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10 THINGS GOING FOR INDIA2047

Sunil Rajguru
sunilr@cybermedia.co.in

India has set about a bold Mission2047 plan which apart from other things will make India a tech and economic superpower. It shows great promise even though things may not be as fast as some would like.

1. **Physical infrastructure in place:** You cannot build an online world without the foundations of the offline. India is forging ahead with a record number of roads, flyovers, toilets etc apart from adding bank accounts and gas connections.
2. **Digital infrastructure going places:** Aadhaar is the world's largest democratic identity project. The JAM (Jan Dhan-Aadhaar-Mobile) trinity is transforming lives. UPI is a global superstar. The future looks exciting.
3. **Demographic dividend:** India is the most populous country in the world. For some time in the future, it will have the largest youth and working population. With the base that has been created, this is the ultimate opportunity to go all the way.
4. **A gung-ho youth:** American youth seem to be busy with climate-global politics and agitations on campuses. Chinese youth are following Tan ping (lie down flat), rejecting overwork and overachievement. Indian youth in contrast seem to be the most ambitious and hard working among their global peers.
5. **Educational infrastructure:** There's the New Education Policy and we are bringing out educational institutes at a record rate. There is focus on AI, R&D along with partnerships with the industry.
6. **Thriving through crises:** India countered the 1990-91 economic crisis with Liberalisation. The Y2K crisis led to us becoming an IT services superpower. The AIDS crisis after that made us the drug factory of the developed world. More recently during Covid when all seemed lost, we did a tech upgrade and readied ourselves for the future. You can be sure that if an unknown crisis comes tomorrow, we will be ready to handle it.
7. **The rise of Tier-2/3:** The smartphone revolution reached all Indian villages and after the Covid crisis talent migrated to Tier-2/3 towns with all the necessary upgrades.
8. **A multi-polar world:** With the decline of America and a China that may never match the superpower status of its predecessors the future is multi-polar. India will most likely be a big power in that multi-polarity. That's a geopolitical situation which suits us because we believe more in cooperation rather than domination.
9. **The economy:** About a decade back we entered the Top 10 GDPs of the world. In a few years we will be third, just behind America and China. We will likely be the fastest growing and most promising among the Big 3.
10. **Overall hope:** One grew up with cynicism about India all the time, but now there is great ambition and hope. It's a nation's will that matters most in the end.

AI: The Next Big Power Guzzler?

AI may be coolest kid in the fancy tech town and new business street, but it's not literally 'cool'. Is that something to be worried about? Now?

By Pratima H

Where is the world's largest refrigerator? Well, it is not in some mega grocery barn or parked at an ice-cream fairyland. It is always whirring busily at some huge nuclear fusion lab or juicing up a quantum lab or firing up the cylinders of a supercomputer.

So it was not a surprise when someone first questioned – Hey, how much power does AI slurp- if it has to run all those large models and churn up that many answers, and that fast? The question is not boring. As to whether it is too soon or too serious – now that, calls for some asking around.

AI-NOT AN ERMINE FOR SURE

Let's start with Indranil Bandyopadhyay, principal analyst at Forrester (who packs special domain expertise in areas like data science and AI). "AI's power consumption angle is a valid question to ask- especially after the heightened interest seen with Gen AI. But we cannot single it out - it is contributing to the carbon footprint that has been created by other industries already. That said - large models – especially in computer vision areas and the rise of multi-modality can add more power burden on today's models."

> IT infrastructure supporting AI models consumes 50-60% of its total power demand when it is not doing work.
>
> **- Jay Dietrich**
>
> Research Director of Sustainability, Uptime Institute

Uptime Intelligence estimates that generative AI annualized energy accounted for around 2.3 percent of the total grid power consumption by data centers in the first quarter of 2024. And this could reach 7.3 percent by the end of 2025.

When fully operational, an AI training system demands a large amount of power, up to two megawatts (MW), Jay Dietrich, Research Director of Sustainability at Uptime Institute gives a back-of-the-envelope glimpse. "In the context of a 300 to 500 MW cloud data center complex run by large hyperscalers, this is a small portion of the installed power capacity. As more and larger training systems are deployed, they will more quickly grow the power demand at a facility in a smaller footprint compared to traditional compute."

Here's how and why. As Dietrich explains further, the big LLMs are likely utilizing brute force computation in their model with significant idle time due to unoptimized software and workload management within their operation. "Available data and informal, anecdotal information suggest that IT infrastructure supporting AI models consumes 50-60 percent of its total power demand when it is not doing work. The average utilization of the compute capability is around 50 percent during the model run. These conditions indicate that firstly, there is a lot of wasted power; secondly, an opportunity exists to construct and better utilize the available compute time. Uptime sees opportunities to significantly increase the work delivered per megawatt hour of power consumed through better software design."

GOBBLING THE ENERGY BAR

- A ChatGPT consumes almost 10 times the amount of electricity as a traditional search.
- Data centers' total electricity consumption could touch over 1,000 terawatt-hours (TWh) in 2026.
- Rapid growth of AI-related services over the last 12 months means investment in power-hungry GPUs by providers.
- Data centers will account for 8 % of total electricity use in the United States by 2030.
- AI could be responsible for as much electricity consumption as Bitcon consumes – and only in a matter of a few years.
- By 2027 worldwide AI-related electricity consumption could climb by 85.4–134.0 TWh of annual electricity consumption from newly manufactured servers.
- This would amount to half a percent of worldwide electricity consumption, but it will also spur a lot of worldwide data center electricity consumption (which is roughly around one to two percent of worldwide electricity consumption.)

Sources: Various reports like - Research by Digiconomist 'The Growing Energy Footprint of Artificial Intelligence', Report by Goldman Sachs, An IEA Report

It's not just data but chips and bricks around it too that are pushing AI on the carbon side. Anushree Verma, Director Analyst, Gartner explains how GenAI models require training with massive amounts of data, which uses much electricity and cooling water. "This creates sustainability issues and

> When cars came, they were not so focused on pollution. But with time, everything changed. The same progression can happen with AI.
>
> **- Indranil Bandyopadhyay**
>
> Principal Analyst, Forrester

> A carbon tax on AI companies and data centers is a viable strategy to address the environmental costs of high-powered AI operations.
>
> **- Saurabh Rai**
>
> CEO, Arahas

carbon footprint problem. For example, training GPT-3.5 required a supercomputer with 285,000 processor cores and 10,000 graphics processing unit chips, which consumed more than 200MWh of power. However, there are other unknown factors (like the exact number of runs or the kind of infrastructure built to deploy the model) that will have amplified the power consumption even further."

Raghavendra Rengaswamy - EY Global Delivery Services (GDS), Consulting Data and Analytics Leader avers that the significant need for computational resources by AI technologies has led to increased demand valuations for those who provide the picks and shovels to run the AI machinery.

"A study by the University of Massachusetts Amherst highlighted that training a single AI model can emit as much carbon as five cars over their lifetimes. This stark comparison underscores the importance of considering the environmental implications of AI development." Ramprakash Ramamoorthy, Director of AI research, ManageEngine, Zoho Corp. adds that with the emergence of large language models (LLMs) that are GPU-hungry, the need for sustainable computing practices has become more crucial than ever.

All this is now going to get more and more challenging.

Dhirender Mishra, Associate Vice President, Growth Advisory, Aranca (a research firm) observes that as AI models advance, their energy requirements are expected to grow dramatically; achieving a tenfold improvement in AI model efficiency could result in a power demand surge of up to 10,000 times. For example, training GPT-4 required over 50 gigawatt-hours of electricity, nearly 50 times the amount consumed to train GPT-3.

AI's escalating carbon footprint cannot be overlooked, particularly as AI systems grow in complexity and energy demand, Saurabh Rai, CEO, Arahas (a player in Geospatial, AI, and Sustainability Technology services) warns. While tech companies are making strides in optimising energy efficiency and developing less power-intensive AI algorithms, the fundamental issue remains significant.

AI- NOT AN ENERGY HOG – EITHER

But – in all fairness- we cannot forget that AI is also the reason that clean energy efforts can now run in a smarter, bigger and faster way. And Big Tech is – at least, claiming to be – investing a lot in fusion energy, clean energy sources and offsets to support AI ambitions.

We may be tempted to think that One-Upmanship is another reason that makes AI an energy culprit. Specially when all the top players are vying for the 'I did it first' spot.

Bandyopadhyay, however, dismisses that angle. "The focus of most players is on how well the models perform – and not so much on environmental-angles." He debunks the myth that AI is out there to eat energy. "AI evolution is just like any technology advancement seen earlier – like automobiles and aviation. It's at a nascent stage now. But just like what happened with Cars- we will see a progression towards better products which are high on efficiency and less of power guzzlers."

Rengaswamy reminds how, paradoxically, AI is a beacon of hope for slashing carbon emissions. "It is not just about replacing surveys with drones, thereby curtailing transportation emissions; it is about the overarching narrative of efficiency. AI is the maestro of optimisation, from bolstering the efficacy of renewable energy sources like wind and solar to being the cerebral cortex of electric vehicles. These are not mere incremental changes; they are quantum leaps toward a greener future. Data centers, once power-hungry behemoths, are on the cusp of a renaissance as AI-driven efficiency becomes the norm.

Data center operators had significant energy consumption growth projections prior to the emergence of AI. AI accelerates both the timing of data center buildout projections and the expected

> The clarion call is clear: AI is not the harbinger of a carbon apocalypse but a potent ally in our quest for sustainability.
>
> **- Raghavendra Rengaswamy**
>
> EY Global Delivery Services (GDS)

energy capacity requirements of new construction. However, a range of factors suggest that current growth projections are not achievable, Dietrich wipes away some fog here. Why? Well, the industry has not identified the 'killer' AI application(s) that will fuel the revenue streams needed to support the levels of investment projected by hyperscalers and colocation data center operators. "In addition, investment projections beyond two years are notoriously unreliable—changes in revenue projections, the state of the economy, competitive position, and other actors can quickly turn a bullish investment outlook into a bearish one." Dietrich argues.

SAYING HI TO THE GREY RHINO – IN TIME

Whichever side AI leans towards, we may, nonetheless, start thinking about making AI greener rather than greedier.

Solutions will happen in multi-pronged ways, Bandyopadhyay augurs. "Example- use of Edge. Use of smaller models. Use of transfer learning. Getting rid of parameters that are not needed and investing in fine-tuning models. The supply side will play a big role here too- like- the use of renewables in sourcing energy." And, as Bandyopadhyay reminds about a practical side - it will not be because some company will take a high moral ground. "Energy is directly related to costs. So we will see advent of AI products that give value at lower costs – which will have a corresponding low energy angle. Also, it is a high probability that the next S curve in AI – when it comes- will be about less costlier solutions that consume less computer muscle."

THE SUNNY SIDE UP

The market for AI in the energy sector could be worth $13 billion – with AI helping clean energy initiatives specially in areas like monitoring, predictive analytics, dynamic supply adjustments and grid forecasting

By 2025, global nuclear generation is forecast to exceed its previous record set in 2021.

Renewables are expected to generate more than one-third of world's electricity in 2025 – they could overtake coal as the largest source of supply.

Low-carbon sources – renewables and nuclear together – may account for 46% of the world's electricity generation by the end of 2026.

Between 2024 and 2026, an additional 29 GW of new nuclear capacity could come online globally- and more than half of them in China and India.

The share of fossil fuels in global generation is expected to decline from 61% in 2023 to 54% in 2026.

Sources: Analysis from Indigo Advisory group, An IEA (International Energy Agency) Report 'Electricity 2024'

Small models can be an immediate answer. As Dietrich seconds, there is an undercurrent of information noting significant development invested in small, issue-specific models. "These models are task-focused, reputed to be more efficient, and require much less energy to train and query. Deployment of these models will likely bend the projected power growth curve."

> Specialized hardware can significantly reduce the energy needed for AI computations, making AI operations sustainable.
>
> **- Ramprakash Ramamoorthy**
>
> Zoho Corp.

