%	18.5%
2022-25(A pr'22-Oct'22)	9,160,261	10,097,326
Ages 18-25	51.0%	47.9%
Women	26.5%	19.1%
Total	61,242,017	74,962,488

Source: EPF, MOSPI

FINANCIAL EXPRESS Thu, 19 January 2023 https://epaper.financialexpress.com/c/71452255

INDIA'S STARTUP ECOSYSTEM

3one4 Capital supports the growth of domestic capital pools and the greater deployment of that capital into Indian startups. It also strongly supports measures to stem, and ideally reverse, the trend of Indian startups domiciling under jurisdictional preserves other than India.

INVESTMENT BLUES

BY PUSHING DOMESTIC INVESTORS TO THE SIDELINES OF THE TECH INNOVATION AND START-UP ECOSYSTEM IN INDIA, POLICIES RISK MAKING THE COUNTRY A DIGITAL COLONY

Aatmanirbharta on funding

TV MOHANDAS PAI & NISHA HOLLA

Respectively, chairman, Aarin Capital, and technology fellow, C-CAMP

To ensure that the start-up ecosystem's tremendous absorption capacity is not dominated by foreign capital, India needs more Fund of Funds. The govt must analyse and remove impediments for entry of domestic institutional capital, such as insurance firms and pension funds

FINANCIAL EXPRESS Wed, 25 January 2023 https://epaper.financialexpress.com/c/71585796

India's Unicorn Step-Function Growth Signals the Emergence of its Innovation Ecosystem

AUTHOR : NISHA HOLLA

Expert Speak India Matters

Published on Apr 28, 2022

Author

Nisha Holla

This article is part of the series – Raisina Files 2022.

CORPORATE GOVERNANCE

As startups continue to redefine industries and push boundaries, the foundation of strong governance practices stands as a guiding force, steering these ventures towards sustainable growth, investor confidence, and ethical excellence. Exploring the intricate interplay between innovation and governance unveils a narrative that resonates far beyond boardrooms – one that shapes the very trajectory of India's entrepreneurial landscape. 3one4 Capital has frequently offered insights into how founders and companies can navigate evolving regulations, while achieving a harmonious balance between growth and governance.

BANK COLLAPSE

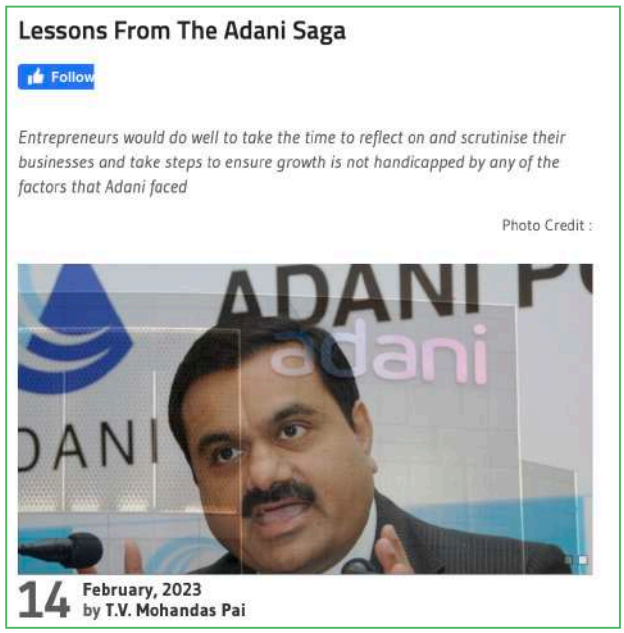
SVB'S COLLAPSE MAKES IT CLEAR THAT STARTUPS SHOULD FOCUS ON THEIR DOMICILES, AND INDIAN REGULATORS MUST FACILITATE EASIER CONDUCT OF BUSINESS HERE

Lessons from the SVB debacle

TV MOHANDAS PAI & NISHA HOLLA

GIFT City is India's answer to the current export of financial transactions overseas, and it must step up to solve the problems faced by incoming investments as well

FINANCIAL EXPRESS



Lessons From The Adani Saga

Follow

Entrepreneurs would do well to take the time to reflect on and scrutinise their businesses and take steps to ensure growth is not handicapped by any of the factors that Adani faced

Photo Credit :

14 February, 2023 by T.V. Mohandas Pai

Explained | How a new angel tax provision has struck fear in startups, VCs

In an about-turn that no one saw coming, the government seems to have tightened the noose on foreign funding for startups even as the sector grapples with a funding crunch with no end in sight

DEEPSEKHAR CHOUDHURY | FEBRUARY 06, 2023 / 02:41 PM IST

Onshoring Indian innovation

SIDDARTH PAI
TV MOHANDAS PAI

Many entrenched issues in the Indian policy landscape are forcing 'flipping'—startups founded by Indians, operating in India, but getting domiciled overseas

Lack of Rupee Capital participation, onerous taxation norms, among other factors, push startups abroad

2. PLAYBOOKS AND KNOWLEDGE SERIES DEVELOPMENTS

DECODING TERM SHEETS

Term Sheets are amongst the essential documents for fundraising by startups. For the startup ecosystem to grow, it is essential for entrepreneurs to be familiar with such documents. Siddarth wrote an entire primer on term sheets which explains the various clauses, their origins, their interplay with governance and the questions that entrepreneurs should ask during such negotiations.

INC42 MASTERCLASSES

Siddarth and Anurag, partners at 3one4 Capital, were both instructors at AngelX, a live cohort-based four-week programme beginning August 20, 2022, to help HNIs master the art of angel investing.

INC42 FINTECH SUMMIT

Siddarth was a speaker at Inc42's Fintech Summit held in July 2022. The Summit is India's premier fintech conference which convenes India's leading fintechs, financial institutions and tech firms under one virtual roof for a dialogue on how fintech will shape up India's new economy.

VISTRA'S FINCLAVE "UNBUNDLING INDIA BUDGET 2023"

Siddarth was part of an expert panel on, "AIFs in India and IFSC", looking at the journey of AIFs in the country thus far and the prospects ahead.

3. INDUSTRY AND STAKEHOLDER REPRESENTATION AND CONSULTATIONS

ISPIRT

iSPIRT (Indian Software Products Industry Round Table) is a think tank for the Indian software products industry. They developed a framework known as the "Stay in India" checklist – a series of measures to help Indian startups remain domiciled in India while being globally competitive. The group is often consulted by the government as a forum for understanding the issues facing Indian startups. Siddarth has been working with them for over 7 years on matters such as ESOP rationalisation, ease of doing business for startups, raising capital incorporation, etc.

IVCA

The Indian Venture and Alternate Capital Association (IVCA) is the apex industry body for promoting the alternate capital industry in India. Siddarth is the youngest Executive Council member of the IVCA, serving his second term. He's also been the co-chair of the Regulatory Affairs Committee, working with the regulator on several matters related to venture capital funds. A number of his submissions on increasing the overseas investment allowance for AIFs, allowing venture capital funds to invest in NBFCs and fintechs, ring fencing of the assets and liabilities of each

venture capital scheme has resulted in changes to the operating framework.

PEVCCFOA

The Private Equity Venture Capital Chief Financial Officer Association is an association of financial professionals and for finance professionals in the alternative investing landscape in India. The aim of the organization is to empower the CFOs to discharge their fiduciary responsibility, improving compliance standards and practices and create greater value to the ecosystem. The organization promotes knowledge sharing, regulatory dialogues, forums and network formation that will offer tangible benefits on the role of finance professionals in the field of private equity and venture capital investing. 3one4 Capital is a founding member of this group.

CII STARTUP COUNCIL

CII (Confederation of Indian Industry) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes. Their Startup Council aims to promote cross pollination between Indian industry and startups. Siddarth works closely with them on this aim as well as policy matters to boost the competitiveness of Indian startups.

IAMAI

3one4 Capital is a Member of the Venture Capital (VC) committee formed by the Internet and Mobile Association of India (IAMAI) to address issues faced by VC firms and their portfolio companies. The committee works on public policy consultations, stakeholder engagement, and ecosystem enhancement. The committee envisions to take up sector-specific challenges faced by startups such as "on direct foreign listing of Indian start-ups, clarification on gift tax, among others".

Siddarth Pai Appointed as a member of SEBI AIPAC

Siddarth Pai was appointed as a member of SEBI AIPAC (Alternative Investment Policy Advisory Committee). Notably, Siddarth is also the youngest member of this esteemed committee. SEBI is the regulatory body for securities and commodity markets in India under the ownership of the Ministry of Finance within the Government of India.

SEBI's AIPAC is dedicated to shaping the future of Alternative Investment Funds (AIFs) and the dynamic start-up ecosystem in India. This committee advises SEBI on various vital aspects, including:

- **Ecosystem Development:** Providing valuable insights and recommendations for the growth of the alternative investment and start-up ecosystem in India.
- **Hurdle Identification:** Identifying obstacles that may impede the progress of the alternative investment sector.
- **Regulatory Interventions:** Recommending regulatory actions to address market practices that are problematic.
- **Collaboration:** Facilitating collaboration with other regulatory authorities to support the development of the alternative investment industry.

Relevant Matters: Addressing any other pertinent issues related to alternative investments and India's start-up ecosystem.

With elite industry representatives such as these brought together, the regulator's positive approach to crafting the industry's growth forward is encouraging to all asset managers in India. At 3one4 Capital, we eagerly anticipate the positive impact that this committee, with Siddarth Pai among its distinguished members, will continue to contribute to our industry.

4. PARTICIPATION IN REGULATORY COMMITTEES, WORKING GROUPS AND FORA

Representations to the Parliamentary Standing Committee on Finance

The Parliamentary Standing Committee on Finance comprises members of parliament for the purpose of oversight over the ministry of finance, corporate affairs, etc. Siddarth has presented the AIF industry before the Committee, being the youngest person to do so. The report released by the committee acknowledged the role that PE/VC Funds play in the country and the measures that must be undertaken to allow them to contribute to the economic development of India.

Representations to the Damodaran Committee on PE and VC Investments

The Damodaran Committee on PE and VC Investments was constituted by the Government of India to closely examine the interplay of regulations on PE/VC investors and to advice the government on measures for the growth and development of the industry. Siddarth was amongst the members who were chosen to represent the industry and articulate their requirements and requests for the sustained growth of capital flows into India.

SEBI Working Group for review of the regulatory framework for overseas investment by AIFs/VCFs

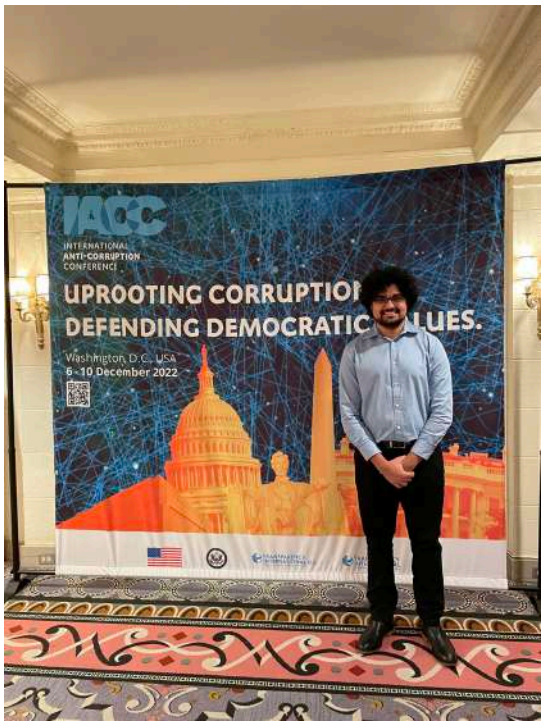
SEBI constituted a working group to examine the regulatory framework for Indian AIF s to make overseas investments. Siddarth was a member of the same and their recommendations for liberalisation of the framework to make Indian AIFs more competitive was well received by SEBI, with several of them being acted upon.

IFSCA Expert Committee on Onshoring Indian Innovation to GIFT IFSC

Siddarth was appointed as a Member of an expert committee constituted by the IFSCA to suggest measures to encourage the Indian startups domiciled abroad to relocate to GIFT IFSC and to identify issues that may be critical for the development of GIFT IFSC as a global Fintech Hub.

Anti-Corruption

3one4 Capital was featured at the International Anti-Corruption Conference 2022 for a session on Anti-corruption Challenges and Opportunities in Impact Investing.



Innovation has always outstripped regulation, and regulators often react to market practices in the dialectic underpinning the relationship between regulations and industry. The only analogue to the interplay of entrepreneurship, capital and policy would be the famous three-body problem in physics, wherein one can't predict the movements of three bodies due to how they influence each other. A two-body system is solvable as one can describe their influences mathematically with respect to each other, allowing the creation of a general solution. Adding just another body into the system creates chaos by exploding the number of unknowns beyond the number of equations that can define the system. This leads to a deterministic system that is inherently chaotic. Deterministic chaos is the ideal phrase to describe the interplay of entrepreneurship, capital, and policy.

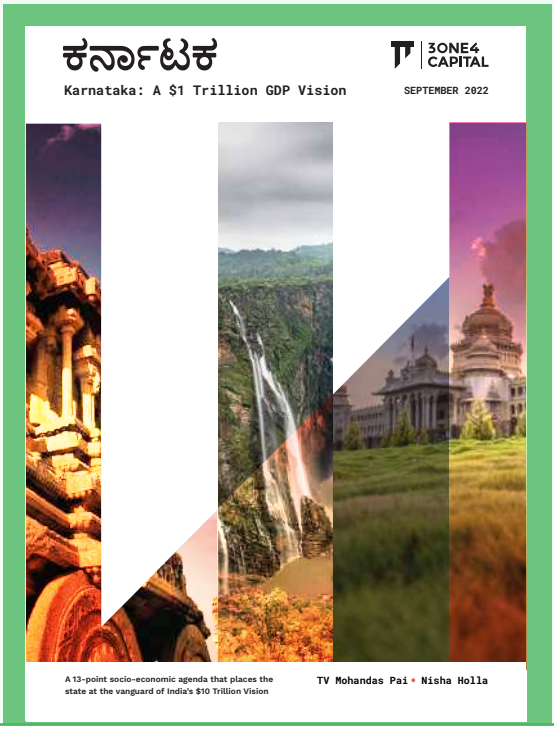
Karnataka: A $1 Trillion GDP Vision - Report by 3one4 Capital

We are proud to announce the launch of 3one4 Capital's 13-point socio-economic agenda that places Karnataka at the helm of India's $10 trillion vision.