> By 2028, 30% of GenAI implementations will be optimized using energy-conserving computational methods, driven by sustainability initiatives.
>
> **- Anushree Verma,** Director Analyst, Gartner

Rai stresses that we should not only adopt renewable energy and innovate in energy-efficient technologies, but also consider financial measures such as taxing data centers that fail to meet environmental standards. "This would promote accountability and incentivise greener practices. A Carbon tax would encourage companies to innovate to reduce their carbon emissions, rather than simply passing the cost on to consumers. This tax must be structured to support sustainability without unduly stifling innovation. Funds collected could be reinvested into sustainable technology grants and renewable energy projects, enhancing the sector's overall sustainability."

There's also some hope in areas like AI (inference) and new model architectures. Dietrich opines that AI Inference has a different, less intense power profile than AI training. "It has been noted, however, that a Google search consumes .3 watt-hours while a ChatGPT request uses 2.9 watt-hours. Google search has spent over a decade improving the energy efficiency of a single search. ChatGPT searches will likely ride an energy efficiency curve over the next several years, significantly reducing the energy demand per search." But there are many uncertainties about the projected power growth curve. Uptime sees constraints driven by lead times to permit and design facilities and procure and install equipment for data centers and electricity generation. Uptime also perceives significant efficiencies to be harvested in AI and inference training and queries by focusing on software improvements and workload placement management to increase the work delivered per MWh consumed.

Techniques such as model pruning, quantization, and knowledge distillation aim to reduce the size and power requirements of AI models without compromising performance. These methods not only decrease energy consumption but also make AI more accessible and affordable.

Another promising approach is the development of specialised AI hardware, Ramamoorthy shines the light on chips here. "Chips designed specifically for AI tasks, like FPGAs, Google's Tensor Processing Units (TPUs), and NVIDIA's newer generation GPUs, offer higher performance per watt compared to traditional CPUs."

Rai also puts the areas of chip and algorithm design on the centre of the table here. "Advances here can significantly decrease the energy consumption of AI technologies. While concerns exist about potential trade-offs in speed and competitiveness, the reality is that efficiency can coexist with performance. By investing in next-generation technologies like neuromorphic computing and optimising algorithmic efficiency, we can reduce environmental impacts without sacrificing capabilities."

Anay Pathak, Global Business Director, Data Protection & Cyber Resilience (Alliances), Dell Technologies offers more suggestions. "Design AI models with energy efficiency in mind by optimising neural networks and using power-efficient hardware like GPUs and TPUs. Prune unnecessary model components and quantize weights to reduce

> Extend model lifespans and apply compression techniques to decrease energy use associated with frequent retraining.
>
> **- Anay Pathak**
> Dell Technologies

> GENAI MODELS REQUIRE TRAINING WITH MASSIVE AMOUNTS OF DATA, WHICH USES MUCH ELECTRICITY AND COOLING WATER.

computation and memory requirements. Use data augmentation and generate synthetic data to reduce reliance on large datasets."

There is a growing trend towards federated learning, which allows AI models to be trained across multiple devices using decentralised data, Ramamoorthy recommends. "This method reduces the dependence on bigger data centers, thereby cutting down on energy consumption. By distributing the training process, federated learning minimises the environmental impact while enhancing data privacy and security."

Whether these steps will work or not- is another question, altogether. Verma gives a pragmatic prism. "Technology players are aware of it, but it's hard to make AI modeling more efficient, especially as most organizations that use turnkey solutions use third-party modeling services. Users can control only the environment in which they model – such as using a high-performance, high-efficiency chip (that is, custom silicon) designed for AI modeling, or using renewable energy or low-carbon electricity during training. For AI infrastructure, there are some core areas to look at optimising such as semiconductors, software, cooling technologies. Enterprises will adopt different approaches to optimise GenAI implementations using energy-conserving computational techniques, driven by their organisation priorities and the importance their organisation places on sustainable business practices."

Major tech firms must lead by example, demonstrating that innovation can align with ecological responsibility, Rai zooms out on the bigger picture. "This involves not only adopting sustainable practices but also being transparent about energy consumption and carbon emissions. India's journey towards integrating AI with sustainability is fraught with challenges including high energy demands, significant socio-economic disparities, and environmental concerns. This could involve stricter regulations on AI-driven operations, incentives for clean energy usage, and heavy penalties for non-compliance. Furthermore, developing local AI solutions that cater to India's unique environmental and social landscape will be crucial."

HOW CAN AI BE CARBON-CONSCIOUS?

- Smaller language models and AI Inferencing
- Use of Edge Computing
- Real carbon-related initiatives instead of offsets by BigTech firms
- Clean energy supply expansion
- Innovations in chip and model design
- Pruning and Quantization
- Federated Learning
- Data Augmentation and Synthetic Data
- Workload management and software advances
- Reduction of idle time and wasted resources
- Neuromorphic computing
- Disincentives like Carbon Tax

Right now, everything is new, Bandyopadhyay gives a reality-check. "As long as someone is funding it, players will not mind the energy angle too much. But as things settle down, we will see a clearer picture."

"It is about harnessing AI's transformative power to not just reimagine but rebuild our world, where increased efficiency is synonymous with reduced emissions. This is the future we must invest in, a future where AI and the environment are not at odds, but in harmony." Rengaswamy hopes.

There is still time to find light at the end of this tunnel. But there is always light when we open a fridge. The problem is that most of the times we open it not because we are hungry but because we want to eat something before someone else does. Sadly, that 'sibling logic' applies to all refrigerators. Whether in our homes. Or in the big ones – housed in a tech backyard.

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Hair Of The Dog: Technology for Climate Modelling

You can't rely on reading tea-leaves for solving the present and upcoming concerns of climate change. With all the data centres, factories, e-waste and supply chains that technology weighs down the planet with, it only makes sense to use the problem, itself, as a solution. But it would take more than a hair-cut here.

By Pratima H

Take a guess on this. Who is the world's best meteorologist? Is s/he sitting in some super-computing facility? Or hovering above us in some satellite? Well, turns out this expert is busy singing on some tree in a busy forest. What's Birdsong to us can be a complex and data-rich algorithm altogether in the world of these tiny creatures that are fluttering and chirruping their own codes. Take the Veeries from the forests of Northern US and Southern Canada. They are the best in the industry when it comes to predicting the Atlantic Hurricane season – thanks to their breeding patterns. Veeries have been observed to stop breeding early when the storms are earlier than expected. You watch them and you can get warnings – early enough.

In other parts of the world, in the Urban concrete jungles, computers of all sizes and stripes are trying to match up to sparrows and butterflies – in predicting hurricanes and other such events where fast action matters. Armed with swift attention and early alerts,

> CLIMATE MODELS HAVE SEEN IMPROVEMENTS IN ACCURACY, ABILITY TO HANDLE COMPLEXITY, AND SPEED IN CRUNCHING HUGE VOLUMES OF DATA- WITH TECHNOLOGY ADVANCEMENTS.

humans can be better equipped to handle many Climate incidents.

Climate models and technology-backed intuition are trying to do just that.

IT TAKES GUTS

The most interesting and beautiful use of our home-grown PARAM supercomputer could not have been any better – in this vein. It has been busy in taking a 'guess' but driven with supercomputing gut-feel. Anuman, which has been jointly developed by CES and VC & BA groups of C-DAC Pune, has been created to give hour-to-hour weather forecast over 50000 locations all over India using high-resolution weather model output – and it's all generated using C-DAC's National PARAM Supercomputer.

There is also the Saptarang initiative wherein CES Group (over last 20 years) has generated a range of simulated model outputs of meteorology, oceanography and air quality. The team has used a very high-resolution global forecast model that can be applied for seasonal forecast of Indian Summer monsoon rainfall along with global coupled model simulations for climate change studies. Also notable is the Experimental Extended Range Monsoon Prediction Experiment of the Department of Science and Technology, wherein the CES Group has helped with seasonal forecasts to India Meteorological Department (IMD) since 2005 using NCEP, Global T170L42 Spectral Model. CES, the Indian Institute of Tropical Meteorology (IITM), Pune and the National Physical Laboratory (NPL), New Delhi developed a methodology for conversion of large-scale emission inventories to gridded/ model-ready format over Indian region using GIS as a tool.

IIT Madras has also established a Centre for Atmospheric and Climate Sciences (CACS) dedicated towards studying the Earth system science and climate in Anthropocene. The idea is to understand the complex dynamics of the atmosphere and work towards strong fundamental and applied research to better understand and mitigate the impact of climate change on society. For example, one research studied Climate-change-induced risk mapping of the Indian Himalayan districts. It observed that the western Himalayan region is at more risk than the eastern Himalayan region in India. Another study explored how reduction in human activity can enhance the urban heat island - as insights from the COVID-19 lockdown. It was seen that the delay in winter crop harvesting during the lockdown increased surface vegetation cover, causing almost half the regional cooling via evapotranspiration. Turns out that since this cooling was higher for rural areas, the daytime surface urban heat island (SUHI) intensity increased (by 0.20–0.41 K) during a period of reduced human activity.

Step out of India, and you can find many such giant set-ups down in the weeds with a lot of simulations and forecasts whirring silently. Speaking of supercomputers, the first Cray petascale capabilities have been applied for forecasting and research – the most recent being selection by the European Centre for Medium Range Weather Forecasts (ECMWF) and Deutscher Wetterdienst (DWD) – for increased resolution and model enhancements.

There is also the Met Office Hadley Centre's HadGEM3 family of models in the UK. And the NOAA Geophysical Fluid Dynamics Laboratory's GFDL ESM2M Earth system model. Along with the Community Earth System Model (CESM) from National Center for Atmospheric Research (NCAR) in the US. Plus, exa-scale supercomputer Frontier which recently became available for scientific use and has helped to sharpen the resolution of Department of Energy (DOE)'s global climate model. It enabled it to simulate the fine-scale atmospheric processes that give rise to clouds (a big uncertainty in climate prediction work) - something that is left to guesswork in coarser models.

> BIG CHALLENGES REMAIN- LIKE THE DILEMMA BETWEEN ACCURACY AND PROCESSING TIME, BETWEEN SIMULATION QUALITY AND SPEED – SPECIALLY WHEN A MODEL TRIES TO 'LEAPFROG' INTO THE FUTURE.

In UK, Met Office Cray XC40 supercomputing system and similar work are lauded for enhancing high-resolution climate modelling and to better assess future impacts of a changing climate at a regional scale, especially from high-impact weather and risk-resilience.

And of course, now there is AI in the fray too. Recently, we heard how NASA and IBM Research have developed a new AI model 'Prithvi Weather Climate Foundational Model' to be trained on a broad set of data (NASA data from NASA's Modern Era Retrospective Analysis for Research and Applications or MERRA-2). It would be using AI to apply patterns gleaned from the initial data across a broad range of additional scenarios.

GUTS NEED PRO-BIOTICS

It all began with how sailors would predict storms with the patterns of winds they captured. When spread over a long period of time, any data captured with rigour and accuracy, can be a good telescope to see what may be expected ahead. Climate models are not new. But their accuracy, ability to handle complexity and above all, their speed and ease at crunching huge volumes of data- have been improved a lot due to some recent technology advancements. Specially those related to supercomputers, quantum computing and AI. This comes in handy when the goal is about simulating an entire ocean, continent or even the planet. The smallest improvement in spatial resolution (grid cell design and layout) of a model can call for a lot of fuel-tanks of compute power. If weather forecasts help us with hourly indicators, climate models play a game of many decades. Just think of the colossal number of calculations and crunching that all that prediction-work can take.

Imagine Earth as a giant, interconnected machine, its temperature, winds, and rainfall all intricately linked. Climate change throws a wrench into this machine, and understanding its future behavior becomes crucial. This is where climate modeling steps in, acting as our virtual time machine, offering glimpses of what's to come explains Saurabh Rai, CEO, Arahas. "But unlike a crystal ball, climate modeling relies on hard science and cutting-edge technology. Early climate models were like trying to understand a complex recipe with key ingredients missing. They captured the broad strokes – the Earth heats up, oceans rise – but lacked the detail to predict regional variations. This is where parameterization comes in, the scientific art of translating complex, unseen processes (like cloud formation or ocean currents) into mathematical equations. Think of it as filling in the missing ingredients of the recipe. Today's models are like having a seasoned chef in the kitchen. They incorporate real-world data from satellites and weather stations, along with sophisticated equations, to paint a more accurate picture of how Earth's climate works.

Dhirender Mishra, Associate Vice President, Growth Advisory, Aranca avers that Climate modeling has become an essential tool for understanding and forecasting the impacts of climate change. "Significant advancements in climate modeling over the past few years have enabled a better understanding of the Earth's climate system. These models have deepened our knowledge of climate dynamics and the potential future impacts of climate change. They are used to forecast future climate scenarios, which help in developing measures and policies to mitigate the potential impacts of climate change."

Another key advancement is spatial resolution, Rai adds. "Think of Earth as a giant grid, with each square representing a specific location. Early models used a sparse grid, like looking at the world through a pixelated screen. This meant regional variations in climate were lost in the blur. Now, thanks to increased computing power, we can use much finer grids. Imagine zooming in on that pixelated screen, revealing the intricate details of a landscape. This increased resolution empowers communities directly impacted by climate change to make informed decisions about their future. Farmers can plan for changing rainfall patterns, and coastal communities can prepare for rising sea levels."

> IT IS CRITICAL TO CONSIDER THE PROBLEM OF MODEL-SPREAD AND MULTIPLE MODEL OUTPUTS WHEN MAKING CLIMATE-CHANGE DECISIONS.

Rai commends how India is at the forefront of this fight against climate change. "Recognizing the criticality of understanding regional climate impacts, they've developed their climate model, specifically designed to predict the impact on the crucial Indian monsoon – a lifeline for their agricultural sector."

A BCT Digital-Chartis Research ESG and Climate Risk Survey shows that 72 per cent of global financial institutions plan to spend upto $500,000 or more on ESG technology.

AND PRE-BIOTICS TOO

These models have their limitations and tight-ropes too.

A persistent challenge with many climate models has been the dilemma between accuracy and processing time, between simulation quality and speed – specially when a model tries to 'leapfrog' into the future.

Mishra reminds that there remain serious shortcomings in its predictions due to gaps in our fundamental understanding of the Earth system and the scientific limitations of supercomputing power. "However, with ongoing technological advancements, it is expected that these challenges will be mitigated in the future."

Striking a balance between model complexity and computational power is a delicate dance, underlines Rai. "Imagine trying to run a marathon on a treadmill – the more features you add (higher resolution, more complex parameterizations), the faster the treadmill needs to go (increased computing power). This can be a hurdle for developing countries with limited resources."

He also talks about the challenge of model spread. "Imagine asking a group of meteorologists to predict the weather tomorrow – you might get a mix of sunny, cloudy, and rainy. Climate models are similar. While improved models with more sophisticated equations should theoretically converge on a clearer picture of the future, the inherent complexity of the climate system throws a wrench into that. Small differences in initial conditions can lead to a range of potential futures, creating a spread of possible outcomes. This highlights the need for continuous improvement and the importance of considering multiple model outputs when making climate change decisions."

Then, there are practical walls and hoops to jump through too. As the BCT Digital-Chartis Research pointed out - over half of global financial institutions feel keeping up with changing regulations as the biggest ESG-related challenge. About 48 per cent of the respondents pick here-risk assessment and mapping relevant ESG. There were also 48 per cent who viewed integrating ESG into operational and financial workflows as significant challenges. The key challenges that were distilled were as follows: meeting regulatory stress testing expectations (67 per cent), accurate GHG (Greenhouse gas) accounting (56 per cent) and integrating climate risk operationally into product lines (50 per cent).

Nonetheless, we need these Climate-models – with more efforts and capabilities.

As the optimistic Rai argues, Quantum computing could be the key to overcoming the computational bottleneck, allowing us to create incredibly detailed models with even finer resolution in a fraction of the time. "Additionally, new algorithms specifically designed for quantum computers could unlock even deeper insights into climate system dynamics. We could be looking at a future where understanding the intricate dance of clouds, oceans, and temperature becomes a reality, leading to more accurate and actionable climate predictions."

Rai is right. "Climate modeling isn't just about predicting the weather – it's about shaping a more sustainable future for generations to come. It's about giving humanity the tools it needs to navigate the complexities of a changing climate and build a more resilient planet."

Technology can, for all its guilt in adding to carbon footprint, aspire to be the world's second-best meteorologist. One swallow never made a summer.

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Greenovation: Building a Circular and Regenerative World

This article examines how renewable energy, circular economy, and smart city initiatives are emerging as powerful tools to address these challenges and create a sustainable future for generations to come. Solar, wind, and hydroelectric power are at the forefront of this shift, each contributing to a more sustainable and efficient energy future. Sachidanand Upadhyay, Hasit Kaji, and other industry leaders share insights into the most promising developments in these fields and the challenges we face in accelerating their adoption.

By Aanchal Ghatak

The imperative for sustainable solutions has never been more urgent. As the world grapples with climate change, resource depletion, and urban challenges, innovation emerges as a powerful catalyst for transformation. The convergence of renewable energy, circular economy, and smart city concepts is shaping a new era of sustainability, with profound implications for industries and societies alike.

REWIRING THE PLANET

The renewable energy sector is experiencing a renaissance, driven by technological advancements and a growing global commitment to decarbonization. As Sachidanand Upadhyay, MD of Lord's Mark Industries Limited, emphasizes, "The energy landscape is undergoing a remarkable transformation." Innovations like perovskite solar cells, bifacial panels, and concentrated solar power fuel the sector's rapid growth. Wind power, too, is experiencing a resurgence, with larger turbine blades, improved aerodynamics, and offshore wind farms expanding its potential.

Hydropower, a mature technology, is undergoing a revival with a focus on small-scale, low-impact

> Value creation from data generated from a solar or wind plant is a result of influencing outcomes as measured by solar yield optimization through predictive maintenance of assets.
>
> **- Hasit Kaji,** Independent Advisor, Former CDIO, Tata Power

projects. Additionally, marine energy is emerging as a promising, albeit nascent, source of renewable electricity.

CIRCULAR ECONOMY: CLOSING THE LOOP ON WASTE

The circular economy, a systemic approach to resource management, is gaining momentum as a response to the mounting waste crisis. "By leveraging data to optimize asset performance and predict energy output, we can significantly enhance the efficiency and profitability of these projects," emphasizes Hasit Kaji, independent advisor and former CDIO of Tata Power. Data analytics is indeed a cornerstone of a circular economy, enabling better decision-making and resource optimization.

Advanced recycling technologies, such as chemical recycling, are transforming waste into valuable resources. Digital product passports, offering a comprehensive record of a product's lifecycle, are crucial for facilitating repair, reuse, and recycling. Industrial symbiosis, where waste from one industry becomes a resource for another, is another key principle of the circular economy.

"IoT and drones can enhance site surveillance, while digital twins can optimize generation and efficiency. Gen AI can streamline maintenance processes and tender responses. Blockchain technology holds the potential for peer-to-peer energy trading, particularly for excess rooftop solar generation." he adds.

Sectors like railways can contribute to a circular economy by recycling materials from old trains and adopting sustainable practices in maintenance and operations. Additionally, smart technologies can be implemented for efficient train operations, energy management, and passenger services.

SMART CITIES: BUILDING SUSTAINABLE URBAN CENTERS

Smart cities are redefining urban living by integrating technology to enhance efficiency, sustainability, and quality of life. "Real-time data on traffic, energy consumption, and environmental conditions enable optimized resource management and improved decision-making," explains an industry expert. IoT-enabled sensors and data analytics are transforming urban management, from traffic optimization to energy efficiency.

Green buildings, incorporating renewable energy, energy-efficient design, and smart building management systems, are essential components of sustainable cities. Electric vehicles, public transportation, and shared mobility services are reducing carbon emissions and improving air quality.

SOLAR POWER ADVANCEMENTS

The solar power sector is experiencing a surge in innovation, making it more efficient and cost-effective than ever before. Key advancements include:

1. **Perovskite Solar Cells:** These cells are known for their high efficiency and lower production costs compared to traditional silicon-based cells.
2. **Bifacial Panels:** These panels can capture sunlight on both sides, significantly increasing energy output.

> Zonal railways and production units have taken initiatives regarding solid waste management and waste processing methods such as segregation and recycling of waste biasing methods like 5s concept like seiri, seiton, seiso, seiketsu and shirsuke and accepting Japanese methods of lean manufacturing like JIT, SMED.
>
> **- Anil Kumar Gahlot,** Retd. Senior Section Engineer, NWR

> Amdocs solutions are designed to modernize, automate, and digitize our customers' businesses, making them more efficient, less reliant on physical hardware and able to scale supporting system environments up and down in real-time to prevent wasting resources.
>
> **- Samit Banerjee,** Division President, Cloud Operations Services & Head of Customer Service Unit, Amdocs

3. **Enhanced Energy Storage:** Improved battery technologies are enabling better storage of solar energy, ensuring a stable supply even when the sun isn't shining.

Lord's Mark Industries is pioneering projects that leverage these advancements. Sachidanand Upadhyay highlights, "In India, Lord's Mark Industries is advancing this vision by securing a project to set up 50 MW of grid-connected rooftop solar projects in Uttar Pradesh, contributing to the country's net-zero emissions target by 2070." He adds, "Besides, we are pleased to get the opportunity to install more than 5000 smart solar street lighting in phases at Ayodhya. As per the contract, Lord's Mark Industries will manage the designing, supply, installation, testing, and commissioning of LED-based smart solar street lights with $LiFePO_4$ battery including 5-year comprehensive warranty along with operations and maintenance."

WIND POWER INNOVATIONS

Wind power technology is also making significant strides, particularly in the following areas:

1. **Offshore Wind Turbines:** These are becoming more efficient and cost-effective, with floating technology allowing installations in deeper waters with stronger winds.
2. **Large-Diameter Turbines:** Extended blades capture more energy, reducing costs.
3. **Vertical Axis Wind Turbines (VAWTs):** Useful in urban settings, these turbines capture wind from any direction.
4. **Lightweight Materials:** Using carbon fiber enhances turbine durability and reduces maintenance costs.

HYDROELECTRIC POWER DEVELOPMENTS

Hydroelectric power, a long-standing pillar of renewable energy, is also evolving:

1. **Small Modular Hydropower Systems:** Designed for low-impact, small-scale production, these systems minimize environmental disruption.
2. **Pumped Storage Hydropower (PSH):** Acts as large-scale batteries, improving grid stability and energy storage.
3. **Hydrokinetic and Tidal Power:** These technologies capture energy from flowing water and tides, providing alternatives to traditional dams.
4. **Fish-Friendly Turbines:** New designs reduce impacts on aquatic life, enhancing the sustainability of hydroelectric power.

ACCELERATING RENEWABLE ENERGY ADOPTION

To achieve a sustainable future, accelerating the adoption of renewable energy sources is crucial. Key strategies include:

1. **Increased Investment:** Funding clean energy projects and research to drive down costs and spur innovation.
2. **Infrastructure Upgrades:** Modernizing energy systems to integrate renewable sources smoothly.
3. **Supportive Policies:** Implementing subsidies, tax credits, and other incentives to encourage adoption.
4. **Collaboration:** Fostering partnerships between governments, businesses, and communities to share resources and expertise.
5. **Awareness and Training:** Educating the public and providing training on renewable technologies to build the necessary skills.

OVERCOMING CHALLENGES

Despite the advancements, several challenges hinder the widespread implementation of renewable energy technologies:

1. **High Initial Costs:** Installation and infrastructure expenses can be prohibitive.
2. **Intermittency Issues:** Solar and wind sources are variable, requiring reliable storage solutions.

> We are pleased to get the opportunity to install more than 5000 smart solar street lighting in phases at Ayodhya. As per the contract, Lord's Mark Industries will manage designing, supply, installation, testing, and commissioning of LED-based smart solar street lights with LiFePO4 battery including 5-year comprehensive warranty along with operations and maintenance.
>
> **- Sachidanand Upadhyay,** MD, Lord's Mark Industries Limited

3. **Grid Integration:** Existing energy grids often need upgrades to handle renewable energy sources.
4. **Regulatory Hurdles:** Inconsistent or outdated regulations can slow progress.
5. **Environmental and Land Use Concerns:** Addressing the impact on ecosystems and land use is crucial.
6. **Market Uncertainty:** Rapid technological changes and market fluctuations can create uncertainty for investors and developers.