The report was launched by the Hon. Chief Minister of Karnataka, Shri Basavaraj Bommai, in the presence of Smt Vandita Sharma, Chief Secretary, Shri ISN Prasad, Additional Chief Secretary and Development Commissioner, Dr Shalini Rajneesh, Additional Chief Secretary, and 3one4 Capital's TV Mohandas Pai, Nisha Holla, Pranav Pai, and Siddarth Pai.

This report analyses the state's economic indicators and identifies factors that contribute to Karnataka's position among India's Top 5 state economies. The state hosts robust agricultural and industrial sectors, 66% of its economy comes from services, and it has the highest per-capita income.

Bangalore is now the innovation capital of India, is amongst the top 5 cities driving tech innovation globally and has attracted over $62 billion in investments for startups since 2014.



Given Karnataka's economic prowess, it was not surprising when the state grew past the recessionary effects of the pandemic while delivering economic security for those in need. The report calls for a re-evaluation of the state's growth drivers in light of this recovery to reach the upcoming golden targets of $500 billion GDP by 2026 and $1 trillion GDP by 2032 from the FY 22 GDP of $273 billion.

The strategic growth plan proposed by the report is steeped in rich data and the multidisciplinary expertise of the authors. It closely analyses the third-largest state economy in the country and suggests ways to maintain its high-economic output with a citizen-first worldview.

The report is available for download on our website.

Following the launch of this seminal report, the Karnataka government under the leadership of the Planning, Programme Monitoring and Statistics Department, GoK, and FICCI-Karnataka assembled several domain experts in the fields of economics, urban and rural development, education, agriculture, manufacturing, construction, technology, and human development. The ensuing report ***$1Trillion Economy: Karnataka's Vision and Roadmap for accelerated growth in the coming decade*** is a first-of-its-kind document that takes the framework of 3one4 Capital's report and deepens the analysis, recommendations and projections. Members of 3one4 Capital were among the prominent visionaries and reviewers of this report, and have contributed thoughtful insights and recommendations in it.

The report is available for download on the GoK website.

At 3one4 Capital, we hope these forward-looking reports will prove to be great assets in driving the ground-up transformation underway and influencing policy decisions that will shape Karnataka's formidable story of growth and inclusive prosperity. These reports are now nation-wide benchmarks for state and national economic roadmaps.

India's sustainable growth story:

The next $10 trillion economy

The $10 trillion GDP goal and the need to develop sustainably

India today finds itself at multiple inflection points. Many deeply ingrained assumptions regarding India's consumption, demography, available wallet share, business landscape, and policy environment have been challenged over the last few years, often to an optimist's delight. India's macroeconomic environment has moved from a tightly-controlled *dirigisme* to one teeming with opportunity and enterprise, unleashing the natural entrepreneurship in its young and ambitious citizens. Its pace of and capacity for change have certainly surprised even its most informed citizens.

The government has played a leading role in this shift by: executing policies to lift millions out of poverty; broadening access to civic amenities; improving education and health outcomes across income segments; supporting the growth of the new middle class and their dynamic consumption curves; building universally accessible technological rails to democratise digital innovation; enhancing the ease of doing business and boosting investor confidence; promoting tectonic shifts to low carbon industry, energy, and transport; and most importantly, setting audacious visions and targets for the country to rally behind. Multiple initiatives in the pipeline, including the National Education Policy (NEP) and ONDC seek to build on the momentum of the last decade. There is undoubtedly more to do, and sustainability lends an exciting new dimension this decade.

Advanced estimates of India's nominal Gross Domestic Product (GDP) in FY 24 are at INR 296.57 trillion[1] or USD 3.62 trillion (at USD 1 = INR 82). The Government of India had announced a bold vision of maturing into a USD 5 trillion economy by 2025. With the COVID-19 recessionary impact in FY 21, the USD 5 trillion goal may be set back to 2026 or 2027. Regardless, every growing economy needs an ambitious goal that all stakeholders can align to and focus on. Looking past USD 5 trillion to the significant goal of USD 10 trillion: only two countries have grown beyond USD 10 trillion—the US and China. India is poised to be only the third economy to break through this ceiling, with favourable tailwinds in domestic consumption, demographics, open market economics and accelerated adoption and development of technology. With a focused agenda, India could join the USD 10 trillion economy club by 2031-32.

To reach this vision, India must first take stock. As shown in Table 1, in FY 24, India's nominal GDP is estimated at INR 296.57 trillion or USD 3.62 trillion (at INR 82 = USD 1) at a growth rate of 8.9% during the FY. Previously, the GDP grew 16% over FY 23, and 18.5% over FY 22. These growth rates are higher than normal – a result of the 3% decline over FY 21 due to the pandemic, followed by the economy rebounding strongly in FY 22 and FY 23. The sub-10% growth in FY 24 is due to a one-time exercise in deflating the WPI. India is expected to continue its strong growth trajectory this decade.

If India grows at a CAGR of 11.4% for the next three years, starting at USD 3.62 trillion, the USD 5 trillion goal by FY 27 is well within reach. Similarly, to reach USD 10 trillion by FY 32, India must continue growing at 14.9% CAGR in dollar terms from USD 5 trillion in FY 27 – in constant currency of INR 82 = USD 1. Putting aside considerations like the depreciation of the INR, the critical issue is, can India sustain 14.9% growth p.y. over the next decade?

India - Gross Domestic Product Growth (Nominal)			
FY	INR (lakh crore)	USD (trillion)	CAGR needed
2023-24 (E)	296.57	3.62	-
2026-27	410.00	5.00	11.4%
2031-32	820.00	10.00	14.9%

Table 1: Growth rates required for India to reach USD 5 trillion in 2027 and USD 10 trillion in 2032. Source: MOSPI (CAGRs estimated based on MOSPI data)

To answer this, one must look at India's past growth. When India's economy liberalized in 1991, GDP was USD 275 billion or INR 5.32 lakh crore; reaching USD 3.62 trillion in FY 24 translates to a growth of 8.1% per year in dollar terms—despite the recessionary effect of the pandemic. 8.1% p.y. growth in dollar terms for 33 years is phenomenal and a testimony to India's healthy growth drivers. This translates to 13% in rupee terms, the difference stemming from the USD-to-INR conversion dynamics and inflation. Given India's strong 33-year history and capacity for growth, it is possible for India to grow at the 14.9% CAGR in rupee terms required to meet its USD 5 trillion and USD 10 trillion targets this decade, but only with a focused agenda and rebalancing of investment and resources.

Primary among the rebalancing concerns is sustainability. India cannot take the pollution-heavy route to development that the US, China, UK, France and other developed nations have. India's average per-capita income has exceeded USD 2,000 (INR 2,12,600[2] translating to USD 2,593), signalling that the economy has firmly moved from sustenance to consumption-driven. When China, the only other comparable economy population-wise, crossed this milestone, its ecological footprint expanded unsustainably.

Socio-economic development necessitates expanding the production and consumption of goods and services, increasing energy consumption, urbanization and industrialization. The nation must find a sustainable but practical way to drive the socio-economic development of 1.4 billion people. India has already taken several steps towards sustainable development. The nation has aligned fully with the Sustainable Development Goals (SDG) framework. It has also made significant commitments at COP26 where Prime Minister Modi announced five essential elements, the 'panchamrit', of commitments to deal with climate change. These ambitious targets testify to India's earnestness towards the causes of climate mitigation and a just transition. The targets for India include-

1) Achieving Net Zero emissions by 2070.

2) Taking its non-fossil energy capacity to 500 GW by 2030.

3) Meeting 50% of its energy requirements from renewable energy by 2030.

4) Bringing down its total projected carbon emissions by one billion tonnes from now till 2030.

5) Reducing the carbon intensity of its economy by more than 45 percent by 2030.[3]

Recently, in August 2022, India submitted its updated nationally determined contributions (NDCs) to the UNFCCC. The initial iteration was submitted in 2015 comprising eight goals, three of which had quantitative targets to be achieved till 2030. India has again submitted eight NDCs with two important updates: i) adopting a more ambitious target to reduce the emissions intensity of its GDP by 45 percent till 2030 based on 2005 levels, up from 33-35 percent in the 2015 version; and ii) Increase the target for cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, up again from 40% in the 2015 version.

In line with the Prime Minister's proposal of a "One-Word Movement" in the context of climate, India has also submitted an NDC to promote LIFE - Lifestyle for Environment as a citizen-centric, sustainable, and environmentally conscious way of living based on values of conservation and moderation with an aim to combat climate change.

Aligning to the Sustainable Development Goal framework

The 2030 Agenda for Sustainable Development is a comprehensive framework launched by the United Nations and adopted by the member states in 2015. India is a prominent signatory and has integrated the framework into its socio-economic policymaking. It uses the SDG blueprint to track the progress at the national and state levels.

Under the leadership of the National Institute for Transforming India (NITI Aayog), several initiatives and dashboards have been launched by keeping the SDG framework at the core. The SDG India Index, for instance, is an India-specific dashboard that tracks the progress and implementation initiatives of Indian states and union territories against the 17 SDGs and sub-indicators.[4] The Index assigns points for the progress towards each sub-indicator and ranks the states and UTs overall and for each SDG. States can also benchmark against the overall India score, allowing for data-based planning to attain the goals in their jurisdictions.

The National Multidimensional Poverty Index (MPI) launched by NITI Aayog is another example of India's initiative in taking the UN SDG framework and guidance and converting it into an India-specific program. After evaluating various criteria and methodologies, an index that measured poverty across three dimensions and twelve indicators was organized.[5] A baseline was then created using the index and plugging in the data from the National Family and Health Survey 2015-16; this baseline provides a data-backed foundation to measure the progress of both India overall and the states/UTs in tackling poverty. As more data points are collected via NFHS-5, Census, and other surveys, these can be plugged into the MPI to provide valuable indications on the direction each state/UT has to take in tackling poverty, which dimension of poverty they might be doing well in and which has yet to progress, to allocate funding for the same, and assess timelines. Due to the richness of available data, the MPI can be extrapolated from the national level down to the district and taluk levels. The nation is indeed converting its advantage in collecting large tracts of data into actionable policy insights in this manner.

India's progress on the development indicators and future targets are examined here under three pillars:

UNLOCKING ACCESS	SUSTAINABLE CONSUMPTION & PRODUCTION	TOWARDS A RESILIENT FUTURE

UNLOCKING ACCESS

Poverty and deprivation stem from the inability to access amenities like water, food, shelter, healthcare facilities,and increasingly, a phone and the internet. The classic definition of poverty by the World Bank and other multilateral institutions is having less than $1.9/day to subsist on. In 1991, the World Bank estimates that 47% of India's population fell under this category. Post-1991, the percentage of poor (with <$1.9/day) in the population fell to 22% in 2011. A Brookings Institute report on 'Rethinking global poverty reduction' shows that The World Data Lab, which collates World Bank, IMF and Indian government survey data, estimates India's poor, per this definition, at 5 crores in 2019.[6] This marks a dramatic decrease from the 2011 estimation of 22% of the population to 4% in 2019. This is a tremendous achievement and is significantly driven by the government's development and digital focus.

India's developmental achievements in the 'Unlocking Access' pillar can be examined through the lenses of SDGs 1 (No Poverty), 2 (Zero Hunger), 3 (Good Health & Well Being), and 6 (Clean Water & Sanitation). Over the last decade, India has waged a multidimensional war on poverty and unlocked access to basic amenities for millions of Indians who now have a roof over their head, water in their tap, road connectivity, increased food security, electricity, LPG cylinders for cleaner cooking, access to education, financial inclusion, affordable healthcare, maternity benefits, and hygienic sanitation facilities. There are steady budget allocations towards improving these facilities.

HOUSING
3.34cr houses built since 2014, majorly in the rural areas.

ELECTRIFICATION
100% electrification of villages.

RURAL ROADS
Over 7 lakh km of roads and 6,000 bridges built since 2014.

FOOD SECURITY
All 36 states/UTs now covered vs. only 11 in 2014.

TAP WATER
14.2cr HH now covered, up from 3.3cr in 2014.

WATER INFRA
INR 3.6tn allocated to provide all HH piped water by 2024.

SANITATION
11.6cr HH have a toilet, India declared 100% ODF.

MOBILE COVERAGE
1.15bn, of which 520.6mn in rural areas.

INTERNET COVERAGE
885mn internet subscribers, with 50% in rural areas.

On healthcare access, the pandemic has exposed the gaps. World-class healthcare infrastructure is only available in the few urban agglomerations and is sparse in between; 75% of the total facilities are in urban areas.[7] Each district requires a 500-bed multidisciplinary hospital with an ambulance service, and every taluk and tehsil needs a primary healthcare centre to ensure coverage of India's 1.4 billion citizens. The government has allocated INR 100 crore to each district to upgrade and improve health delivery and pandemic preparedness.[8] The vision is also to have a medical college in each district to improve the human capital. This is much needed as, according to WHO recommendations, there is a deficit of 6 lakh doctors and 20 lakh nurses in the country. The nation is also making steady progress towards unlocking access to all with insurance coverage via Ayushmann Bharat, maternal and childcare via Intensified Mission Indradhanush, the focused increase in the number of medical seats, and the wide distribution of LPG cylinders to rural women which allows them to cook smoke-free and preserve lung integrity.

DISTRICTS HEALTH INFRA
INR 100cr/district allocated to build and upgrade health and pandemic infra.

PRIMARY HEALTHCARE
79,415 wellness centres set up, with 1.5 lakh more in the pipeline.

GAS CONNECTIONS
From 14.5cr (2014) to 31.4cr now, of which 9.6cr free to rural women.

NEW MOTHERS' WAGE COMPENSATION
Partial compensation of wage loss to take adequate rest around childbirth.