THE INTERCONNECTEDNESS OF SUSTAINABILITY

The four pillars of sustainable innovation—renewable energy, circular economy, smart cities, and sustainable transportation—are interconnected. As Samit Banerjee, Division President of Amdocs, points out, "Our cloud-based solutions help businesses reduce their carbon footprint by optimizing resource utilization." Technology, in the form of cloud computing, artificial intelligence, and the Internet of Things, is a powerful enabler of these interconnected systems.

The transition to a sustainable future requires a holistic approach that integrates these elements. For instance, renewable energy powers smart cities, while smart cities generate data that can optimize renewable energy systems. Both contribute to a circular economy by reducing waste and resource consumption. The railway sector can play a vital role in this ecosystem by adopting sustainable practices and integrating with the broader sustainable infrastructure.

"Product sustainability and accessibility are embedded in our research and development approach and products development. Starting from environmental benefits, providing governance improvement opportunities, and leading to digital inclusion touch points are some of the case studies in this field." Banerjee iterates.

"The energy landscape is undergoing a remarkable transformation," reiterates Upadhyay. "Each of these advancements is a step toward a more sustainable and efficient energy future, reflecting a collective push towards cleaner energy solutions."

To realize the full potential of these innovations, collaboration among governments, businesses, and communities is essential. By investing in research and development, creating supportive policies, and fostering public awareness, we can accelerate the transition to a sustainable future.

INTEGRATING RAILWAYS' SUSTAINABILITY EFFORTS INTO THE RENEWABLE ENERGY DISCUSSION

The insights provided by Anil Kumar Gahlot, Retd. Senior Section Engineer, NWR, offers a valuable perspective on the Indian Railways' commitment to sustainability. The railway sector, as a significant energy consumer, is making substantial strides in reducing its environmental footprint.

RAILWAYS: A PILLAR OF SUSTAINABLE MOBILITY

The Indian Railways is actively addressing challenges related to solid waste management, noise pollution, and greenhouse gas emissions.

Their initiatives align with the broader goals of the renewable energy sector.

Solid Waste Management: The adoption of the 5S concept and bio-toilet technology demonstrates the railway's proactive approach to waste reduction and treatment. These practices not only improve cleanliness but also contribute to resource conservation.

Noise Pollution Mitigation: By implementing noise barriers, dampers, and track maintenance, the railways are working diligently to reduce noise pollution, enhancing the passenger experience and minimizing environmental impact.

Greenhouse Gas Reduction: The transition to electric locomotives and the focus on freight transportation are crucial steps in decarbonizing the railway sector. The introduction of hydrogen-

THE URGENCY FOR SUSTAINABLE SOLUTIONS IS AT AN ALL-TIME HIGH AS CLIMATE CHANGE AND RESOURCE DEPLETION THREATEN GLOBAL STABILITY. INNOVATIONS IN RENEWABLE ENERGY, CIRCULAR ECONOMY PRACTICES, AND SMART CITY TECHNOLOGIES ARE DRIVING SIGNIFICANT ADVANCEMENTS.

powered trains signifies a forward-looking approach to achieving zero emissions.

Energy Efficiency: The use of regenerative braking, LED lighting, and optimized energy management systems underscores the railway's commitment to reducing energy consumption.

SYNERGIES BETWEEN RAILWAYS AND RENEWABLE ENERGY

The railway sector can further enhance its sustainability profile by exploring opportunities to integrate renewable energy sources.

Solar Power: Installing solar panels on railway stations, workshops, and other infrastructure can generate clean electricity, reducing reliance on the grid.

Wind Power: Analyzing wind resources along railway lines could identify potential sites for wind farms, contributing to the railway's energy mix.

Energy Storage: The railways can leverage their infrastructure to deploy energy storage systems, such as battery banks or pumped hydro storage, to support grid stability and optimize energy consumption.

A COMPREHENSIVE APPROACH TO SUSTAINABILITY

The combined efforts of the renewable energy sector and the railways can accelerate India's transition to a low-carbon economy. By sharing best practices, collaborating on research and development, and exploring joint projects, these two sectors can create a more sustainable and resilient future.

"Railways has introduced Insulated-Gate Bipolar Transistor (IGBT) based 3 - phase electric locomotives and emu or memu with regenerative braking which means to regenerate energy possessed by the train during costing of the train thus supplying it back to OHE wires," he explains.

The advancements in solar, wind, and hydroelectric power, along with sustainable practices in other sectors like railways, are paving the way for a cleaner and more efficient energy future. By addressing challenges and accelerating adoption through strategic investments, policy support, and collaboration, we can achieve a sustainable energy landscape that benefits both the environment and society.

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The era of Glass Pipes: Blockchain

With clear visibility, real-time traceability and tamper-proof information – Blockchain can not only help our supply-chains and information tunnels in unclogging corruption and fraud but can also improve the flow of carbon accountability. Time to call the plumber?

By Pratima H

The problem with rabbit-holes is, well, they house rabbits or rats or fossils. And it is never easy to navigate a warren. So why have we endured the complexity, obscurity and incorrigibility of closed pipes and elusive tunnels in some industries? For so long!! Where's the light here? Why has no one used some tough and tenacious, but, crystal-clear glass instead of copper, opacity and iron all this while?

Turns out, Blockchain could be that glass we have been looking for - glass that is transparent but also 'not brittle' and 'not so fragile'. What makes it shine? Especially in green shades? And what keeps it under the bubble wrap in some places? Let's follow this pipe.

FROM RUBBER TO COTTON TO PAPER- GLASS IS NOW MORE THAN A VASE

Recently, we saw how India is trying to promote Kasturi cotton as a premium brand from India. As seen at the meeting where the Ministry of Textiles,

> If you take an ecosystem approach and combine blockchain with IoTor IIoT, you can drive even greater transparency into supply chain management.
>
> **- SubramaniamThiruppathi**
>
> Zebra Technologies

the Cotton Corporation of India (CCI), Texprocil and textile industry pushed for Kasturi cotton at the International Cotton Advisory Committee (ICAC) - unlocking various standards to global representatives. It will be a blockchain-enabled cotton that will help in traceability. Just by scanning a QR code of the product, a consumer can trace the supply chain right until ginning and spinning. And as envisaged, when the framework evolves, the system would be able to provide more details of the complete supply chain.

Not far away are attempts in other sectors too. The Indian Rubber Manufacturers Research Institute (IRMRI) and Emertech Innovations Pvt. Ltd. shared about India's first initiative to incorporate blockchain innovations across the rubber sector. This will bring in the verifiability and security of certification credentials and streamline the validation process for skilled professionals.

Raghav Putrevu, Co-founder & Chief Strategy Officer, Natfirst; Founder & CEO, OrangePeople offers many more examples. "Companies like ITC and Walmart India are adopting blockchain, supported by government initiatives such as Telangana's blockchain project for seed traceability. Collaborative platforms, like IBM's partnership with Indian tea producers, are ensuring product authenticity. Andhra Pradesh utilizes blockchain to track farm produce, while Mahindra integrates IoT to track automotive parts in real time. ICICI Bank has implemented blockchain for efficient trade finance, reducing transaction times and costs."

India seems to be embracing Blockchain in a serious way now.

In an Observer Research Foundation (ORF) note, it was cited how the Government of India has been taking a keen interest in blockchain technology and its application to the public domain, as is evident from the release of the 'National Strategy on Blockchain' by MeitY in December 2021 – talking about adoption of blockchain in various sectors like healthcare, agriculture, finance, voting and e-governance. India might soon enable 'Made in India' blockchain technology for global use by 2027 - achieving convergence across blockchain, Internet of Things, cloud and Artificial Intelligence (yes, the 'BICA Stack'). Many departments are already exploring use of blockchain technology for land registration, issuing digital certificates and customs duty payment.

Examples all across India reiterate the interest and possibilities in Blockchain. Prateek Tripathi, Research Assistant, Centre For Security, Strategy and Technology, ORF outlines many examples. Like the use of NFTs for land mutation by the New Town Kolkata Development Authority in West Bengal. These NFTs can provide 'proof of land ownership' and all documents embedded with them are tamper-proof. This makes the land mutation process transparent – and also wipes away manual paperwork and record-keeping. Then there are instances like how municipal corporations of Durgapur and Bankura districts in West Bengal have also built a blockchain-based platform to issue legal

> By enhancing traceability, reducing fraud, and improving efficiency, blockchain technology can transform supply chains and sourcing practices, leading to more environmentally sustainable outcomes.
>
> **- Padmakumar Nair,** CEO and Co-Founder of Ennoventure, Inc.

> By tracking the movement of goods with pinpoint accuracy, we can expose unsustainable practices like deforestation or unethical labor conditions.
>
> **- Kirthiga Reddy,** CEO and Co-founder, Virtualness

documents like birth certificates. We also have the example of the 'Tamil Nadu Blockchain Backbone' or 'Nambikkai Inaiyam' for providing every citizen of Tamil Nadu with a unique state ID to consolidate all their essential documents like e-sevai, academic and birth certificates into a single digital wallet. In North India, there is the Uttar Pradesh Government which, in partnership with Polygon, has explored the 'Firozabad Public Grievance Management System' - an online portal based on blockchain technology for filing and tracking complaints. Small Industries Development Bank of India (SIDBI) is another good case. It is trying a block-chain based platform for the Indian MSME sector – to confront the growing issue of duplicate pledging of collaterals among MSMEs which has led to financial losses and challenged the trust factor across the industry.

A NITI Aayog report also cited the Union Territory of Chandigarh case. As a city that has existed for only 66 years and where most land parcels may have exchanged hands maybe 2 to 3 times, it was tough to ensure that every piece of land has a unique ID and is mapped for ownership (including change of ownership). This made it an ideal candidate for NITI Aayog to pursue a PoC project for land records using blockchain.

It is not hard to guess why so many industries are rewiring their ways to tap the beauty of Blockchain. At a basic level, this is a distributed digital ledger or database. But its real-time, tamper-proof and consensus-driven traits ensure that any change made in this ledger is visible, transparent, and corruption-free. The advent of 'smart contracts' after the launch of Ethereum in 2014 has opened a wonderland of new applications and self-executing contracts – adding more business-world relevance for Blockchain.

Virtualness, recently partnered with Indri Single Malt to provide authentication and proof of verification to consumers. This was a great use-case in demonstrating how blockchain can elevate consumer trust and secure ownership records - thus, making the supply chain more transparent.

Kirthiga Reddy, CEO and Co-founder, Virtualness cites this case and explains,

"Imagine a system where every step – from raw material extraction to product delivery – is documented on a secure, tamper-proof ledger. This is what blockchain offers. By tracking the movement of goods with pinpoint accuracy, we can expose unsustainable practices like deforestation or unethical labor conditions. Consumers, for the first time, can have real confidence in the claims made about the products they buy."

A 2023 joint report by Assocham and EY also indicates that 40 percent of surveyed Indian businesses across various sectors are planning or piloting blockchain projects. As per GlobalData, the blockchain market size revenue was pegged at $12.4 billion in 2023 and it can rise at a compound annual growth rate (CAGR) of more than 57 percent over the forecast period of 2023-2030. In the 2024 Manufacturing Vision Study from Zebra Technologies Corporation, it was spotted that 57 percent globally, and 63 percent (in APAC, including India) of manufacturing leaders expect to increase visibility across production and throughout the supply chain by 2029.

Recent trends show blockchain fast gaining traction across varying sectors like manufacturing, logistics, and government services, observes Subramaniam Thiruppathi, Director of Sales for India and Sub-Continent, Zebra Technologies. "Notably, global bio-pharmaceutical manufacturers are already using blockchain to track vaccines, to ensure their product integrity and safety."

Surprisingly, even fresh-off-the-boat industries like EV (for battery supply chain and energy consumption) and Renewables (smart Power Purchase Agreements and REC certificates) are finding strong advantages in Blockchain.

TRANSPARENT BUT GREEN. GREEN BECAUSE TRANSPARENT

There is a big green upshot that emerges through

> Blockchain can give accurate and real-time facts on useful resource use and waste manufacturing.
>
> **- Saurabh Rai**
> CEO, Arahas

Blockchain. "Companies can no longer greenwash their practices, and consumers can make informed choices that align with their values. This, in turn, incentivizes businesses to adopt sustainable practices throughout their supply chains." Reddy elucidates.