MATERNAL CARE
Maternal mortality rate declining rapidly, from 130 (2016) to 97 (2020).

CHILDREN IMMUNIZATION
Full immunization coverage increased from 62% (2016) to 76.4% (2021).

INFANT CARE
Infant mortality rate declining rapidly, from 37 (2015) to 30 (2019).

COVID-19 VACCINE
Administered cumulatively 220cr vaccines till January 2024.

AYUSHMANN BHARAT
54cr beneficiary base; 6.3cr free treatments availed already.

MEDICAL DEGREE SEATS
MBBS seats increased from 51k (2014) to 91k (2022).

MEDICAL PG SEATS
Medical PG seats increased from 31k (2014) to 45k (2022).

TELECONSULTATIONS
Teleconsultation market estimated at $800mn (2024), will greatly increase access.

SUSTAINABLE PRODUCTION AND CONSUMPTION

India must forge a socio-economic development path borne by sustainable production and consumption while also providing its massive population opportunities for employment and personal economic growth. Under this pillar, India's achievements and potential growth areas can be examined through the lenses of SDGs 7 (Affordable & Clean Energy), 8 (Decent Work & Economic Growth), 9 (Industry, Innovation & Infrastructure), and 12 (Responsible consumption and production).

The last decade has also seen a ramp-up in multiple economic growth drivers. India's construction sector has traditionally lagged behind economies like China and is a highly underutilized growth driver. The construction industry potentially has the highest backward linkage in terms of metal consumption, mass employment, and generation of taxes. Focusing on the construction industry will feed into other sectors, like manufacturing and production, export and trade.

China is a great case study. China rapidly urbanized from 26.4% in 1990 to 59.2% today. Urbanization significantly boosted the construction industry which grew at an average annual growth rate of 16.6 percent.[9] The industry's value-added output reached 5.57 trillion yuan (about $816.6 billion) in 2017, compared with only about 13.9 billion yuan in 1978. The industry's value-added output accounted for 3.8 percent of the country's GDP in 1978 and rose to 6.7 percent in 2017. In 1978, China only had 52,000 km of railways in operation. The length increased to 127,000 km by the end of 2017, including 25,000 km of high-speed railways. China has 130,000km of highways, the largest in the world, exceeding even the United States. It has been steadily adding 10,000km every year since 2011.

The consistent focus on infrastructure development has made the East Asian nation one of the most efficient economies for supply chain and cargo movement. India would benefit from such an approach as it would massively reduce the transport inefficiencies and high supply chain costs prevalent today; supply chain costs are an estimated 14% of GDP. India must aim for 7-8% of GDP, like China. The unified Goods and Services Tax (GST) system, adopted in 2017, is expected to reduce supply chain costs by 2% of GDP. The focus on infrastructure spending by the government, especially railways and road networks, targets a further reduction of 2%. The balance of 2-3% reduction will come from reconfiguring distribution networks and using large-scale technology platforms to optimize movement and reduce wastage. Sustainability and good governance practices are paramount to reducing inefficiencies.

Newer schemes like the National Logistics Policy (NLP) and the Pradhan Mantri Gati Shakti will ably complement the National Infrastructure Pipeline and other existing initiatives. With sector-specific logistics plans, the NLP will work on building world-class infrastructure and modern warehousing and help enhance tracing and tracking as well as ease of arranging shipment. There will be four critical features: Integration of Digital Systems, a Unified Logistics Interface Platform, an Ease of Logistics Service Portal, and a System Improvement Group. Taken together they should help India expand its reach, "reduce costs, and shore up export competitiveness."[10]

NATIONAL RAIL PLAN VISION – 2030
To increase modal share of the Railways in freight to 45%

NATIONAL INFRASTRUCTURE PIPELINE
Whole-of-government exercise to build world-class infrastructure in India, worth $1.4Tn over 5 years.

NATIONAL HIGHWAYS
Total length increased from 91,287km in Apr 2014 to 1,40,937 in Dec 2021. Targeting 25,000km by 2025.

DEDICATED FREIGHT CORRIDORS
DFCs crucial for increasing freight speed, frees up roads and railways for passengers.

PM GATI SHAKTI
Integrated planning and coordinated implementation of infrastructure connectivity projects.

NATIONAL LOGISTICS POLICY
Integrated digital system to integrate digital data belonging to various ministries, helping in smooth cargo movement.

AIRPORTS
Number increased from 64 (2014) to 118 (2022), target of 220 by 2025.

PORT CAPACITY
Increased from 870mt (2014) to 1,550mt (2021), 574 projects worth $82bn in the 2035 pipeline.

GOODS AND SERVICES TAX
Collected INR 103tn cumulatively under the unified GST.

Significant investment is being routed towards developing alternative energy sources to power India's economic growth ramp-up and meet its COP26 commitments. Apart from this, efficient resource utilization and optimization are prioritized, for example, drip and micro irrigation to reduce unnecessary water consumption, the mass move towards LEDs and smart meters for efficient energy consumption, public transit options like E-buses and Metro, and the proliferation of last-mile transport options like E-bike fleets.

India has emerged as a trailblazer in the global pursuit of a just transition, taking several giant strides in the recent past to enmesh a clean energy ecosystem that seeks to ensure access to affordable, reliable, sustainable, and modern energy for all its citizens. A few examples of India's leadership on clean energy include the creation of the world's first fully solar power operated airport at Cochin; the commitment by Indian Railways to achieve full electrification by 2024 and use solar power for its traction power needs leading to the transporter becoming a net-zero carbon emitter by 2030 in all likelihood; and India's achievement of its NDC target of having 40% of its total installed energy capacity come from non-fossil fuel based sources 9 years ahead of time.

India's renewable sector received record levels of investments in the 2021-22 financial year, totalling over USD 14 billion. India currently has the world's largest renewable energy expansion plan and has been at the forefront of renewable energy capacity installation, successfully catalysing state support and private investments to add around 15.4 gigawatts (GW) of renewable power capacity in 2021, the third highest after China and the United States. India also ranked third in the 2021 Renewable Energy Country Attractiveness Index (RECAI), cementing its place as a global hub for renewable energy.

According to the India Investment Grid portal, the business case emanating from India's renewable energy generation potential is extraordinarily positive, with over 530 opportunities at the moment worth USD 182.5 billion. India has allowed for up to 100% Foreign Direct Investment (FDI) under the automatic route for renewable energy generation and distribution projects. Between April 2000 and March 2022, FDI inflows in the non-conventional energy sector totalled USD 11.6 billion. The launch of the National Hydrogen Mission will further bolster India's standing as a major player in the new-energy space.

Solar power has been the mainstay of India's renewable energy play, with installed capacity increasing by over 18x since 2014 and further capacity additions slated to be on their way. 45 solar parks with an aggregate capacity of 37 GW have been approved in various regions of the country. The world's largest renewable energy park comprising a 30 GW solar-wind hybrid project is also currently under installation in Gujarat. These capacity additions come in the wake of the country already enjoying some of the lowest solar tariffs in the world. The recently introduced PLI Scheme for high-efficiency solar PV modules promise to further these trends while enhancing India's manufacturing capabilities and boosting exports.

From an energy standpoint, India's efforts at making its production processes more sustainable have predominantly focused on fossil fuel substitution— either directly, in applicable cases, or indirectly, through a greater reliance on electrification and a corresponding

move towards greening the grid by incorporating more renewable energy. The other set of strategies has mostly looked at making upstream processes more sustainable. In other words, making processes like metals mining and refining, steel production, and cement and concrete manufacturing, to name a few, less polluting and wasteful and more resource and energy efficient.

The abovementioned developments in the clean energy space have opened up avenues for broad-based green economic growth and millions of green jobs. As discussed in the climate-tech thesis, there has been a discernible shift in global consumer sentiment towards more sustainable consumption patterns, premised on a move away from the expedient-yet-wasteful consumption cultures prevalent in certain developed economies. In India's case, one of the most conspicuous shifts has come with the steady uptake of electric vehicles. The NITI Aayog's cumulative sales projections put the figure for India's EV adoption at 80 million electric vehicles by 2030. This can translate to more than INR 1 lakh crore in annual savings on oil imports and reduction of emissions by millions of tons besides the furtherance of a range of health and socio-economic outcomes. A recent report by EY, IVCA, and IndusLaw suggests that India's EV industry can create 10 million direct and 50 million indirect jobs by 2030.

ENERGY EFFICIENCY
36.9cr LED bulbs distributed since 2014.

RENEWABLE ENERGY
India achieved 40% energy install base from non-fossil sources 9 years ahead of target.

RENEWABLES INVESTMENT
Record levels of investment in FY 22.

3RD ON RECAI
India ranked third in 2021 on the Renewable Energy Country Attractiveness Index

SOLAR POWER
45 solar parks approved for aggregate capacity of 37GW across India.

RAILWAYS ELECTRIFICATION
Indian Railways committed to 100% electrification by 2024.

SUSTAINABLE AIRPORTS
World's first fully solar powered airport built at Cochin.

IRRIGATION EFFICIENCY
Multiple projects for drip and micro-irrigation underway.

SMART METERS
Replacing 25cr conventional meters with smart meters to weild power sector reforms.

ELECTRIC BUSES
India plans to buy 50,000 E-buses, which could facilitate 100% coverage in 5-7 years.

EV ADOPTION
India's EV base projected to reach 80mn by 2030.

LAST-MILE
Proliferation of sustainable last-mile options in the recent half-decade.

Many vectors have converged to drive India's employment and entrepreneurship capacity. India has added more than 5 crore identifiable jobs over the last eight years, a significant number of them in the formal sector. The Employee State Insurance (ESI) and Employee Provident Fund (EPF) databases are reliable proxies to track formal employment growth in India, as these databases only count beneficiaries – both existing and new – when the actual payment is made. In FY 23 alone, ESI added 1.67 crore new subscribers onto the system while EPF added 1.38 crore.[11] [12]

One criticism is that EPF does not indicate new jobs but only formalization because existing employees are inducted in this manner. This criticism doesn't hold because we can easily account for this. For example, 55,337 establishments remitted their first electronic challan in 2022-23; multiplying this number by 20 (minimum number of employees a corporation must employ to register on EPF) yields 11.06 lakh new subscribers which are existing employees getting formalized.[13] Subtracting 11.06 lakh from the net number of 1.38 crore in 2022-23 yields 1.27 crore new jobs. Further, new employees over the 20-employee minimum of these entities count as new jobs. Moreover, major developments on the social security front include the recently enacted Code on Social Security which extends social security coverage to unorganised enterprises and gives recognition to gig and platform workers.

Small-scale entrepreneurship has boomed with India's digital inclusion initiatives, discussed in detail later in this chapter. With unprecedented connectivity, mobile phone accessibility, internet coverage and, lately, smartphone availability, many Indians, both in the urban and rural areas, are embarking on novel business ideas – either as

greenfield ventures, brownfield ventures or supplemental income streams. The GoI's Mudra loan program has also added an impetus to this vector and has particularly given individuals from lower strata of society or in villages and small towns an opportunity to create decent work for themselves and the society around them. Indeed, there are many stories of these entrepreneurs successfully launching greenfield enterprises, expanding them, and providing decent work opportunities to their families and friends along the way. For example, the Union Bank of India counts amongst its Mudra success stories a loan given to Mr Chandrabali Verma who received information about this scheme in the local newspaper and applied. He expanded his agri clinic and business in Jayapur village, Varanasi, and now employs ten other people.

A major dimension to availing decent work and personal economic growth is insurance access, which can make a monumental difference when unexpected events happen. Ayushmann Bharat is addressing this in the health dimension, as discussed above. The government has launched several insurance schemes for accident and disability coverage and life insurance, which are backed by the government and hence available to a greater spread of lower-income households. Special carve-outs for women and other social groups are available with some insurance schemes.[14] Lastly, crop insurance with increased distress relief for crop damage has made a prominent difference in the lives and livelihoods of farmers in India. Nearly 12 crore farmers across the country also directly benefit from the PM-KISAN scheme, where they receive INR 6,000 annually as income support.[15] The minimum income support for farmers allows them to plan ahead for the crop and seasonal rotations, and to react faster to unexpected crop events.

EMPLOYEES' PROVIDENT FUND
1cr new subscribers every year. Record of 1.38cr new subscribers in FY23.

EMPLOYEES' STATE INSURANCE
1cr new subscribers every year. Record of 1.67cr new subscribers in FY23.

CODE ON SOCIAL SECURITY 2020
Extends social security coverage to unorganised enterprises, recognises gig and platform workers.

MOBILE PENETRATION
1.15bn, of which 520.6mn in rural areas.

RURAL INTERNET ACCESS
2+ lakh gram panchayats equipped with fibre optic cable connectivity.

INTERNET SUBSCRIPTION BASE
885mn internet subscribers, with 50% in rural areas.

SMARTPHONE COVERAGE
750mn smartphone users.

MUDRA ENTERPRENEURSHIP LOANS
43.6cr loans sanctioned

ACCIDENT INSURANCE
34cr citizens enrolled in government-backed accident insurance.

LIFE INSURANCE
16.2cr citizens enrolled in government-backed life insurance.

CROP INSURANCE
11.4cr farmers registered for crop insurance.

TOWARDS A RESILIENT FUTURE

India's focus on sustainable energy infrastructure by 2070 signals an inherent desire to build a strong, sustainable and resilient future for current and future generations. The impact of current policies and institution-building efforts can be viewed via the lenses of SDGs 4 (Quality Education), 5 (Gender Equality, and indeed equality of opportunity and access for all communities), 11 (Sustainable Cities & Communities), 16 (Peace, Justice & Strong Institutions) and 17 (Partnerships for the Goals).

The knowledge economy is driving growth in the 21st century. Material assets have characterised agricultural and industrial economies. However, knowledge economies use drivers like information, innovation, human capital, intellectual property, research and development, and focused creation of new specialisations to augment

goods and services rapidly. World-class education that evolves with these drivers is the single largest investment a nation can make towards securing the future of its citizens. The world's leading economy, the United States, has established the value proposition of a strong education system that continuously ensures its academic offerings and research frameworks are at the leading edge. China has taken several leaves out of the US playbook and set up an education and research apparatus that rivals the US, to great effect.

In FY 22, India had 265.2 million children enrolled[16] in one of the largest education systems globally by far. India's Gross Enrollment Ratio (GER) in primary school is 103.4, indicating that almost all of the children in the eligible age group of 6-10 are in school and possibly some older children as well who may have started school late. The GER for elementary school, defined as classes 1 through 8, is 100.13, dropping to 79.6 in secondary school (classes 9-10) and to 57.6 in higher secondary school. Retaining students through Class 12 must be the next priority and, indeed, the Indian government could make education till Class 12 mandatory as detailed in SDG4. Along with retention, the focus must also remain on driving quality of education and learning outcomes. Teacher training will be critical here. Today, India's Pupil-Teacher-Ratio (PTR) is roughly 27; a robust ratio would be 20.

India also has one of the largest higher education (HE) systems in the world. In FY 22, 43.2 million students were enrolled across the country with a GER of 28.4.[17] India's total eligible population (in the age group of 18-23) is 142 million. There is certainly a lot of room for growth here and will depend greatly on the capacity-building efforts of both the public and private sectors. There are nearly 1.6 million teachers in the system, bringing the PTR to 27. It is imperative to ramp up teacher training, especially for specialized courses, to ensure the PTR stays closer to 20 as enrollment increases. The country has nearly 56,000 HE institutions, of which 1,168 are universities, 42,825 are colleges, and the balance are standalone institutions. Only 21.5% of Indian colleges are government-run, while 78.5% are either privately held or aided institutions.

SCHOOL SYSTEM
14.89 lakh schools across India, 68.4% are public.

SCHOOL ENROLLMENT
26.52cr enrolled, GER of 103.4 in primary and 57.6 in higher secondary school.

SCHOOL TEACHERS
95 lakh, with average pupil-teacher-ratio of 27.

COLLEGES
42,825 colleges across India.

UNIVERSITIES
1,168 universities across India.

HIGHER EDUCATION INSTITUTIONS
55,995 across India, including colleges, universities and stand-alone institutions.

INSTITUTES OF NAT. IMPORTANCE
165, including IITs, IISERs, AIIMS, NITs, IIITs, and IIMs.

HIGHER EDUCATION ENROLLMENT
4.32cr with national GER of 28.4.

HIGHER EDUCATION TEACHERS
15.97 lakh, with average pupil-teacher-ratio of 27.

NAT. EDUCATION POLICY 2020
Future-forward education policy after 34 years.

SCHOLARSHIPS
8.4cr scholarships given to deserving students to improve access to education.

The NEP 2020, launched 34 years after the previous NEP in 1986, provides a robust blueprint for driving the changes required in the Indian education system like improvement in quality, focus on learning outcomes, retention of students, closing the skills gap between what students learn versus industry-ready skills, drive up academic research, and overhauling curricula to ensure it meets the knowledge economy of the 21st century. The frameworks laid out in NEP 2020 demonstrate and integrate flexibility, a multidisciplinary architecture for human capital development, an awareness of the effect of a loaded curriculum on students, a connection with society and societal problems, a link to science on brain development, the utility of online platforms and digital repositories, and an emphasis on using technology wherever appropriate. Both the Central and State governments must work together to make the recommendations of the NEP 2020 a reality in this decade.

NATIONAL EDUCATION POLICY 2020 - HIGHLIGHTS

NEP recommendations for schools:

1. New curricular and pedagogical framework of 5+3+3+4
2. Integrate extra-curriculars, arts, sports and academics
3. Vocational training
4. Reduction to core concepts
5. Special education zones
6. Foundational literacy and numeracy mission
7. Computational thinking and technology
8. Overhaul in teacher education and training
9. National repository of high-quality resources
10. Indian languages and Sign Language

NEP recommendations for higher education:

1. Consolidation into large multidisciplinary universities and clusters
2. Research focus; National Research Foundation
3. Multiple certification options – UG, certificate, diploma
4. Academic Bank of Credit
5. Vocational and skills development built-in
6. Governance and autonomy structures
7. Expanding open and distance learning
8. Internationalization: Top 100 global universities
9. Emphasis on technology

India is faring very well on gender equality. The gender ratio of the general population is now 1,020 females to 1,000 males, up from 991 in 2015-16.[18] Girls now constitute 46% of total enrollment in Indian schools (12.3 crore of 26.52 crore). The Gender Parity Index (GPI) in primary school is 1.03 in primary school and 1.02 in higher secondary.[19] GPI in higher education also crossed 1 in FY 20. Women's GER at 28.5 has overtaken men's GER at 28.3. They constitute 46% of total enrollment in Indian HE. Women have also overtaken men in both, enrolling in and graduating from postgraduate programs. While this is not yet true of PhD programs, rates of enrollment suggest they might overtake men here also over the coming years.

NATIONAL GENDER RATIO
Today 1,020 women/1,000 men, up from 991 (2016).

GIRLS IN SCHOOL
12.3cr girls in school, 46% of total enrollment.

GENDER PARITY INDEX (SCHOOL)
1.02 in 2022.

WOMEN IN HIGHER EDUCATION
2.07cr women in HE, 48% of total enrollment.

GENDER PARITY INDEX (HE)
Reached 1.0 in 2020.

INTERNET USAGE PARITY
33.3% of women in India use the internet, compared to 57.1% men.

OWNERSHIP
43.3% of women in India own a house and/or land

BANKING INCLUSION
78.6% women have a bank account (2021), up from 53% (2016)

[19] Gender Parity Index is the ratio of female GER to male GER. GER is the ratio of enrolled students to their eligible population in the corresponding age group. Since there are lesser women in the eligible population, GPI is higher than 1 even though the absolute enrollment percentage of women might be lower.

Beyond gender, India is faring well on equality among social groups as well. The data at the intersection of social equality and education shows remarkable progress, as shown in Table 2. Men represent 51.5% of the population and represent 52% of the total enrolled in HE. Women represent 48.5% of the population, with 48% enrolled in HE. In other social groups, too, enrollment seems to be quite close to the population composition. The Scheduled Caste (SC) community represents 16.6% of the population, with 15.3% enrolled – quite close. The Scheduled Tribe (ST) community represents 8.6% of the population, with 6.3% enrolled – this, too, is quite close. The Other Backward Caste (OBC) communities represent 41% of the population, with 38% enrolled – quite close, here too. However, minorities do not seem to be faring as well. Their aspiration is clear, as demonstrated by having the highest 5-year CAGRs at 6.5%. Focused scholarship programs and greater availability of education infrastructure in areas closer to these communities can drive up their enrollment.

Social Group	AISHE 2021-22		Population %	AISHE 2014-15		7-year CAGR
	Enrollment	% of total	Census 2011	Enrollment	% of total	
Men	2,25,76,389	52.2%	51.5%	1,84,88,619	54.0%	2.9%
Women	2,06,91,792	47.8%	48.5%	1,57,23,018	46.0%	4.0%
SC	66,22,923	15.3%	16.6%	46,06,666	13.5%	5.3%
ST	27,10,678	6.3%	8.6%	16,40,809	4.8%	7.4%
OBC	1,63,36,460	37.8%	40.9%	1,12,56,849	32.9%	5.5%
Muslim	21,08,033	4.9%	14.2%	15,33,658	4.5%	4.6%
Other Minorities	9,05,159	2.1%	6.0%	6,49,526	1.9%	4.9%
General Category	1,45,84,928	33.7%	13.6%	1,45,24,129	42.5%	0.1%
All	**4,32,68,181**	**100.0%**	**100.0%**	**3,42,11,637**	**100.0%**	**3.4%**

Table 2: Higher education enrolment of various social groups in India compared to the corresponding population. Source: AISHE, Census 2011, NSSO

A resilient future is predicated on sustainable cities and urban conglomerates. Urbanization is a pivotal economic process as it aggregates human activity - aggregation leads to specialization, specialization to increased productivity, enabling greater availability of goods, delivery of services, increased wages, and job opportunities. In India, like elsewhere in the world, urban areas drive the nation's economic growth. By 2030, India's urban population is expected to reach 630 million, more than 1.4x the current population of the entire European Union. The Indian government's focus on sustainable urbanisation has been underpinned by a strong desire to continually improve the ease of living for all its urban citizens, with an eight-fold increase in the total expenditure on urban development between 2015 and 2021.

Currently, major Indian cities are facing a significant immigration issue as large populations from labour-surplus states, and rural regions with states are migrating to urban areas in search of work. This exposes three problems. One, that rural areas do not provide enough high-growth opportunities to cater to these large populations. Two, labour-surplus states like Bihar and Uttar Pradesh are not creating adequate opportunities for their massive populations. Three, cities like Bengaluru are reeling from inadequate infrastructure and opportunities to cater to the significant incoming population across multiple skill levels. The solution is for each state to create a systematic urbanization agenda that caters to the specific needs of its population.

India has close to 4,000 census towns, and a further 2,200 towns may be added during the upcoming population census.[20] Each state must develop its census towns into economic growth engines so rural populations might find work there and retain their existing dwellings instead of uprooting their families in search of work. For example,

Uttar Pradesh has 680 census towns, of which perhaps 600 towns can be sustainably urbanized with infrastructure and connectivity, as well as the use of new sustainable and renewable technologies to offset the challenges of urbanization, and planning for capacity building right from the start. Labour-intensive industry clusters can be attached to these towns to provide employment and upskilling opportunities. Similarly, 200 towns in Karnataka and 400 towns in Maharashtra can be developed in the same manner; each state must evaluate its demographic and employment needs and execute accordingly. This will arrest the large-scale movement to India's few urban conglomerates by providing local employment and decent living conditions. These networks of towns can be developed into new growth engines for India which provide opportunities for the larger population rather than just to those who reside in a few large cities. Women, who today cannot migrate in search of employment as easily as their male counterparts, can increase their workforce participation by finding employment close to their homes. Systematic urbanization and industrialization is, indeed, a pragmatic way to also drive inclusion.

India's path to urbanization, nevertheless, faces several challenges including the pervasive presence of slum settlements and other manifestations of unsafe, unsanitary, and oftentimes inaccessible housing forms and practices. One in six urban dwellers in India today lives in a slum. According to the Down to Earth magazine, "six out of 10 slum dwellers live close to unsanitary drains, and almost four of every 10 do not get treated water.[21] Notwithstanding the existing lacunae, India has made substantial progress in the domains of affordable housing and sanitation. The Government's flagship schemes in this area, namely, the Pradhan Mantri Awas Yojana - Urban (PMAY-U) and the Swachh Bharat Mission, have borne considerable fruit. Construction of more than 1.2 crore houses has been sanctioned under PMAY-U. And the country has surpassed its Swachh Bharat Mission (Urban) targets, constructing more than 6 lakh community and public toilets.

With regard to sustainable urbanisation in general, a number of Government initiatives such as the Smart Cities Mission, the Swachh Bharat Mission, PMAY-U, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), the National Urban Livelihood Mission etc. have converged to strengthen urban infrastructural capacity and advance sustainable outcomes. Going forward, India must implement innovative financial models to incentivise private players to provide affordable housing projects and improve access to low-cost, local-context-appropriate, and scalable housing technologies. On the latter, the initiation of six Light House projects, each using a distinct technology, under the Global Housing Technology Challenge-India (GHTC-India) program, can set the stage for continued innovation.

URBAN DEVELOPMENT
Spending on urban development increased 8x over 2015-21

STREET LIGHTS
85 lakh street lights replaced under AMRUT, resulting in energy savings of 185.33 crore units (kWh)

WASTE COLLECTION
97% of the wards in India have 100% door-to-door waste collection under SBM(U)

URBAN PARKS
1,800+ parks over 3,700 acres have been developed under AMRUT

GLOBAL HOUSING TECHNOLOGY CHALLENGE
To identify and mainstream the best available construction technologies worldwide

Orderly, safe, and sustainable waste management is a major component of a healthy urban civic ecosystem. It has emerged as a major priority under SDG 11 as well as for successive Central and State governments. The former's initiatives such as the Swachh Bharat Mission Urban (SBM(U) 1.0 and 2.0), AMRUT, Smart Cities Mission, and the new Solid Waste Management Rules (SWM), 2016 have helped create a new paradigm for waste management centred around key themes such as systematic segregation at source, the establishment of waste processing facilities, promotion of compost and waste to energy mechanisms etc. 97% of the wards in India have 100% door-to-door waste collection.[22] The percentage of wards with 100% source segregation, however, is much lower at 78.03% and the percentage of municipal solid waste (MSW) processed to the total MSW generated is even lower at 68.1%.[23] There is, therefore, a need to strengthen institutional capacity at the level of urban local bodies and to additionally consider fiscal, policy, and business reforms to recognise the true value of waste as a potential resource with real economic value.