"Blockchain can be utilized to monitor water usage, plastic production, energy sourcing and consumption, and waste reduction and recycling, thereby promoting sustainable operations. For instance, major retailer Walmart has adopted IBM's blockchain-based Food Trust network to ensure product safety, reduce waste, and verify sustainability claims, illustrates Dhirender Mishra, Associate Vice President, Growth Advisory, Aranca.

Traditional supply chains often suffer from opacity, making it difficult to verify the sustainability of sourced materials, explains Padmakumar Nair, CEO and Co-Founder of Ennoventure, Inc. "Blockchain addresses this by creating an immutable ledger that records each step a product takes from origin to consumer. This transparency ensures that every transaction is traceable, which helps in verifying that materials are sourced responsibly and sustainably. For instance, consumers can scan a QR code to see the entire journey of their product, ensuring it adheres to ethical and environmental standards."

Consider how electronic products embedded with blockchain can be traced and managed throughout their lifecycle, ensuring proper disposal and recycling. Nair opines that the combination of Blockchain and IoT offers a thorough understanding of the whole supply chain by enabling real-time tracking of supplies and items. "Businesses may guarantee adherence to sustainability guidelines and promptly resolve any difficulties by gathering data at every stage. Another trend is the development of decentralized energy grids. Peer-to-peer energy trading is made possible by blockchain, giving people and companies the ability to directly purchase and sell renewable energy. This encourages the use of renewable energy and reduces dependency on conventional energy suppliers, resulting in an ecosystem for energy that is more sustainable."

Siddharth Ugrankar CEO & Co-Founder at Qila. Io adds how blockchain has been widely adopted in carbon credit and renewable energy certificates. "With the adoption of blockchain, it makes it easier for companies to offset their carbon emission by transparently trading carbon credits, avoiding double counting. This makes it easy to measure the environmental benefits."

Saurabh Rai, CEO, Arahas adds that blockchain can improve useful resource control through presenting accurate and real-time facts on useful resource use and waste manufacturing. "This information can be used to optimize operations and decrease waste."

However, there are still gaps to address. Blockchain technology itself can be energy-intensive, and we need to ensure these systems are built on sustainable protocols. We need to be conscious of the protocols we choose for blockchain systems, opting for those designed with energy efficiency in mind.

Nair also contends that since current blockchain networks can be resource-intensive, this is still a major concern that may prevent large-scale supply

> There are potential risks in the initial stages of implementation of the technology due to the possibility of hacking, cyber-attacks and technical glitches.
>
> **- Prateek Tripathi,**
> Centre For Security, Strategy and Technology, ORF

> Funding for advanced research and encouraging global collaboration will be key to enhancing India's blockchain expertise and supporting the sector's growth."
>
> **- Neeti Sharma,** CEO, TeamLease Digital

chains from adopting blockchain technology widely. "Interoperability between different blockchain platforms is also crucial for seamless integration across sectors and regions. Moreover, switching to more energy-efficient consensus methods like proof-of-stake is necessary to address environmental concerns raised by blockchain technology's energy consumption, particularly in proof-of-work systems."

Cryptocurrencies such as Bitcoin that use Proof of Work (POW) for its consensus mechanism need heavy computational power which requires high energy usage and more carbon emissions, Ugrankar echoes that concern. "This challenge is being curbed to some extent with the adoption of different consensus protocols such as Proof of Stake (PoS), Ethereum 2.0 has been using the proof of stake model to reduce its energy consumptions and carbon footprint."

IT'S NOT SMELLING ALL BLOCKCHAIN YET, BECAUSE....

We cannot ignore the stains that have appeared on this glass pipe – even if it looks all sleek and shiny.

Let's turn to an analysis of NITI Aayog's pilots – as shared in a NITI Aayog report 'Blockchain: The India Strategy' 2020. One key challenge outlined here was Garbage In, Garbage Out. A significant amount of work is needed to ensure data is 'dispute free'. It also talked about how Blockchain's 'immutable' nature necessitates the need to create a 'single source of truth' before a process is put on the blockchain. It is also vital for blockchain systems to develop the capability to integrate with legacy systems. The initial implementation of blockchain solutions have hinted that they are more amenable to atomic transactions i.e. transactions that have a finite life, as compared to non-atomic transactions which may have large / infinite life e.g. land records.

Tripathi contends that there are many challenges on this path. "Blockchain technology can be complex and there is widescale ignorance of its benefits and inner workings. Blockchain technology itself is not completely impervious to cyber-attacks, as is evident from cases like the '51 percent attack' on cryptocurrency wallets. There is also the issue of the capital required for the hardware implementation of the technology on a large scale. While this may not be a major issue for large corporate entities, financing is a major hurdle for smaller startups and even government establishments."

Other challenges also need attention, Putrevu points out. "Like managing large transaction volumes, regulatory uncertainty, high implementation costs, complexity, and a limited understanding of the technology among stakeholders."

Tripathi also brings to the fore the factor of regulation. "The legal status of smart contracts executed on a blockchain is still evolving in India and there are no established guidelines by the government at the moment."

Of course, humans will always be needed to push any technology. While premier educational institutions and a vibrant tech community provide a strong foundation, there is a notable shortage of specialized skills and practical experience, highlights Neeti Sharma, CEO, TeamLease Digital. "To bridge this gap, it is crucial to expand blockchain courses and specializations in universities, promote online learning platforms, and encourage IT companies to invest in upskilling their workforce. Government support through policy implementation, grants, and innovation hubs can further foster development."

As we can see, Blockchain is still finding its way around all these underground corners and sharp turns. If we can address the cybersecurity, talent, scalability and legacy-compatibility issues of Blockchain applications, we might finally find what the industry has been searching for – after the big digitalization party where the Climate Clock has struck a loud 12. We might get our hands on - The other glass slipper. But let's do it soon- before the other shoe drops.

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Tech and Sustainability: Forging a Future Together

Environmental sustainability must be prioritized, with technology playing a crucial role. The synergy between these realms is essential for reducing carbon footprints and enhancing ESG reporting, driving positive impact. As we navigate our interconnected world, the harmony between sustainability and technology will continue to shape our future.

By Mona Bharadwaj

As a kid in the 70s living in Bangalore, I remember the city vividly for its charming and serene atmosphere. Our family car was often the only vehicle on the road for miles, even though many neighbours owned cars. People preferred walking, even for relatively long distances. We walked everywhere, enjoying the sprawling parks that earned Bangalore its title as the Garden City. For several decades, this unhurried pace of life persisted. Sustainability was merely a word in the dictionary, an abstract concept that held little significance in our day-to-day lives.

Then, rapid and profound changes started reshaping the landscape and introducing new dynamics into our daily lives. The Liberalization, Privatization, and Globalization (LPG) Reforms in 1991, marked a significant shift in India's economic policy. The late 1990s and early 2000s saw the rapid expansion of internet connectivity across India. The proliferation of smartphones and mobile internet in the 2010s further accelerated India's digital transformation. Various government initiatives such as "Make in India," "Digital India," and "Startup India," have played a crucial role in attracting foreign investment and fostering a startup ecosystem.

Today, Bangalore, like many cities around the world, has transformed into a bustling hub of technological innovation. Not only it is home to many large multinational companies but is also a global hub for startups. This shift brought great benefits—enhanced connectivity, improved access to information, and fuelled economic growth. However, it also presented new challenges, particularly in terms of environmental sustainability, a phenomenon most cities experiencing exponential growth have faced.

TECHNOLOGY INTEGRATION WITH SUSTAINABILITY

The synergy between technology and sustainability is pivotal in addressing global environmental challenges.

Technology plays a crucial role in reducing greenhouse gas (GHG) emissions and minimizing the carbon footprint. For instance, advancements in renewable energy technologies, such as solar and wind power, have significantly lowered the dependency on fossil fuels. Smart grid technologies enhance the efficiency of energy distribution, reducing wastage and ensuring a stable supply.

Moreover, tech companies are increasingly aware of their environmental responsibilities. Many are implementing measures to ensure their operations adhere to sustainability goals. This includes optimizing data centers to reduce Scope 2 emissions from purchased electricity, adopting eco-friendly manufacturing processes to minimize Scope 1 emissions from direct operations, and promoting the use of sustainable materials in hardware production to reduce Scope 3 emissions throughout the supply chain.

The role of technology extends beyond operational efficiencies. It is instrumental in gathering and analyzing data for ESG reporting. Advanced analytics and artificial intelligence (AI) enable organizations to monitor their environmental impact in real time, providing insights that drive informed decision-making. Integrating data from diverse sources helps companies build a comprehensive view of their sustainability performance, ensuring they meet regulatory requirements and align with stakeholder expectations.

It has become imperative for firms to understand ESG standards to comply with them. It is also

> MANY COMPANIES ARE IMPLEMENTING MEASURES TO ALIGN WITH SUSTAINABILITY GOALS, SUCH AS OPTIMIZING DATA CENTERS TO CUT SCOPE 2 EMISSIONS, ADOPTING ECO-FRIENDLY MANUFACTURING TO REDUCE SCOPE 1 EMISSIONS, AND USING SUSTAINABLE MATERIALS IN HARDWARE PRODUCTION TO LOWER SCOPE 3 EMISSIONS THROUGHOUT THE SUPPLY CHAIN

> INDIA HAS MADE SIGNIFICANT STRIDES IN EMBRACING ESG PRINCIPLES. THE SECURITIES AND EXCHANGE BOARD OF INDIA (SEBI) MANDATED BUSINESS RESPONSIBILITY AND SUSTAINABILITY REPORTING (BRSR) FOR THE TOP 1,000 LISTED COMPANIES BY MARKET CAPITALIZATION STARTING FROM THE FINANCIAL YEAR 2022-23.

paramount for firms to hire people who have Sustainability as a mainstream skill (for every job), rather than as a specialization for a small segment of employees in a company.

THE EVOLUTION OF ESG STANDARDS

Environmental, Social, and Governance (ESG) criteria emerged as a crucial framework for assessing a company's commitment to sustainable practices. ESG standards provided a structured approach to evaluating how businesses managed their impact on the environment, their relationships with stakeholders, and their governance structures. Milestones in the journey of ESG standards include the establishment of the United Nations' Principles for Responsible Investment (PRI) in 2006 and the launch of the Task Force on Climate-related Financial Disclosures (TCFD) in 2015.

India has made significant strides in embracing ESG principles. The Securities and Exchange Board of India (SEBI) mandated Business Responsibility and Sustainability Reporting (BRSR) for the top 1,000 listed companies by market capitalization starting from the financial year 2022-23. This move underscores the growing recognition of the importance of sustainability in corporate governance and the need for transparency in ESG reporting.

EDUCATION FOR SUSTAINABILITY AND GREEN JOBS

India's focus on education for sustainability is crucial for preparing the workforce for green jobs. Integrating sustainability into educational curricula across disciplines ensures that future professionals are equipped with the knowledge and skills to tackle environmental challenges as part of any job role. Green jobs, which contribute to preserving or restoring the environment, are essential for sustainable development.

Emphasizing sustainability in education will foster a generation that prioritizes ecological balance and innovative solutions.

IBM'S COMMITMENT TO SUSTAINABILITY

IBM has been at the forefront of leveraging technology for ESG reporting, sustainability projects, and promoting as well as providing education on Sustainability.

According to research by IBM and Morning Consult, 71% of business leaders anticipate prioritizing sustainability skills in hiring over the next two years, with 92% planning to invest in sustainability training within the next year. In November 2023, IBM SkillsBuild launched a new sustainability curriculum, addressing the growing skills gap in sustainability.

IBM's Sustainability Accelerator is a pro bono social impact program that applies IBM technologies, such as hybrid cloud and AI, to enhance and scale solutions for nonprofit and government organizations. This initiative is particularly focused on helping populations vulnerable to environmental threats, demonstrating IBM's commitment to driving positive change through technological innovation.