The public transport sector serves as a vital cog in modern India's urban civic infrastructural wheel. According to data from the 2011 Census, more than a quarter of all urban work trips are made through public transport modes,

either by bus or train. Having said that, India has an acute shortage of buses, with just 1.2 buses per 1000 people.[24] Moreover, several state-owned public transportation agencies have been under severe financial distress for the past few years, with the pandemic-induced reduction in ridership further exacerbating the state of affairs. Policy support and strategic investment for multi-modal integration, bus and Metro network expansion, energy efficient and tailpipe emission-free e-buses, mobility-as-a-service (MaaS) platforms, and capacity additions to improve accessibility for transport-disadvantaged and persons with disabilities should help India achieve target SDG 11.2 of providing *"access to safe, affordable, accessible and sustainable transport systems for all"*. The recent proposal by the state-controlled Convergence Energy Services Ltd. to consider floating a USD 10 billion tender for 50,000 electric buses will bode well in this regard.[25]

The last few years have seen India take giant leaps in making its internal governmental processes more efficient and simplifying its public-facing bureaucratic procedures. In the realm of public finance, India moved away from the traditional distinction it had employed between planned and unplanned expenditure while adopting the Output-Outcome Monitoring Framework (OOMF), which is more amenable to monitoring. The Public Finance Management System (PFMS) has worked to increase responsiveness and transparency. Since 2020, the tech-driven Government Integrated Financial Management Information System (GIFMIS) has been made into a separate vertical under the PFMS division at the Comptroller General of Accounts. The GIFMIS has helped improve fiscal reporting, especially in the fields of payments, receipts, accounting, and internal audits. The Budget 2022-23 further introduced the E-bill system to further improve the Ease of Doing Business (EoDB) and foster the Digital India ecosystem. It should help *"enhance transparency, efficiency, and faceless-paperless payment system by allowing suppliers and contractors to submit their claim online which will be trackable on [a] real time basis."* [26]

India has also taken several steps to increase its tax base in a sustainable manner. India's tax to GDP ratio is 2.5 percentage points higher than the average economy during the period of 2011-2019.[27] The GST system has played a leading role in doubling the tax base since 2017, improving tax buoyancy, increasing collections, maximising compliance and limiting evasion. India's bold decision to undertake one of the largest corporate tax cuts in global history has yielded positive results. For the AMJ 2022 quarter, corporate tax revenues are up 30% on a year-on-year basis, and have increased by 66% compared to FY 20.[28] As a signatory to the Multilateral Convention on Mutual Administrative Assistance in Tax Matters, India has consistently advocated for information sharing between states to counter illicit financial flows.

A sustainable future is possible when the institutions enforcing and governing the processes are robust. India's institutions demonstrated extraordinary resilience during the COVID-19 pandemic. An INR 1.7 lakh crore (trillion) package—the Pradhan Mantri Garib Kalyan Yojana, was mobilized in May 2020 to include free food for 800 million citizens as well as DBT payments for 420 million people including minimum income support for farmers and rural workers, women, widows, the elderly, the disabled and other disadvantaged groups. Digital platforms like Aarogya Setu and COWIN were built to manage the tracking of infections and vaccinations of 1.4 billion people. Regulatory capacity was increased rapidly to evaluate and regulate multiple aspects of the pandemic including vaccinations, therapeutics, patient care, and other medical devices. Hundreds of hospitals were connected and managed with regard to the rising healthcare demands of the pandemic. While there was trouble with oxygen availability at the beginning of the second wave, capacity was quickly built to ensure smooth functioning thereafter. The COVID-19 pandemic proved an active testing ground of a nation's institutional strength and India passed with flying colours.

Looking forward, there are multiple areas where India can strengthen its organizational and institutional capacity. There is a particular deficit in the judiciary. Today, India has 21 judges/million population; this must grow to 50 over the next 5-6 years to provide adequate trial capacity. The police capacity also requires strengthening. Institutional building in the healthcare sector too needs bolstering, as discussed earlier. However, after the pandemic exposed the gaps, there is already a significant expansion underway. There is also a paucity of long term infrastructure financing options in India primarily because of an underdeveloped corporate bond market. The corporate bond market as a percentage of GDP is merely 18% in India, compared to 36%, 80%, and 120% in China, South Korea, and the United States respectively. Having said that, corporate bond outstanding has grown almost four-fold over the past decade, going from INR 10.4 lakh crore in 2012 to INR 40 lakh crore in 2022.[29]

Other deficiencies in institutional capacity include the education and skilling sectors. While education has been discussed in detail above, skilling in its various

dimensions—upskilling, re-skilling and mass-skilling-needs a serious overhaul in the country. According to the India Skills Report 2022, only 46.2% of Indian graduates were found to be employable due to a lack of professional, hard skills.[30] India must work on skilling its youth to do justice to the demographic swell visible through its continuously increasing higher education enrolment numbers. Government initiatives such as the Pradhan Mantri Kaushal Vikas Yojana 3.0, including the planned setting up of numerous model training centres as Pradhan Mantri Kaushal Kendras, in addition to the continued support to Jan Shikshan Sansthans and the India International Skill Centres should help to a great degree. It is vital that skilling efforts are directed towards new-age industries and sectors such as electric mobility which offer massive employment absorption potential as discussed earlier. World Bank data shows that since 2000, India has been moving 1% of its workforce every year from agriculture to industry and services. This trend will only accelerate as more of the government's industry initiatives like Make in India and the Production Linked Incentive (PLI) schemes expand where more rural citizens will turn to the sector for employment as opposed to agriculture. In all of the above institutional capacity building exercises, technology and digital platforms will be of immense value.

India has a strong track record of building global partnerships. The nation has pioneered multiple global initiatives such as the International Solar Alliance, LIFE - Lifestyle for Environment, the Coalition for Disaster Resilient Infrastructure as well as the Leadership Group for Industry Transition. India has committed a total of USD 150 million over a decade to the India-UN Development Partnership Fund.[31] The Fund aims to support the implementation of SDGs in small-island developing states, least developed countries, and land-locked developing countries, across multiple thematic areas ranging from climate resilience, environmental sustainability, renewable energy, and livelihoods and infrastructure. The IBSA facility for poverty and hunger alleviation (IBSA Fund), jointly established by India, Brazil, and South Africa has disbursed over USD 44 million, supporting 35 development projects in 31 countries since 2006.[32] Projects include efforts aimed at improving healthcare access for children in Cambodia as well as resilience training of more than 1,500 farmers in Timor Leste.[33]

India has also played an instrumental role in establishing strong, interdependent, and mutually beneficial multilateral partnerships such as the BRICS grouping. Under the current dispensation, India has worked to ameliorate and stabilise conditions in the subcontinent by reviving the SAARC forum as well as intensifying its 'Act East' focus with respect to the ASEAN. India has also moved to strengthen relations with South America and the Caribbean Community. Additionally, India has substantial stakes in the New Development Bank and the Asian Infrastructure Investment Bank. India has extended development assistance in the form of concessional Lines of Credit (LoC) under the Indian Development and Economic Assistance Scheme worth USD 30.59 billion to more than 60 countries. Till now, about 322 LoC projects have been completed while 277 projects are under implementation.[34]

A grant assistance fund of USD 600 million was also established to strengthen India's relations with its African partners, including USD 100 million for the India-Africa Development Fund and USD 10 million for the India-Africa Health Fund.[35] India's healthcare outreach has been praiseworthy with initiatives such as Vaccine Maitri and the e-Vidhya Bharati Aarogya Bharati Network Project (e-VBAB). Under the e-VBAB, services such as tele-education and telemedicine are being offered to educational institutes and hospitals in participating countries from Africa. India has also lent a helping hand to developing countries during the COVID-19 pandemic with the grant of humanitarian relief including *"deployment of Rapid Response Teams, supply of essential life-saving drugs, antibiotics, medical consumables, vaccines, and other laboratory and hospital equipment."* [36]

In essence, India has followed an exemplary model of developmental cooperation, and these efforts have accelerated over the last decade. The country's standing in the geo-political order today is at its highest since Independence. The nation has grown into the fifth-largest economy, up from the tenth in 2014. India's ForEx reserves are at a record high of $600Bn+. Stock market capitalization has rocketed to an excess of INR 290 lakh crore. India has climbed 41 places in the Global Innovation Index since 2015 to stand at 40 (of 132 countries) in 2022.[37] FDI reached an all-time high of USD 84 billion in FY 22, signalling the world's recognition of India's growth story as the nation advances towards the USD 5 trillion and USD 10 trillion GDP visions.

FIFTH-LARGEST ECONOMY
India is currenty the 5th largest economy globally at $3.7tn

STRONG FINANCIAL INSTITUTIONS
India has record-high ForEx reserves of $600bn

STOCK MARKET CAPITALIZATION
India is now the fourth-largest equity market, at $4.3tn+

FOREIGN DIRECT INVESTMENT
Record-high of $84bn in FY 22

GLOBAL INNOVATION INDEX
Retains rank 40 on GII 2023; climbed 41 places since 2015

CORPORATE TAX
Corporate tax revenues increased 66% since FY20

CORPORATE BOND
Corporate bond outstanding has grown nearly 4x in the past decade to reach INR 40tn

DEVELOPMENTAL COOPERATION
India has extended concessional Lines of Credit worth $30.59bn to 65 countries

DIGITAL INCLUSION

It is of interest to note that Digital Inclusion, a primary driver of socio-economic development in today's era, is not included in the SDG framework. This is a consequence of having developed the current framework in the early 2000s when digital platforms were in a nascent stage. Today, digital inclusion is the foundation for accelerated financial and economic inclusion, access to education, learning and upskilling, and fast becoming the gateway to health infrastructure. In India, digital inclusion, via the India Stack, is a force multiplier for the nation's robust socio-economic development.

At a fundamental level, digital inclusion, which enables enhanced interaction between individuals in a virtual setting, becomes a key driver for sustainable development by reducing unnecessary physical interactions. Digital payments pave the way for reduced paper-based cash usage. Virtual meetings are replacing a significant number of in-person meetings, leading to reduced transportation usage and, consequently, carbon footprints. The pandemic has confirmed this irreversible shift. The evaluation of adding Digital Inclusion as an SDG is a worthy exercise.

Globally, this movement is in its nascent stages. The Digital Public Goods Alliance, a multistakeholder initiative which includes UNICEF and iSPIRT from India, released its 5-Year Strategy (2021-2026). The intent is to promote digital public goods (DPGs) as a means to foster an equitable environment across the world, particularly in LMICs. Here, DPGs are defined as *"open source software, open data, open AI models, open standards and open content that adhere to privacy and other applicable laws and best practices, do no harm, and help attain the SDGs."*[38] India, however, is far ahead of the global status quo with respect to digital inclusion and the use of DPGs in driving the same.

DPGs: India is ushering in a new tech-enabled era in governance

The COVID-19 pandemic and the consequent lockdowns globally have only accelerated the trends of digitalisation, internet and mobile penetration, and technology adoption. In 2000, barely 413 million people globally used the internet;[39] today, more than 5 billion do so. Social media was almost unheard of around then; today, it is rather ubiquitous. With critical services like government communications, distribution of essentials, health, education, relief delivery, and bill payments disseminated digitally in many countries, especially with the pandemic, techno-citizenship is an inevitable feature of our future.

Citizenship refers to the implicit social contract between an individual citizen and a State to which the individual owes allegiance and is, in turn, entitled to the State's protection. In this era of digital technology, three new relationships arise, which entail a re-formulation of the citizenship contracts: one, the State's duty to protect the digital personas of citizens in the same vein as their physical beings. Two, protection of citizens' digital data that resides with other States. For example, Indian citizens' data residing in the US via Facebook or in China via PubG. Three, citizens now interact with other global citizens on decentralised platforms (for example, on blockchain-based systems like cryptocurrency). Since the State obligates to itself the responsibility to protect the identity and material interests of its citizens, new mechanisms and policies with global consensus are required to govern this third relationship. The term 'techno-citizenship' re-formulates citizenship contracts and relationships in today's digitalized and globalised era.

Establishing universal access to the internet, digital platforms, and cutting-edge technology has become a necessity in the 21st century to democratically uphold techno-citizenship. Accordingly, there is a need to make digital rights like security, data privacy, personal safety, and self-determination via opt-in authorisation loops, among others, inviolable and sacrosanct.[40] Democratizing the development and access to critical technologies must be sustainably undertaken in the same way public goods are developed and maintained for society. Leaving this in the hands of global private tech companies alone brings multiple risks – like monetization of personal data, digital monopolization, and privacy and financial losses due to transnational security breaches with no recourse to local laws. Depending on external state actors for technology development carries additional national security risks. Instead, DPGs must be developed and deployed as a *"shared [national] resource in which each stakeholder has an equal interest"*.[41]

For a democratized DPG, one can envision five ideas that must serve as foundational attributes:[42]

1. Universal and equitable access at scale, with no community left behind
2. Active inclusion policy with an inbuilt philosophy to reduce costs and friction
3. Inviolable rights like personal safety and security (protection from leaks and abuse of personal data), privacy (right to private digital communications with encryption), self-determination (to opt-out of terms and conditions, to control and consent to the use of one's data, portability), not to be profiled (to opt-out of automated profiling and bulk surveillance)
4. Recourse to the law: In the case of abuse of digital rights, one needs recourse to the law. This is only possible if a citizen's data resides within the same borders where he or she is a citizen or resident. Enforcing sovereignty via data localization is invariably the only way to provide every citizen with rightful recourse to the law.
5. Supports continuous innovation on top of it: The nature of technology's rapid evolution necessitates continuous updates and innovation. Interoperability is also essential for DPGs to serve as platforms that can support new systems being built on top of them.

India is one of the few economies that has built population-scale DPGs with the potential to incorporate these five essential features for all its citizens' benefit. DPGs in India are neither developed solely by private players for profit nor by the government. The India Stack has risen as an exemplar of public-private partnership (PPP), a series of volunteer-driven digital platforms that drive the government's digital and financial inclusion policies.

EVOLUTION OF INDIA STACK

India Stack began by solving a basic issue inhibiting financial inclusion: the absence of a comprehensive identifier. With the Unique Identification Authority of India (UIDAI) launch in 2009, the Indian government initiated the world's most extensive one-sweep identification system – Aadhar, a 12-digit unique identifier for every Indian resident linked to residential, demographic, and biometric data.

Before Aadhar, India faced a massive problem identifying its then 1.2+ billion population on a single database. Various available IDs like driver's licenses, PAN cards, voter IDs, and ration cards were on different databases and lacked interoperability. The country needed a systematic nationwide ID identifying the ordinary Indian citizen, who perhaps did not have a bank account or vehicle to avail of the existing types of IDs. Aadhar coverage now exceeds 1.39 billion.[43] India built the world's most comprehensive biometric ID database, recognized globally for its extensive coverage, inventiveness, and flexibility. Nobel Prize Winner for Economics and Former World Bank Chief Economist Paul Romer said *"the system in India [Aadhar] is the most sophisticated that I've seen"*, *"[is] the basis for all kinds of connections that involve things like financial transactions"* and *"could be good for the world if this became widely adopted"*.[44]

With the serious involvement of digital technology pioneers like Nandan Nilekani, the Aadhar system was designed from its conception as a multi-platform public utility with open application programming interfaces (open APIs). The open APIs are used to create products, services and platforms on top of the existing stack, allowing for modular, interoperable and plug-and-play architectures. This critical decision proved crucial to developing the India Stack as a DPG model. Aadhar first unlocked new banking and payment modes. The National Payments Corporation of India (NPCI) launched AEPS (Aadhar Enabled Payments System) and APBS (Aadhar Payment Bridge System), which Indian residents with an Aadhar and bank account could easily use.[45] The AEPS-APBS network is the foundation of the Indian government's massive Direct-Beneficiary-Transfer (DBT) system.