IBM's Envizi platform is a powerful tool for better data collection and reporting. It enables organizations to integrate data from various sources, providing a holistic view of their sustainability performance. This integration is critical for accurate ESG reporting and informed decision-making. IBM's Maximo application suite allows businesses to manage their assets more efficiently, predict and prevent breakdown and maintain compliance with safety and regulatory guidelines, all by gathering data from the right sources.

CONCLUSION

Environmental sustainability will have to be regarded as a first-class citizen, and technology will play a key role. From reducing carbon footprints to enhancing ESG reporting, the synergy between these two realms is pivotal for driving positiveimpact. As we navigate this interconnected world, the harmony between sustainability and technology will continue to play a crucial role in shaping our future.

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Navigating the Culture of Security: Insights from Amazon CSO Steve Schmidt

Knowing security culture dynamics is necessary for global companies in an era in which cyber threats have evolved unusually. In this interview, **Steve Schmidt,** Amazon's Chief Security Officer, expounds on security intricacies, the generative AI role, and the shared responsibility model that defines cloud security to **Thomas George,** the Managing Editor of Dataquest, a more than four-decade-old ICT publication.

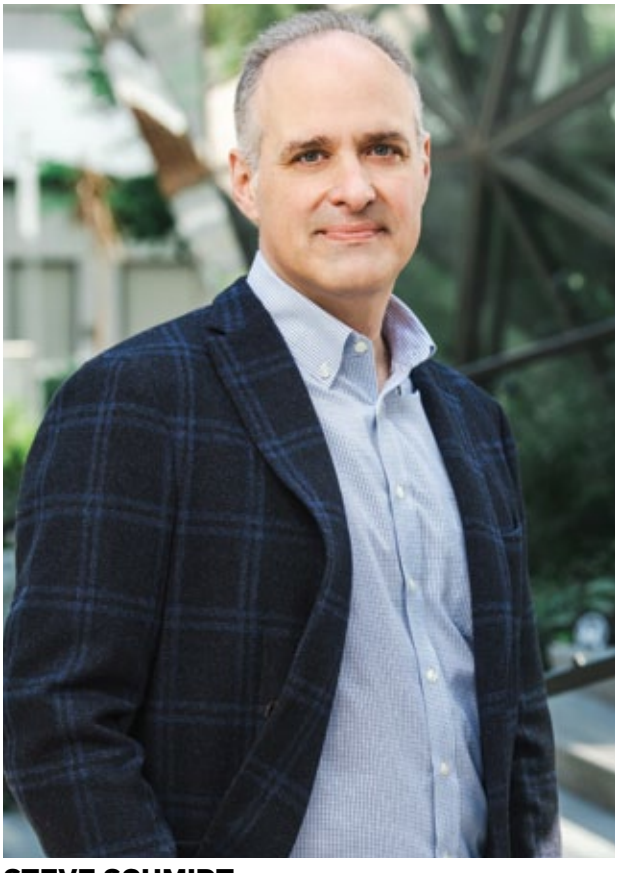
By Thomas George

A lot has been said about the culture of security. In a shared responsibility model, who is responsible for failures, and how do we differentiate and allocate roles?

Sometimes, to improve security, one must get into details of particular problems. The recent high-profile failures uncovered cultural gaps, such as the lack of multi-factor authentication exploited by nation-state actors. It should be noted that the division of labour makes it clear that there are divided responsibilities in terms of security. All people should feel responsible for the entire system's safety. While Amazon S3 defaults to non-public access, customers can choose to make data public if they decide to do so. It is essential to lay a strong foundation, educate customers and maintain communication across all channels for alignment.

How has the attack landscape evolved, especially with the emergence of AI, and what kind of damage can it cause?

Generative AI revolutionises computer protection for defenders and attackers. When using AI in defence, vast amounts of data can be processed more efficiently with critical information separated. This makes traditional defences less effective as hackers use AI to create more advanced phishing emails. The primary threat



STEVE SCHMIDT
Chief Security Officer, Amazon

> THE PRIMARY THREATS ARE MOTIVATED BY MONEY, IDEOLOGY, OR EGO. ADVERSARIES' CORE MOTIVES REMAIN CONSTANT AS THEIR TOOLS AND TECHNIQUES CHANGE. THEREFORE, TO RESPOND TO GENERATIVE AI-BASED THREATS, IT IS ESSENTIAL TO ADJUST DEFENSES ACCORDINGLY."

remains identity theft through phishing, often aided by other hacking methods. Amazon Web Services (AWS) emphasises using hardware-based multi-factor authentication instead of SMS-based authentication. Spoofing is easy if an attacker wants phone numbers diverted from their intended recipients. The focus is breaking apart attack chains and implementing robust defences such as cryptographic proofs in MFA tokens.

What are the biggest threats in the coming years, and how will AI influence your priorities?

The primary threats are motivated by money, ideology, or ego. Adversaries' core motives remain constant as their tools and techniques change. Therefore, to respond to Generative AI-based threats, it is essential to adjust defences accordingly. Efficient use of scarce security talent is crucial. AWS team focuses on automating routine tasks instead of increasing staff so that human experts can concentrate on uncertain decisions with possible legal implications.

What are the main security challenges with Amazon Bedrock integrating models from various providers? How do the challenges of analysing logs at scale are addressed?

Regardless of an organisation's model, Amazon Bedrock has a standard set of control points. This ensures that different models have similar safety controls, making it easy for customers to experiment safely. Besides offering potential future regulations, this approach enables regulatory compliance through auditable control points, facilitating adherence to future regulations.

The logs generated are voluminous, and AWS has addressed this scalability problem for us. For log analytics, customers can choose from various partner solutions, e.g., CrowdStrike and Splunk, among others, or use AWS CloudWatch Lake, which supports natural language queries. With such elasticity, every consumer can get the best solution that will work for him without forcing himself to make a single choice.

How do small and medium-sized businesses, especially those lacking IT resources, find support in transitioning to the cloud? How can limited-resource companies secure their business, unlike big companies like Amazon?

Most SMEs use the "lift and shift" strategy, taking their existing systems to the cloud. In addition, AWS provide managed services for those who need more internal expertise. Planning and executing transitions of clouds are done by partners with AWS staff members who also provide customers with customised support around individual requirements. Our partners recommend identity services like Okta, Ping, or CrowdStrike. Thus, the importance of choosing the right identity solution cannot be stressed enough, as identity theft still poses the most significant risk from ransomware.

How does Amazon Web Services ensure compliance with various data regulations worldwide? How does It interact with law enforcement while handling vast amounts of data?

Some examples include employee access restrictions, customer-controlled encryption and detailed logging as compliance building blocks provided by Amazon Web Services (AWS). Customers can choose data storage locations according to regional requirements. There are areas explicitly designed with specific needs in mind, such as the manufacturing sector in Taiwan or GDPR in Europe. The company obeys local laws everywhere it operates. Nevertheless, there is collaboration on standardising rules between governments and technical means towards achieving them offered by it. Furthermore, we also proactively address insights into and preventive measures against potential cyber-attacks.

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Technology in lending- not a NPA for sure. But T&Cs apply.

A chat with **Jyothirlatha B,** CTO, Godrej Capital unpacks why, and where, future-forward FinTech players are borrowing technology to grow personalisation, efficiency, compliance, security as well as a strong confidence posture for today's digital borrowers.

By Pratima H

It's good to speak to a woman CTO. How is it going?
It has been great. I joined five years back during the starting phase of the organization. We drive D&I at many levels and roles. As an organization, we launched during the pandemic and had no option but to take the digital approach. It was challenging and exciting. We have put all processes with a digital-first approach in mind. A lot of firms talk about digital but digitization and digital-first are two different DNAs. We came up with zero-touch loans, digital signatures and e-KYC during the pandemic and post the pandemic, this DNA has become our staple. Last financial year, we launched flexi loans which is something very few NBFCs have done – and we did it in a record time of six months. And Godrej Capital's AUM is also growing quite well. So it has been going quite great.

Do you use technology for soft credit scores as well as for pre-qualification or suggestions to borrowers?
We have a lot of AI and ML algorithms that come up with scorecards for customers – which are used in multiple places. We have a Digi Docket initiative and we enable automatic pre-filling of forms. Technology is a part of the credit underwriting process also. The scorecards and algorithms are applied for segmentation and eligibility assessment. The ambit also covers intention-checks and propensity-checks. It has been a year since we came up with CredVue. This eliminates multiple documents and inputs and gathers them in a unified view for an underwriter. It has seen good adoption. It also removes bias and delays.

JYOTHIRLATHA B
CTO, Godrej Capital

Are zero-proof models in place? How do you navigate data privacy with minimal PII while also making sure you make good bets?
Our KYC process is centralized. We can mask personal data parts while ensuring KYC validation – it helps us adequately in assessment. Our predictive

analytics models and financial data assessment strengths help us to ensure good bets.

Let's expand on this. Delinquency control and fraud management is a key issue in this business. A lot has been accentuated with recent Prudential guidelines and developments like SMA (Special Mention Account/s). How much can technology help here? Especially since you also have an Early Warning System and other tech tools in place.

We understand customers better by using AI and algorithms and proactively focusing on NPA. We can use scorecards to check if we should pursue a lead or not. Technology -along with predictive modeling and analytics- helps in customer segmentation, customer prioritization and further processing of a loan.

How much will change with DPDP?

We have apt data controllers and data leakage prevention methods which have been initiated at all the right places. We also exercise data classification and security control to manage outlets of data during various processing areas.

Do you think the Big Tech league – which is now getting into FinTech- has an information advantage over other players?

I don't think so. They do have the advantage of being agile. We can also use good and ample data sources. It's all about who does it fast and well. AI will be a huge enabler. If used in the right way, it will reduce a lot of dependencies.

How much would you embrace it? Especially with your foray into Gen AI?

We were very excited about our ongoing POCs. We would be making our processes very intelligent ahead.

Since you are also catering to MSMEs as a segment – how much pace or foothold does the India Stack or ONDC provide?

ONDC is still evolving. We have to still start that journey. Other India Stack areas like connectors and integrators – Aadhar etc. are already in use.

What helps you to come up with specific offerings like Dairy loans or MSME products?

Dairy loans constitute a different journey altogether- our products are driven a lot by tech-enabled integrations. Our Nirmaan platform is also very interesting with many tech partnerships and marketplaces for helping MSMEs.

CAFRAL (Centre for Advanced Financial Research and Lending) projects FinTech to surpass traditional lending by 2030. Do you think these two kinds of players will stay compartmentalized?

My guess is that they will co-exist. FinTech has agility and the precision-focus on one particular area. A lot of collaboration and innovation can happen as long as security concerns are addressed properly and consistently.

Is hyper-personalization in your space easy? Is it worth it?

It is a difficult paradigm to achieve. We recently launched CRM using Salesforce- to tap the 360-degree view. We are improving our approach in serving customers with more speed, personalized advice and more options – and learning from feedback data and past data. We have Gen AI, sentiment analysis, intention analysis, etc. to enable this process – both for our sales teams and contact centers.

With so many loans done now, can you sketch the profile of a typical digital borrower?

They are very demanding and want everything online. They need prompt, immediate solutions. They also lean heavily towards transparency. They are open in using new processes and tools.

Is it easy to serve them while also ticking the right regulatory boxes? What's your biggest challenge, as a CTO?

The biggest challenge is to drive any change. Not because our team is averse to technology. We are, in fact, organically savvy about technology. Our organization is young and the adoption of technology has been easy. But when a process gets a change, it can be a bit of a journey despite the openness to adopt something new. As to the ability to manage security with speed, we keep training our people on data leakage, cybersecurity and governance in a strong and consistent way. Security, you see, is always a three-pronged game- people, processes and technology.

What's your favorite initiative- so far?

We started with zero-touch loans, of course. Now, I am very excited about Gen AI along with the existing use of AI and ML. The right use-case and model can really drive up efficiencies.

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Leading in the Quantum Era

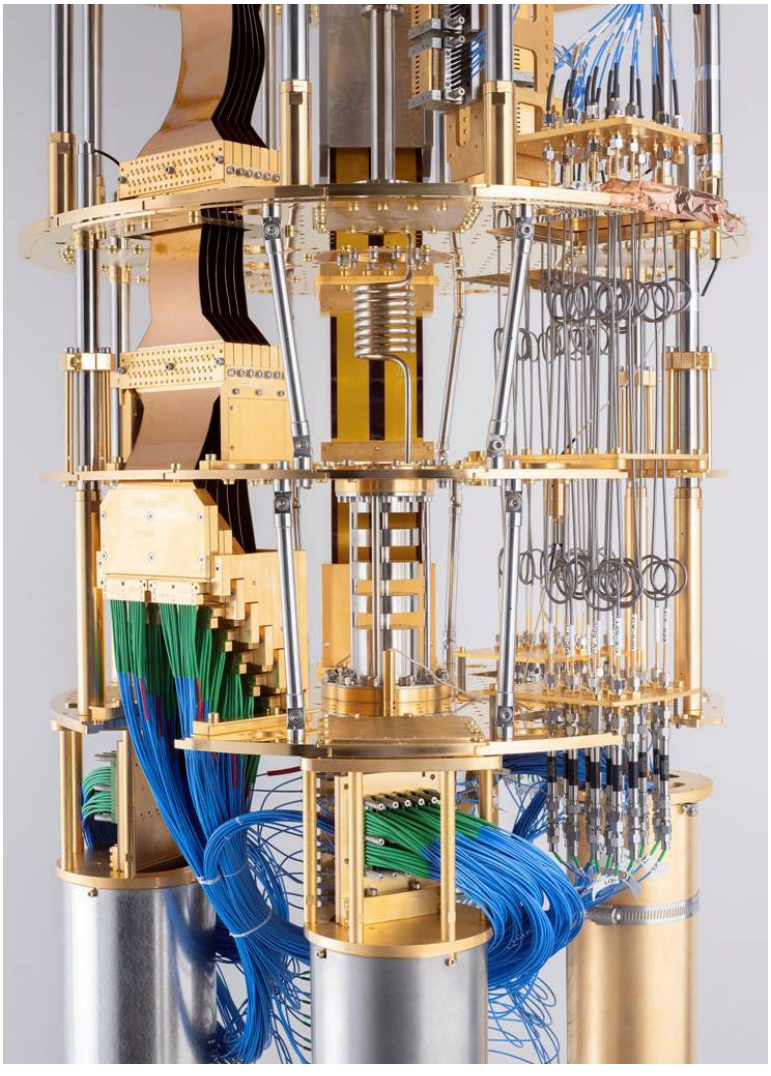
India is rapidly emerging as a global leader in quantum technology, leveraging its vast talent pool and educational initiatives to drive innovation and solve real-world problems. From significant strides in research to government-backed initiatives, India's commitment to quantum advancements is positioning it at the forefront of the global quantum revolution.

By L. Venkata Subramaniam

Last year, IBM brought about a significant milestone in quantum computing: the advent of the quantum utility era. Quantum utility means quantum computers can execute circuits that surpass the brute-force simulation capabilities of classical computers. And India is poised to become a leader in this era and help bring about the next evolutionary leap in quantum computing: achieving quantum advantage.

Quantum advantage represents point where quantum computers not only perform tasks beyond the reach of brute-force classical simulations but also solve practical problems faster or more efficiently than any classical computing method, hereby offering real-world benefits. Achieving quantum advantage requires advancing in two areas: the first is the continuing maturation of quantum hardware and software, relying on ever-improving scale, quality, speed, error handling techniques, and more. The second is in developing the algorithms, applications, and ecosystem required to make the most use of that quantum infrastructure.

Researchers, educators, students, and other stakeholders are passionately working to build the country's quantum computing community. And now,



> ACHIEVING QUANTUM ADVANTAGE REQUIRES ADVANCING IN TWO AREAS: THE CONTINUING MATURATION OF QUANTUM HARDWARE AND SOFTWARE, AND THE DEVELOPMENT OF ALGORITHMS, APPLICATIONS, AND AN ECOSYSTEM TO MAKE THE MOST USE OF THAT QUANTUM INFRASTRUCTURE.

with its National Quantum Mission, the country is becoming quantum ready and working to push the field closer to quantum advantage.

INDIA'S NATIONAL QUANTUM MISSION

On April 19, 2023, the Union Cabinet approved the National Quantum Mission (NQM), funded from 2023-24 to 2030-3. This mission aimed to "seed, nurture and scale up scientific and industrial R&D and create a vibrant & innovative ecosystem in Quantum Technology (QT)."

India's national quantum mission has led to cutting-edge research proposals from some of India's top professors and researchers. These proposals aim to push the boundaries of quantum technologies across various sectors, including computing, communication, sensing, materials, and more, demonstrating a comprehensive approach to integrating quantum advancements.

A key feature of this mission is its inclusive framework that not only involves academic institutions but also engages startups and industry players. This collaboration is designed to ensure that research isn't confined to theoretical studies but also demonstrates value on real quantum hardware, which can then be swiftly translated into marketable solutions that can have a tangible impact on both the economy and everyday life.

With robust government backing in terms of funding and policy support, India's national quantum mission is poised to transform the technological landscape, fostering groundbreaking research, and pioneering applications. This strategic initiative is set to unlock unprecedented opportunities and position India at the vanguard of the global quantum revolution.

BUILDING INDIA'S QUANTUM COMMUNITY

India has firmly established itself as a pivotal center for quantum technology, demonstrating remarkable enthusiasm and robust engagement with this pioneering field. Since 2021, over 200,000 individuals in India have accessed IBM Quantum learning resources, showcasing a profound commitment to understanding and advancing quantum technologies. The interest is further evidenced by the Qiskit YouTube channel, which has amassed more than 1.2 million views from subscribers in India, highlighting the country's interest in quantum content. Remarkably, India's participation in IBM Quantum events surpasses that of the U.S. and all other nations, demonstrating its extreme hunger for opportunities in the field.

India has also been actively expanding its quantum computing workforce through educational initiatives. A growing number of universities and educational institutions are now offering courses in quantum computing in traditional classroom settings along with strong lab sessions. These programs are designed to equip students with the skills necessary to contribute to and lead in the rapidly evolving quantum industry. Of course, these educational opportunities need to further expand the knowledgeable and skilled pool of professionals ready to drive innovation and build India's edge on the quantum frontier.

India boasts the world's largest youth population and is at a critical crossroads. To effectively harness this demographic, the Indian economy needs to generate approximately 7.85 million jobs annually in the non-farm sector throughout this decade until 2030. This ambitious target, underscored in the Economic Survey 2023-24 presented to Parliament on July 22, 2024, is crucial for absorbing the rapidly expanding workforce and supporting economic growth. The field of quantum computing, known for its dynamic and revolutionary potential for economic growth, stands out as a prime area where India could establish global leadership.

Positioning itself as "The Quantum Nation," India has the opportunity to not only lead in technological innovation but also create a

> ON APRIL 19, 2023, THE UNION CABINET APPROVED THE NATIONAL QUANTUM MISSION (NQM), AIMED TO 'SEED, NURTURE AND SCALE UP SCIENTIFIC AND INDUSTRIAL R&D AND CREATE A VIBRANT & INNOVATIVE ECOSYSTEM IN QUANTUM TECHNOLOGY.

new paradigm for economic development. The growing field of quantum computing offers vast potential for job creation in research and development, manufacturing of quantum devices, and various application areas such as finance, drug discovery, and optimization tasks for logistics and manufacturing. With its vast reservoir of young, skilled talent, India is well-positioned to drive significant advancements in technology and economy.

By embracing quantum technology as a cornerstone of its future economic strategy, India can not only make progress toward solving the pressing issue of creating almost eight million jobs every year, but also leapfrog into a position of global quantum industry leadership. This proactive approach would capitalize on India's demographic strengths and its expanding status as a technological innovator, paving the way for a prosperous and sustainable future.

UTILITY-SCALE RESEARCH WORK IN INDIA

India is already beginning to make an impact in this field. Quantum researchers worldwide are pushing the boundaries of the technology, running quantum circuits that involve over 100 qubits and hundreds, even thousands, of gates. India has emerged as a significant contributor, with notable research efforts coming from collaborations that merge the expertise of industry and academia.

One prominent example of such collaborative innovation is the joint research undertaken by IBM scientists and the faculty and students of IIT Madras. This team is focusing on developing new algorithms for protein folding, a crucial challenge in biochemistry and pharmaceuticals. Protein folding involves determining the three-dimensional shapes of proteins from their amino acid sequences, a process essential for understanding biological functions and developing new medical treatments. Quantum computing offers unique potential in this area, specifically for modelling complex molecular structures accurately. By leveraging quantum algorithms, researchers aim to simulate protein behaviours more efficiently than traditional methods, which could revolutionize drug discovery and our understanding of diseases.

This research not only underscores India's role in advancing quantum computing but also illustrates how such technology is being explored to solve real-world problems that have significant implications for health and medicine. The success of these endeavours highlights the potential of quantum computing to transform various scientific fields, and India's emerging position as a leader in both quantum research and its application to vital real life challenges.

THE RISE OF QUANTUM GIANTS: THIS DECADE'S TECHNOLOGICAL REVOLUTION

This decade is poised to witness the rise of leading quantum institutions, much as previous technological revolutions have given birth to giants in the past.

As we stand on the brink of the quantum era, the question arises: who will drive quantum computing to widespread adoption? This technological frontier offers unprecedented potential for solving complex problems that are beyond the reach of classical computers, from drug discovery and optimization to financial modelling and beyond.

Bolstered by its vast talent pool, India must aim to become and foster quantum tech titan, exporting technology globally and aiming to establish itself as a pivotal player in the international quantum landscape.

Venkat Subramaniam, IBM Quantum Lead, IBM Research India.
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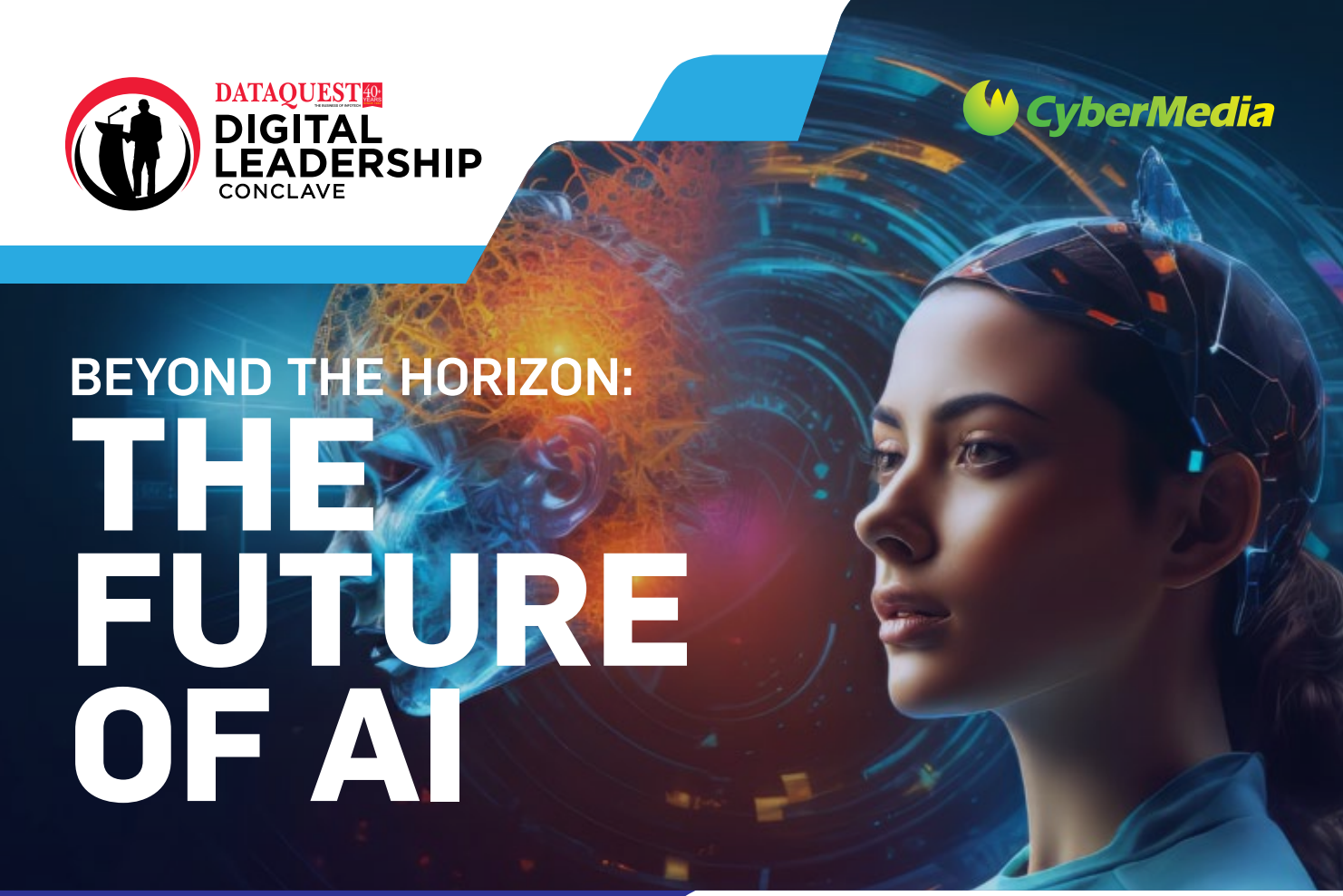