Aadhar also paved the way for e-KYC or Know Your Customer in 2012. e-KYC solved the lack of comprehensive identification in banking because banks and other businesses could now execute KYC verification digitally using biometrics or the mobile OTP linked to Aadhar. With mobile coverage skyrocketing in the country, linking Aadhar to mobile opened several new avenues in digital and financial inclusion. The third element of the JAM (Jan Dhan – Aadhar – Mobile) triad, Jan Dhan, was executed in 2014 and is, to date, one of the most extensive financial inclusion initiatives in the world. More than 500 million previously "unbanked" Indians now possess a digitally accessible bank account with Jan Dhan - literally translating to "people's wealth".[46]

Jan Dhan banking, launched by the Pradhan Mantri Jan Dhan Yojana (PMJDY) scheme, is built on the unique-identification Aadhar system. Some crucial features of PMJDY include the provision of a basic zero-balance banking account for every household, access to credit, a RuPay debit card for online transactions, and insurance, pension, and remittance facilities.[47] Mobile banking became available on even basic feature phones to serve every stratum of Indian society. Before JAM came along, a significant swath of Indians never had the opportunity to avail services at their fingertips like this. Women, especially, were an underserved group; now, they represent more than half of Jan Dhan account holders.[48] India's DPG model is paving the way for universal access and equity among a billion Indians.

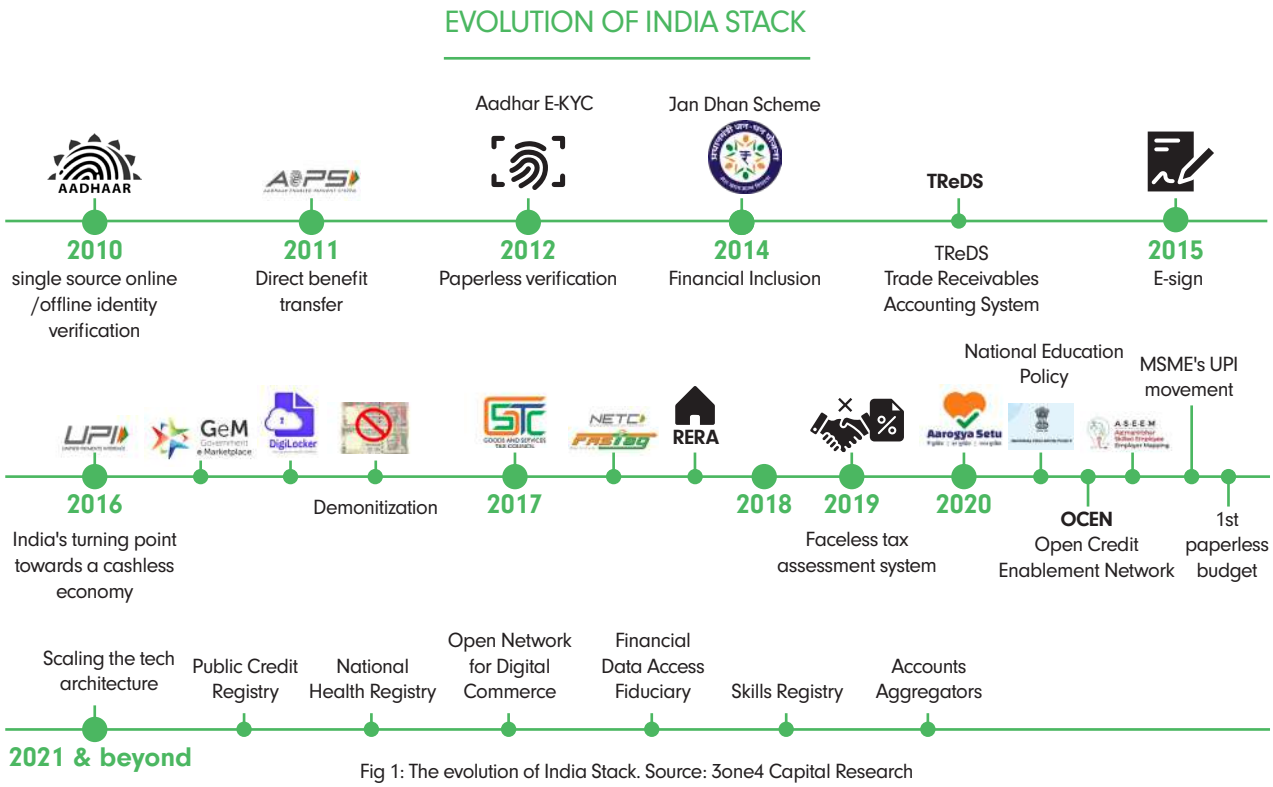


Fig 1: The evolution of India Stack. Source: 3one4 Capital Research

India Stack democratized access to financial services and facilitated the country's leap beyond inclusion into financial integration. Various government departments and ministries launched essential services using JAM. For example, DigiLocker allows Indians to save verified digital copies of essential documents on registered mobiles eliminating the need to carry physical copies.[49] Central-KYC is a central KYC repository where businesses can access verified records on a need-to-know basis with customer approval.[50] e-Sign enables verified Aadhar holders to sign documents digitally.[51] Aadhar Pay allows merchants to receive through the Aadhar biometric system.[52] The MUDRA scheme provides verified beneficiaries with small business loans to start enterprises, spurring entrepreneurship across the country.[53]

NPCI launched UPI (United Payments Interface) in 2016, which uses the Immediate Payment Service protocol to transfer money immediately between accounts in any participating bank at any time of day - unlike RTGS or NEFT protocols.[54] UPI allows money to be transferred by a click on the mobile from one bank account to another mobile-linked account in under 6 seconds, for the first time across the world. UPI pioneered the movement of money from one account to another; the actual movement of money in contrast to just ledger entry on transaction followed by delayed reconciliation of accounts that Visa and other protocols execute. The UPI system heralded the hockey-stick-like growth of India's nascent digital payments ecosystem by onboarding all the major banks onto one system, routing funds seamlessly between them, merging multiple banking facilities, and enabling the merchants to onboard on the same platforms allowing for efficient payouts.

Customers, merchants and banks were now on one unified system allowing for reduced inefficiencies and time lags, standardization of protocols, cost reduction, and vastly simplified opt-in and consent structures. The Bharat Bill Pay System was also introduced to allow UPI's simplicity to make bill payments efficient and hassle-free. The BHIM app was created as an instance of UPI's ability as an end-to-end use case. BHIM spurred the launch of apps like Paytm, PhonePe, and MobiKwik as one-stop digital shops that integrated payments, bills, railway ticket procurement and various digital activities.

UPI transaction volume has been steadily increasing, recording its highest ever in Dec 2023 at 12 billion transactions totalling over INR 18.2 trillion.[55] The degree of interoperability in the UPI system is unprecedented in the world, which is why its transaction volumes are surging exponentially. The UPI system unbundled the payment into a four-party system, with the payer, payer's bank, recipient and recipient's bank now four distinct parties. Neither the payer nor recipient are beholden to their banks to make the transaction on their mobile. Since all the major banks in India have been onboarded onto the UPI system, it serves as a frictionless way for Indians to transfer money to one another.

MOBILE PENETRATION
1.15bn, of which 520.6mn in rural areas.

AADHAR COVERAGE
139cr Aadhar cards issued.

AADHAR AUTHENTICATION
Aadhar used 107bn times for authentication.

BANKING INCLUSION
500mn+ previously "unbanked" beneficiaries under the Jan Dhan scheme.

DIGILOCKER
6.3bn verified digital documents issued.

UPI TRANSACTIONS
Monthly volume at 12bn+ transactions valued over INR 18tn.

e-KYC
18bn+ e-KYC transactions since inception.

FASTAG
Avg. monthly volume at ~348mn transactions valued at INR 5,861cr.

DIGITAL LITERACY
7cr+ rural beneficiaries via PMGDISHA.

India Stack has evolved steadily from solving the simple-yet-complex issue of identification with Aadhar to the continual onboarding of interoperable modules for banking, mobile transactions, bill payments, and DBT-enabled delivery of relief and income support. Its immense value in democratizing access to digital platforms and commerce is no longer up for debate. The nation can keep assimilating modules like this, for example, for regulatory frameworks or data privacy.

Importantly, India's digital goods are not owned by private players but managed by the government via independent technical consultants. Citizens are involved stakeholders with recourse to the law in Indian courts if their rights are threatened. All five necessary features for DPGs, in this manner, can be implemented and enforced within the DPG system India has formulated.

DIGITAL PLATFORMS FORM THE FRAMEWORK FOR A DIRECT ASSAULT ON POVERTY

The digital architecture has opened up innumerable ways to end poverty once and for all and enable every one of India's citizens to fully participate in the economy with bank accounts, digital payments and perhaps the most significant achievement of all – Direct Benefit Transfer (DBT). As of the writing of this report, the government has disbursed a substantial INR 36.2 trillion directly to the bank accounts of the most vulnerable citizens through DBT. Its value proposition is clear – by eliminating the intermediary layers, the savings enabled by the system is already estimated at INR 2.73 lakh crores - nearly 1% of the current nominal GDP.[56]

During the COVID-19 pandemic and series of national lockdowns, India Stack's value proposition became clearer. The Indian government sent relief support instantly and directly to 420+ million beneficiaries via DBT,[57] including rural workers, farmers, women Jan Dhan account holders, widows, the disabled, and other disadvantaged groups. Bill Pay allowed citizens to pay digitally for the continuity of utilities. The UPI protocol allowed people to continue transacting easily when in-person payments weren't possible. Facilities like e-Sign and DigiLocker enabled some businesses to continue operating, either fully or partly, while in lockdown.

DIRECT BENEFICIARY TRANSFER
INR 36.2tn sent directly to beneficiary bank accounts since FY15.

DBT SAVINGS
Reduced inefficiencies by using DBT led to estimated gains of INR 2.73tn (~1% of GDP).

COVID-19 RELIEF SUPPORT
INR 1.7tn was mobilized in DBT for vulnerable groups, free food for 80cr, and HCW insurance.

FARMER SUPPORT
12cr farmers enrolled in DBT minimum income support of INR 6,000/year.

AAROGYA SETU
21.8cr app downloads, network effect helping India fight the pandemic.

FURTHER UNBUNDLING OVER THE NEXT DECADE

The new commanding heights of India's digital economy have been created on the back of successive waves of innovation enabled by DPGs. The likes of Aadhar, UPI, and other components of the India Stack have acted as veritable building blocks, allowing for a combinatorial explosion of innovative solutions to subsequently be built using them. As explored earlier, DPGs have successfully compounded possibilities for innovation by enabling access to advanced digital infrastructure, supporting knowledge sharing, and helping create scalable common-use utilities–all of this at the population scale.

In other words, DPGs have open-sourced innovation. Scores of Indians can now tinker, experiment, and engage with cutting-edge digital rails to build a range of solutions for their fellow Indians and the world at large.

These unprecedented open, free-flowing, and animated notions of innovation have been unlocked due to India's adoption of a "playground" approach. In essence, it refers to the sectoral ecosystem being served by a particular DPG including, but not limited to, its constitutive actors; institutionalised rules of conduct governing such actors' interactions; regulatory mechanisms upholding interoperability and non-discrimination to forestall monopolistic capture or underutilisation of the DPG in question; enhanced participation by small and marginal players and improved end-user accessibility; and, lastly, seamless exchange of information and facilitation of recurring virtuous cycles of innovation. The playground is, therefore, a potentially wide and open canvas for innovation, promoting ceaseless creative destruction while configuring and maintaining clear-cut roles for all stakeholders.

It is useful to think of DPG playgrounds as a collection of basic building blocks, or indeed in some ways, being similar to active pharmaceutical ingredients which can be combined in innovative ways to create entirely new formulations by leveraging the government, private enterprises, and the citizenry as catalysts. Once rules for a playground are established, various entities, both public and private, can access these foundational digital rails and innovate on top of them with a free-flowing exchange of information, often with little-to-no friction. We have seen this in the case of Aadhar with the Identity layer of the India Stack, allowing for near-instant completion of KYC processes. Similarly, UPI's boost to digital payments has been facilitated by a government-regulated zero merchant discount rate (MDR) regime wherein merchants accepting payments through UPI do not have to pay a percentage of the transaction as MDR, unlike the case with, say, accepting payments through credit cards.

With institutions and frameworks of this sort in place, DPGs have altered digital interactions, and the concomitant perspectives and identities of the concerned actors, in two fundamental ways. Firstly, DPGs have emerged as agents of distribution for government entities. The Jan Dhan-Aadhar-Mobile (JAM) trinity has allowed for direct benefits transfer at scale, thereby plugging leaks; enabling improved transparency and efficiency in subsidy disbursal; reducing the role of intermediaries and their orchestrated rent-seeking; ensuring greater accountability, and enabling financial inclusion at a rapid pace. With an ever-increasing digital and internet footprint across the country, it can be reasonably expected for several other welfare functions of the State to move away from discretionary, human interaction-dependent transactions to DPG-driven, technologically anchored, large-scale policy solutions. We are already witnessing this in the healthcare space with the likes of COWIN, for instance, increasing access to healthcare and digital health services. Going forward, the proposed creation of a Unified Health Interface alongside a Health ID and the National Health Stack should form a beneficial triumvirate, furthering access to public healthcare and giving a fillip to health-tech startups much like UPI, Aadhar, and India Stack did for Fintech in India.

This brings us to the second tangible change that DPGs have brought about, namely, the elevation of private enterprises, especially startups, as equal stakeholders in the creation of economic value and entrepreneurial output. With the unbundling enabled by successive generations of DPGs, private enterprises no longer need to shell out massive amounts of money to deploy technologically advanced solutions to further their reach. Nor do they need to wait to achieve a certain scale or navigate a byzantine bureaucracy. The Open APIs framework of the India Stack allows them to readily and conveniently build out customised, world-class products for the world to use on top of the common rails. That is the power of scalable, technologically robust, open-source tools. DPGs have already unbundled payments with UPI, allowing for four different parties to come together seamlessly for a single transaction. ONDC, as elucidated earlier, is on track to do the same for digital commerce.

Further unbundling is planned in tandem with the consent layer of the India Stack, with the Data Empowerment and Protection Architecture (DEPA) being established to restore users' control over their data. The presence of such powerful tools will act as a springboard for creative solutions to India's problems by adopting a plug-and-play model for innovation. The upcoming Open Credit Enablement Network (OCEN) will similarly unbundle lending, laying down new credit rails for a new class of borrowers and merchants. As an API framework governing the communication between lenders, loan service providers, borrowers, and account aggregators (AA), OCEN will give a boost to embedded lending in the country, facilitating MSME lending in addition to creating innovative retail lending products. When paired with the AA framework— which will allow individuals to digitally access and share their financial data across entities and platforms in a secure and efficient manner in order to give them greater access and control over their financial records— OCEN can completely transform the way small enterprises access and provision for working capital credit. The AA framework can further help unearth new methods and models to establish creditworthiness in a country woefully devoid of formal credit history data for the majority of its population. The protocols behind such ambitious initiatives, namely, Beckn and Springboard, among others, have the potential to similarly unbundle mobility, food delivery, learning and skilling, language translation, and a host of other functions and sectors.

The coming of DEPA signals obvious concerns around the best ways to design playgrounds and safeguard users' sensitive data. In light of the tech landscape being increasingly characterised by strong monopolistic impulses, data capture has emerged as a strong moat for omnipresent, all-encompassing platforms. Market dominance in certain domains has become inextricably intertwined with the collection and harvesting of users' personal data.

In such a scenario, the mere presence of DPGs is not enough to counter such trends. Neither open sourced code nor the presence of diverse actors with competing interests can guarantee non-monopolistic, optimal distribution of a digital good. Having a single entity act as the curator of the playground or become a hub while enmeshing a 'hub and spoke' model can have disastrous consequences even if intensive unbundling has taken place. Ring-fencing value chain landlords— as BigTech companies have often come to be characterised— is critical but not sufficient. Anaemic petitions in the name of abstract and usually ill-defined, blanket terms such as "data protection" or "privacy" offer no antidote to concerted monopolisation efforts either.

It is, therefore, imperative that DPG playgrounds are designed with caution and care, with clearly configured and institutionalised roles for the State, the private sector, and the consumers with respect to the DPG in question. The architecture of the playground can oftentimes be just as important as the DPG it supplies. This makes it essential that playground rules are cognisant of the specific peculiarities and societal considerations attached to the sector in which the said DPG operates and substantively delineate roles and responsibilities right from the outset. Playgrounds for payments servicing DPGs, for instance, will need different incentive structures and contextual frameworks than those for healthcare or education. In some cases, especially where the potential for data capture and misuse is high, it might be prudent for the government to take the leadership on playground design and act as a steward. Elsewhere, the private sector or a joint consortium of different stakeholders may oversee the management and stewardship aspects. Stewardship itself, of course, should not endow any special rights on the entity in charge and profiteering from the same should be institutionally discouraged. Regulatory principles cannot, therefore, be decoupled from the potential for value and data capture including at the secondary or tertiary levels in terms of interactions between and among stakeholders, even if they are not in relation to the DPG but, nevertheless, take place within the playground.

The way out in such a scenario is to stridently abide by the five foundational attributes outlined earlier. As alluded to earlier, only a playground that conforms to the values of interoperability, autonomy, accountability, intelligent design, dispensability, and continuous learning and modification can ensure the optimal distribution of a DPG.[58]

An India-first imperative is vital to align with core ESG considerations

Globally, the ability of communities to develop and adopt technologies to drive sustainable development will be key to achieving the SDGs. Over the years, India has established itself to be an agile technology developer and adopter, given the right circumstances. Its pioneering DPG system, India Stack, has delivered digital and financial inclusion to the country's 1.4 billion people in less than a decade.

In 2020, faced with global supply-chain disruptions during a pandemic-induced rise in demand for health equipment, India ramped up the design and production of personal protective equipment, N95 masks, diagnostic kits, and respiratory aids—going from almost-zero to near-export volumes in three months. The country also has a robust pharmaceutical manufacturing base, which helped it remain self-reliant in troubled times and provide timely aid to other nations, for instance, through the COVID-19 vaccine programme. However, India has not invested nearly as much as needed to maintain a technological edge across all sectors. Large-scale imports are currently essential for meeting the population's needs for cutting-edge technology in electronics, medical equipment, defence, automobiles, and energy equipment. Moreover, even when domestic manufacturing fulfils a large portion of the demand, the technological designs are primarily foreign.

The Indian leadership has finally committed to indigenous technology development in recent years. The Atmanirbhar Bharat Abhiyan, the clarion call for a "self-reliant India" launched in the wake of the COVID-19 pandemic, recognises manufacturing and technology as critical for such self-reliance. Digital India continues to be expanded and deepened,[59] with new verticals such as health[60] proposed to be onboarded using the same fundamental India Stack framework. Prime Minister Modi recently announced India's focus on developing indigenous capabilities in frontier telecommunication technologies, e.g. 5G and 6G.[61] Recognising the global shortage of semiconductor chips as a critical economic crutch, the government launched the INR 76,000 crore Design Linked Incentive (DLI) scheme to start greenfield semiconductor and display fabs.[62]

Make in India initiatives have slowly started demonstrating success. India was racking up mobile import burdens worth USD 8 billion in 2014; the Make in India initiative reduced India's mounting mobile import burden and led to export surplus volumes – today, the nation exports $3 billion worth.[63] India is today the second largest mobile manufacturer globally.[64] Indeed, India's total exports touched an all-time high of USD 669.65 billion in FY 22, registering a 34% increase over the previous year. Furthermore, the FDI Equity inflow in Manufacturing Sectors has increased by 76% in FY 22 (USD 21.34 billion) compared to previous FY 21 (USD 12.09 billion).

Following the success of mobile phone manufacturing, PLI schemes were launched for 13 critical sectors, including advanced battery cell manufacturing—with an outlay of INR 18,000 crore to set up a total manufacturing capacity of 50GWh. Twenty companies, including Reliance, Ola Electric and Tata Chemicals, have reportedly expressed interest in this PLI scheme.[65] Motivated to move away from China-centric dependence for Active Pharmaceutical Ingredients (APIs), the government launched the PLI scheme for domestic manufacturing of bulk drugs and APIs,[66] fostering R&D investments to pursue economic and innovative production technologies. Other PLI schemes include automobile and auto components, electronics and IT hardware, telecom, solar modules, metals and mining, textiles and apparel, and drones. There are many such examples, especially in the recent half-decade, of the Indian state mobilising resources and setting tangible goals for self-reliance in technology development and deployment.

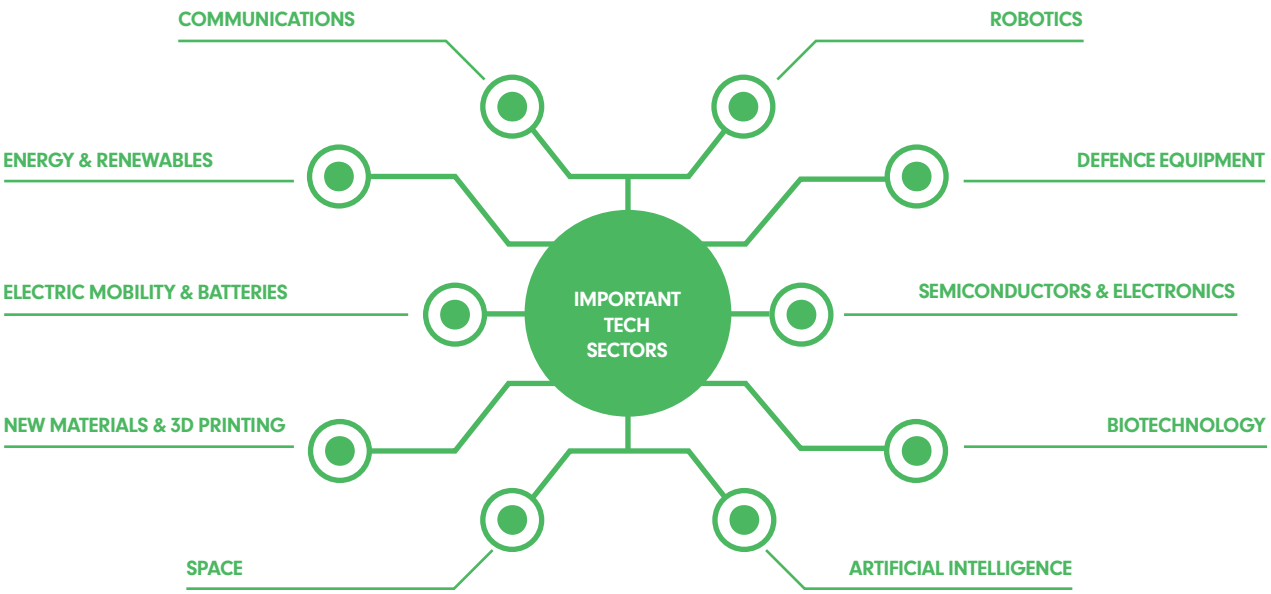


Fig 2: Some technology sectors crucial to an India-first imperative

However, many of these announcements and scheme launches are often reactionary and lack the intentional and planned commitment to technology leadership that other nations, particularly the US and China, have fiercely internalised. Both the top economies deploy a nation-first approach to technology design and, more recently in the case of the US, indigenous manufacturing. This is in recognition that long-term socio-economic power comes from true indigenous sufficiency in technology development, full-stack design and manufacturing.

There are several reasons why a nation like India must entrench indigenous technology development and manufacturing engines:

1. Economic: Remaining dependent on imports and other nations' IP results in a soaring trade deficit and mounting patent utilization rates.

2. Resiliency: Resiliency and defensibility are at risk when the nation depends on foreign countries with which we have disputes, for cutting-edge technology. Supply shocks, like those seen with the pandemic or with economic sanctions in uncertain geopolitical climates, also challenge resilience.

3. Sustainability: To comfortably attain India's COP26 commitments, indigenous technology development is necessary. Only then sustainability and environmental protection can be maintained as a core tenet and implemented across the country in every growth engine.

4. Reduced carbon burden: By developing technologies and manufacturing them in situ with eco-design principles, India could potentially reduce its carbon burden that is generated by shipping items from across the world to its shores.

5. Technological leadership: Maintaining technological leadership allows the country to innovate for India, maintain the required quality standards and control, become a technology exporter, and improve its standing globally.

A NATION-FIRST APPROACH TO TECHNOLOGY DEVELOPMENT AND INDIGENISATION

India must switch to the nation-first approach other countries have taken to take control of its sustainable growth journey. The US and China have produced growth engines where the state actively facilitates indigenous technology development, deployment and manufacturing. In these countries, the state deploys every tool in its arsenal to give its companies and citizens a competitive advantage.

The US deploys five distinct strategies to maintain its technological edge. One, the nation has built extensive public investment vehicles like the Defence Advanced Research Projects Agency and the National Science Foundation, which have been functional for more than 60 years. Two, the American state actively channels philanthropic capital and private-sector investment toward developing technology in university laboratories and national research centres. Three, following the Second World War and during the Cold War, the US built sweeping systems of national research laboratories spanning different technologies. Multiple government departments like Defense, Energy, and Space maintain their own series of laboratories. Four, the US routinely provides extensive non-term funding to university laboratories to develop frontier technologies. Five, the US has pioneered a first amongst public-private research frameworks emphasising the reduction of policy friction. The state is also among the early adopters and remains one of the principal clients of American companies in every sector – from Google, Amazon and Microsoft to Boeing, Lockheed Martin and Qualcomm. This America-first imperative has created a powerful undercurrent, allowing its technology companies to ride the swell and become multi-hundred-billion-dollar and trillion-dollar companies with near-monopolistic global reach.

China remains the only country to have successfully recreated the multidimensionality of the America-first model of strategic public investment in R&D as a major lever for socioeconomic growth. By adopting and deploying the best strategies relevant to its context, China achieved what the US has—and in half the time. Since economic liberalisation in 1978, China has judiciously deployed the transformative power of indigenous technological and intellectual property development.

China, too, has incorporated five distinct strategies. One, the nation has also developed a massive public investment engine focusing on fundamental scientific development and specialised functions such as renewables, clean energy and EV technology. Two, it has invested billions in developing its human capital and keeping them sponsored with non-term funding to pursue interests that coincide with national growth ambitions. Three, China has spearheaded several Economic Development Zone models, which have laid the foundation for high-end and low-end technology development and manufacturing. Four, sectors and enterprises central to growth strategies benefit from preferential policy frameworks and special carve-outs from standard regulations, including most technology spaces. Five, the Chinese state publishes 20- and 50-year vision statements and goals for each major sector, taking an enviably long view of world leadership and providing a fulcrum to align stakeholder efforts around. A clear example of promoting sustainability is China's mandate on automakers requiring that EVs make up 40% of all sales by 2030.

A nation-first approach entrenching indigenous technology development and deployment will be crucial in India's achievement of the SDGs. Crucially, the massive public investment vehicles executed by the state in both US and China are necessary for India to fund the innovation and deployment required to build the nation's sustainability-friendly infrastructure. These will be essential in developing world-class academic research hubs with non-term funding, as will channelling private sector funding and philanthropic capital towards technological research and development.

The role of the state in setting the vision statements for such infrastructure development, public commitment to supporting technologists, and creating a conducive atmosphere for technology development with every tool in its arsenal (such as capital commitments, IP development frameworks, tax incentives, advance procurement of critical materials, a decadal commitment to stability in taxation, export-import policy consistency, and investing in world-class research infrastructure) cannot be overstated.

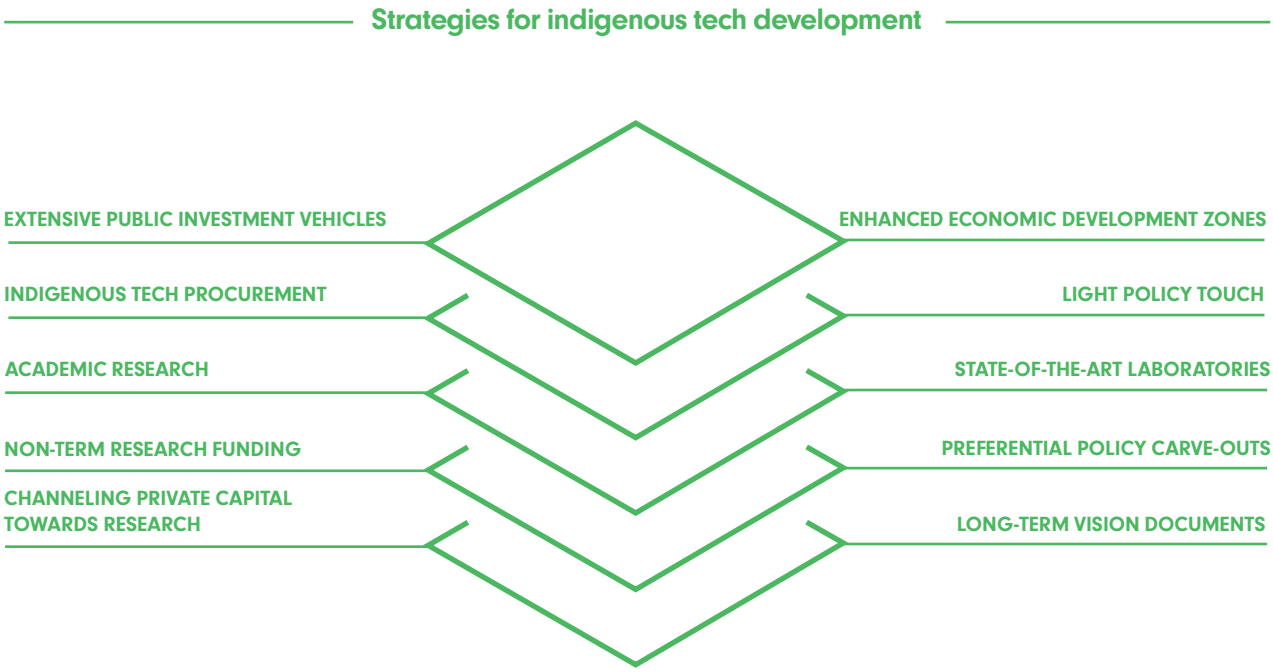


Fig 3: Strategies for the state to drive indigenous technology development

Startups today; companies and change-makers tomorrow

The role of entrepreneurs and investors in the private equity and venture capital spaces in India's economic trajectory is growing prominently. Startups were already on the path to becoming mainstream in India, and the pandemic effect cemented this in 2021. The year marked a new peak in inbound capital - Indian startups raised USD 49 billion over 1,540 deals in 2021, compared to roughly USD 70 billion between 2014 and 2020.[67] It was also a record year for unicorn generation, exits, M&As (mergers and acquisitions), and IPOs (initial public offerings). The number of unicorns in India doubled during the year - the total jumping from around 44 at the end of 2020 to nearly 90 as 2021 came to a close. 2021 set a new peak for tech exits, with USD 17.4 billion returned—20x the USD 847 million returned in 2020.[68] Eleven startups raised over USD 7.3 billion in their IPOs in 2021,[69] with unprecedented retail investor participation. The nation's rapidly growing retail investor base eagerly anticipates the IPOs of the 20+ companies who have filed to execute over 2022 and 2023.

Fulfilling the long journey from tech-startup-to-IPO is essential for several reasons. One, it functions as a force multiplier of the value created in the tech startup ecosystem over the last decade. Two, it allows millions of Indians via retail investment to participate in the growth. Three, it releases large pools of invested capital in returns that will likely be reinvested in the next growth cycle.

2021's noteworthy events demonstrated that India's startup ecosystem is accelerating its evolution to become one of the nation's primary growth drivers this decade.

Today, in India, like everywhere else globally, startups are leading the knowledge-economy surge. Between 2014 and 2023, Indian startups collectively raised USD 146 billion.[70] Funding into the ecosystem has grown at 7% CAGR.[71] The supporting ecosystem has also kept pace; there are over 250 quality accelerator-incubator systems and about 500+ institutional and 2,500+ active investors. Bengaluru, Delhi-NCR and Mumbai have emerged as epicentres of innovation globally.

With more than 112,800 startups[72] and over 112 unicorns, India is home to the third-largest startup ecosystem, behind only the US and China. Projections indicate that by 2025-26, India may well have over 200,000 startups that employ more than 3.5 million people and produce over 250 unicorns, with a total market value closer to USD 1-1.5 trillion bracket. The pipeline of companies that will potentially become unicorns and go on to list in the public markets is also expanding rapidly.

STARTUPS
112,800+ startups registered in India.

INVESTORS
500+ institutional investors, 2,500+ active investors and 250+ incubators/accelerators.

STARTUP FUNDING
~$146bn+ cumulatively from 2014 till OND 2023.

UNICORNS
112; third-largest unicorn ecosystem in the world.

MARKET VALUE
Startup ecosystem cumulatively valued at ~$500bn.

2021: STARTUPS EMBED IN THE MAINSTREAM AMIDST THE PANDEMIC

Amidst the pandemic in 2020-21, startups with digital platforms unexpectedly became invaluable. With digital becoming the only way to access services amidst the lockdowns and pandemic scare, these companies delivered every service: from bills and other payments, coordination of oxygen and other essentials, grocery and food deliveries, teleconsultations and medicine delivery, to communication, education, entertainment, the deployment of information and live updates digitally, and more. Indian startups established that they were inevitably an integral part of everyday life. Despite being cash-strapped, many startups supported their employees during the lockdowns with part or full salaries, benefits and insurance coverage. 2021 was thus a major inflection point in the Indian startup story.

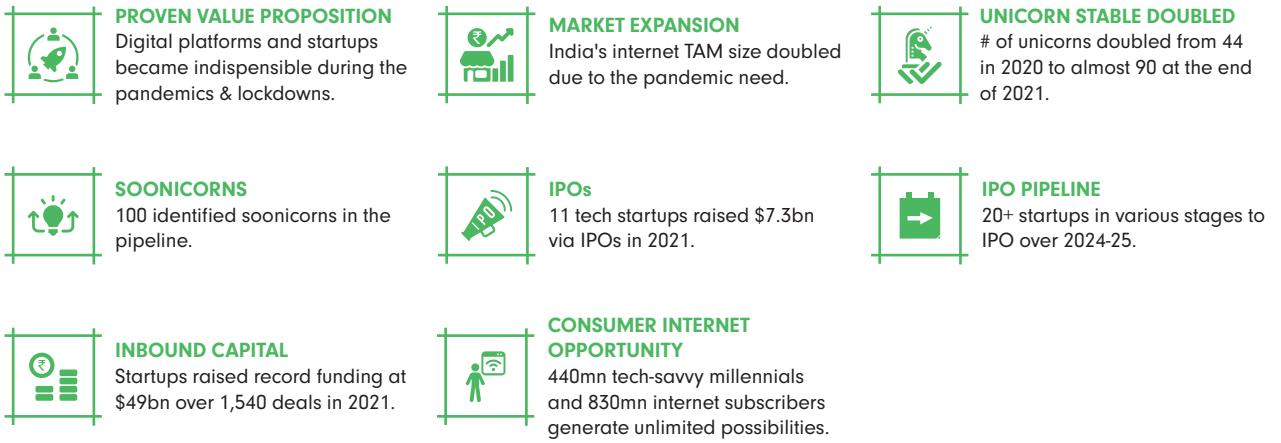
Today, citizens are appreciative of the startups and companies that helped them access essentials during a volatile period in their lives. As a result, many are now dedicated customers of these companies. Indians across the nation have conceded that an increasing number of factors in their daily lives now depend on technology. The status quo of their consumption behaviour and wallet share has fundamentally shifted. The pandemic has also confirmed that people in tier-2 and tier-3 towns would also pay for digital services, which was previously in doubt.

India's internet total addressable market (TAM) nearly doubled over 2021 as consumers across the country adopted digital platforms in daily life, tech solutions became mainstream, and India's business backbone strengthened its operations with technology and supported the shift towards a self-reliant economy. Moreover, with 440 million "tech-savvy" millennials in the country with a growing wallet share, the consumer internet opportunity is bigger than previous "guesstimates". Further, India has over 830 million internet subscribers; the affordability of data rates has accelerated access, democratised utility, and is propelling the rise of new economic development engines.

Post the pandemic, more Indian consumers are willing to remain paying subscribers for digital products like

health services, video and audio entertainment, edtech, video games, and more. This is happening across the range of consumer classes, from metropolitan India to non-metro and small towns. In the audio streaming and sharing platform space for regional content—KukuFM, for instance, has acquired more than 1.6 million paid users today, with a strong subscription renewal rate of 75% and over 30,000 creators on board the platform. The outdated assumption that only 10-20 million Indians living in tier-1 cities will spend for services has been disproven by this post-pandemic behavioural shift. And with the TAM expansion, the value of the market-leading unicorns in each of these spaces is also multiplying.

These companies now serve millions of lifetime customers. It is conceivable that there will soon be close to 100 million Indians willing to pay for digital products and services. This signifies that, in a rapid upward shift, many more startups can become USD 100 million revenue companies and make assertive claims for unicorn valuations. In the direct-to-consumer space, from IPO-ed startups like Zomato and Nykaa to IPO-bound startups like Licious and Swiggy, multiple companies have a growing umbrella of present and potential customers, and this is driving them from being unicorns to becoming decacorns (startups with valuations north of USD 10 billion).



India is amongst the world's most exciting FinTech sandboxes. The sector is revolutionizing a billion people's access to financing and capital - by re-engineering how Indians earn, save, spend, and transact online. Startups such as PolicyBazaar, Oxyzo, Open, Jupiter, PhonePe, BharatPe, and others are leveraging these new realities to create unique approaches to capturing market share and value. The swell in retail investment volumes via new-age digital stock brokerage platforms like Zerodha and Dhan—which also distribute various products like mutual funds and Structured Investment Products—has also ushered record allocations to these asset classes.

Enterprise technology is another standout vertical that is re-engineering how India does business. As Indian companies scale, many startups are building SaaS (Software-as-a-service) platforms to support them at the enterprise level. In this space, India does not only rely on foreign companies but has a robust homegrown set that designs for India's needs. Companies such as Freshworks, Darwinbox, Open, Zoho, BillDesk, Udaan, InMobi, and BetterPlace have not only proven their value propositions in the country; many of them are now global companies with diverse client bases across the world. The procurement of indigenous technology is now much larger than initially assumed.

Unsurprisingly, these three verticals—e-commerce and consumer-brand, enterprise-tech, and fintech—lead the startup ecosystem in the number of unicorns, soonicorns, and cumulative sector valuations. Other flourishing sectors include logistics, education-tech, deep-tech and agri-tech. Today, India has over 110 unicorns.[73] With 100 identified soonicorns[74] (startups approaching unicorn valuation with consistent growth indicators), the nation could host 250 unicorns by the 2025-26 timeframe.

A unicorn is a startup valued at or above USD 1 billion. An apt name because, just like the mythical hooved creature, the rareness of such an incredibly successful business is improbable, but not entirely impossible. Startups successfully exceed this much-coveted valuation by constructing a moat, either with a distinctive product or service, or a comprehensive go-to-market approach. They maintain a competitive advantage either with a first-to-market strategy or are best-in-class and can supplant incumbent players consistently. Attaining unicorn status is a robust signal of success, and the company deserves

the ecosystem's applause. This is why the replicable generation of this formidable outcome is a noteworthy indicator of the stability of a country's startup ecosystem.

A natural evolution trajectory for unicorn startups is to list on the public markets, and 2021 marked a record year for Indian tech IPOs. Eleven startups—Nykaa, EaseMyTrip, Freshworks, MapMyIndia, Nazara, Zomato, PolicyBazaar, Fino, Paytm, CarTrade and RateGain—raised over USD 7.3 billion on public markets.[75] Freshworks made history by becoming the first Indian software product company to list on Nasdaq; the first Indian IT services company to get listed on Nasdaq was Infosys over two decades ago. Subsequently, three Indian tech startups listed in 2022, and five in 2023. Most of these IPOs were vastly oversubscribed, indicating that retail investors across the country welcome this prospect to invest and participate in the Indian growth story.

Startups today become unicorns tomorrow, and ultimately, massive companies and conglomerates over a decade or two. They embed in the daily lives of citizens and the economic engine. The decisions taken and frameworks adopted by the entrepreneurs and investors driving the ecosystem will compound and have a tremendous impact on sustainability and other concerns within economic growth. The decision to opt for eco-design engineering or an ethically and sustainably sourced raw material or to construct an environmentally-friendly factory or shift entire delivery fleets to clean or green energy-based vehicles will have strong feedforward effects on India's carbon footprint.

The ESG framework is a useful blueprint to direct investment toward those organizations whose products, services, missions and internal structures are compatible with sustainable growth. It can help foster innovation that furthers production and consumption in line with the SDGs and India's vision for a strong but sustainable growth trajectory.

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3one4 Capital has been ranked by Preqin, a global reference database for asset management, as India's top performer for two of its funds in the recent Alternative Assets report. The seed and early-stage funds managed by the firm have been recognised for their performance amongst the India-focused venture capital funds in this Asia Pacific-focused report published in 2021. With industry-leading Net IRRs, 3one4 Capital's Rising I & Fund II are the top two amongst the best performing India-focused VC funds between the vintage years, 2010-2018.

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