BEYOND THE HORIZON: THE FUTURE OF AI

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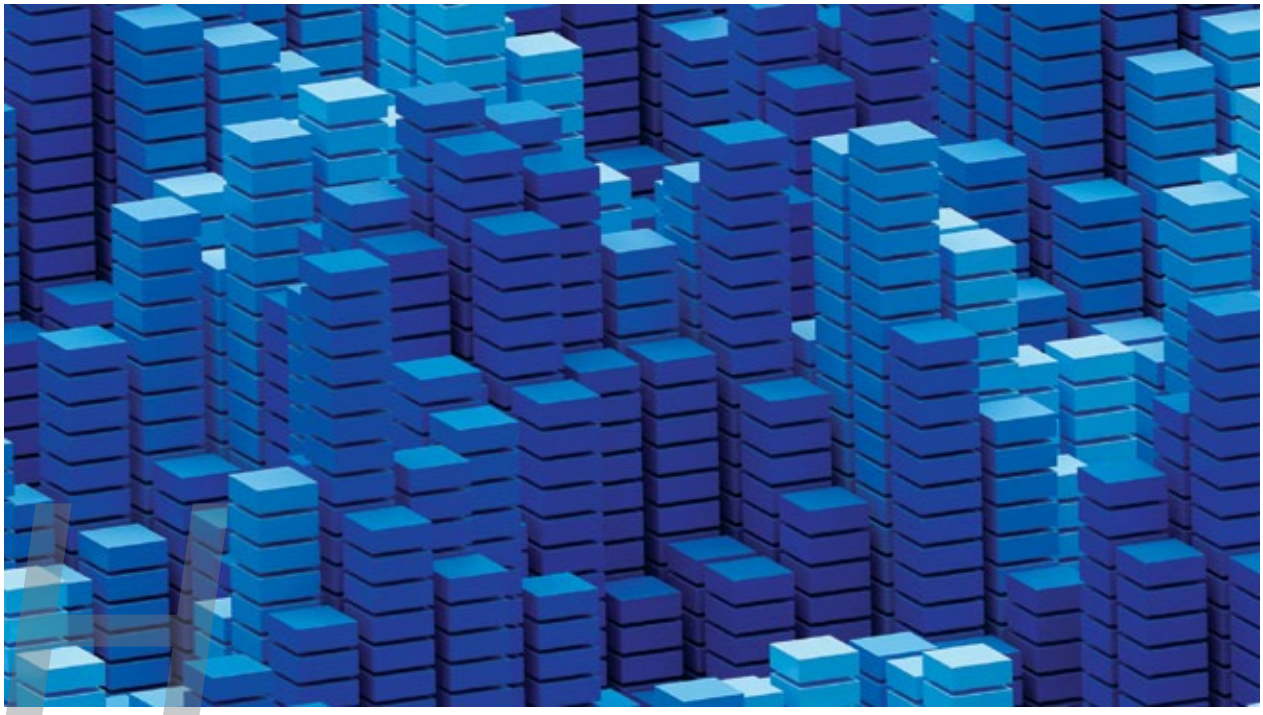
The Data Dividend

"If your data isn't ready for GenAI, your business isn't ready for GenAI"

By Raju Chellam



Here's a corny corporate story: At the annual company picnic, Bob, the IT guy, won the "Employee of the Year" award. Suddenly, everyone wanted to be his friend, even the CEO's dog. "No wonder they say success is relative," Bob laughed. "Because the more the success, the more the relatives."

That paradigm is also true with data – whether authentic or fake – with a twist. The more the data, the more the relationships between authentic data and possibly fake data, with some outcomes, decisions or predictions being at risk. Adding to this mix is the emergence of a new type of data: synthetic data.

Synthetic data is annotated information that computer simulations or algorithms generate as an alternative to real-world data. It is data created in digital worlds rather than collected from or measured in the real world. Why do you need it? Because authenticated data is the new oil in the AI age, but only a handful of companies can afford to have a massive corpus and a continuous stream of authentic data. Others are therefore making their own fuel, one that is both inexpensive and effective.

"It may be artificial, but synthetic data reflects real-world data, mathematically or statistically," notes Nvidia. "Research demonstrates it can be as good or even better for training an AI model than data based on actual objects, events, or people. That is why developers of deep neural networks are increasingly using synthetic data to train their models." A survey in 2019 reported that use of synthetic data "was one of the most promising general techniques on the rise in modern deep learning, especially computer vision," which relies on unstructured data like images and video.

> RESEARCH DEMONSTRATES IT CAN BE AS GOOD OR EVEN BETTER FOR TRAINING AN AI MODEL THAN DATA BASED ON ACTUAL OBJECTS, EVENTS, OR PEOPLE. THAT IS WHY DEVELOPERS OF DEEP NEURAL NETWORKS ARE INCREASINGLY USING SYNTHETIC DATA TO TRAIN THEIR MODELS.

PLACEHOLDER POSITION

Synthetic data can be used as a placeholder for datasets. It is more frequently being used for training of ML (machine learning) models because of its benefit in data privacy, such as in healthcare apps to protect patient data and enhance clinical trials.

"The interest from the healthcare sector stems from the compliance regulations surrounding patient data," IBM reports. "For instance, Health Insurance Portability and Accountability Act (HIPPA) is a US Federal law that protects individuals' information from being discriminated against, which synthetic data helps overcome by creating AI generated data."

About 72% of leading organizations polled in a McKinsey survey said managing data was one of the top challenges that prevented them from scaling AI use cases. The challenge for CDOs (chief data officers) is to focus on changes that can enable GenAI to generate the greatest value for the business.

"If your data isn't ready for GenAI, your business isn't ready for GenAI," McKinsey says. "GenAI could add the equivalent of US$2.6 trillion to US$4.4 trillion in annual economic benefit across 63 use cases. Pull the thread on each of these cases, and it will lead back to data. Your data and its underlying foundations are the determining factors to what's possible with GenAI."

In determining a data strategy for GenAI, CDOs might consider adapting a quote from US President John F. Kennedy: "Ask not what your business can do for GenAI; ask what GenAI can do for your business." Focus on value is a long-standing principle, but CDOs must particularly rely on it to counterbalance the pressure to "do something" with GenAI, McKinsey advises.

SYNTHETIC SENSE

To be clear, there are three key types of synthetic data:

- **Fully Synthetic:** No real data is used with this technique. The computer program may use real-world data characteristics to narrow down and estimate realistic parameters. The data generator will identify the density function of features in the real data and estimate parameters. The data is then randomly generated and provides a strong privacy protection.
- **Partially Synthetic:** This technique replaces only a portion of selected sensitive features with synthetic values and keeps some real data or existing unstructured data. This technique is useful when data scientists are trying to fill in the gaps in original data and is done to preserve privacy in the newly generated data.
- **Hybrid:** A combination of real and synthetic data that takes random records from a real dataset and pairs it with close synthetic records. "This technique has advantages from both fully and partially synthetic data," IBM says. "While it can provide good privacy preservation, the drawback is the longer processing time and more memory."

What's driving organizations to use synthetic data in their test and production environments? A slew of regulations covering data privacy, and soon, AI. About 18% of enterprises are integrating synthetic data to address privacy regulations and facilitate secure data exchange in insurance services.

"Due to regulations surrounding AI, 40% of AI algorithms utilized by insurers in the policyholder value chain will utilize synthetic data to guarantee fairness within the system and comply with regulations by 2027," reports IDC. "This integration of AI spans from underwriting to marketing and claims handling. However, concerns about privacy and bias will require insurers to develop guidelines that align with evolving regulations like the EU AI Act to ensure compliance, address biases, and enhance transparency."

TESTING TIMES

Since synthetic datasets maintain statistical properties that closely resemble the original data, they can produce precise training and testing data that is crucial for model development. For example, training computer vision models often requires a large and diverse set of labeled data to build highly accurate models. Obtaining and using real data for

> LEADERS CAN USE TECHNIQUES SUCH AS DIFFERENTIAL PRIVACY TO ENSURE ANY SYNTHETIC DATA GENERATED FROM REAL DATA IS AT VERY LOW RISK OF DEANONYMIZATION.

this purpose can be challenging, especially when it involves PII (personally identifiable information).

"Two common use cases that require PII data are ID verification and ADAS (automated driver assistance systems), which monitor movements and actions in the driver's area," says Gartner senior director analyst Alys Woodward. "In these situations, synthetic data can be useful for generating a range of facial expressions, skin color and texture, as well as additional objects like hats, masks, and sunglasses. ADAS also requires AI to be trained for low-light conditions, such as driving in the dark."

Why does it matter? Because efforts to manually anonymize and deidentify datasets – or remove information that links a data record to a specific individual – are time-consuming, labor-intensive, and prone to errors. This can delay projects and lengthen the iteration cycle time for development of ML models. Synthetic data can overcome many of these pitfalls by providing faster, cheaper, and easier access to data that is similar to the original source, suitable for use, and protects privacy.

"Moreover, if manually anonymized data is combined with other publicly available data sources, there's a risk it could inadvertently reveal information that could lead to data reidentification, thus breaching data privacy," Woodward says. "Leaders can use techniques such as differential privacy to ensure any synthetic data generated from real data is at very low risk of deanonymization."

BROAD BASE

The bottom line: How can you optimize the value of data with the capabilities offered by GenAI? Build specific capabilities into the data architecture to support the broadest set of use cases. That's necessary because the scope of value has gotten much bigger because of GenAI's ability to work with unstructured data such as chats, videos, and code.

"This represents a significant shift because data organizations have traditionally had capabilities to work with only structured data, such as data in tables," McKinsey says. "Capturing this value doesn't require a rebuild of the data architecture, but the CDO will need to focus on two clear priorities."

The first is to fix the data architecture's foundations. While this might sound like old news, the cracks in the system a business could get away with before will become big problems with GenAI. Many of the advantages of GenAI will simply not be possible without a strong data foundation.

To determine the elements of the data architecture on which to focus, the CDO could start identifying the fixes that provide the greatest benefit for the widest range of use cases, such as data-handling protocols for PII, since any customer-specific GenAI use case will need that capability.

The second is to determine which upgrades to the data architecture are needed to fulfill requirements of high-value use cases. The key issue: how to cost effectively manage and scale the data and information integrations that power GenAI use cases.

"If they are not properly managed, there is a significant risk of overstressing the system with massive data compute activities, or of teams doing one-off integrations, which could increase complexity and technical debt," McKinsey says. "These issues can be further complicated by the business's cloud profile, which means CDOs must work closely with IT leadership to determine compute, networking, and service use costs."

Since we started this column with a corny corporate story, let's end with a slightly sobering saga: At a "family day" corporate party, Jim, the usually reserved accountant, had one too many pegs. By the end of the night, he was dancing on tables and confessing secrets. The next day, his colleagues had a field day mocking him. "No wonder alcohol is considered an effective solvent," Jim sighed. "Because it effectively dissolves marriages, families, and careers."

Raju Chellam is a former Editor of Dataquest and is currently based in Singapore, where he is the Editor-in-Chief of the AI Ethics & Governance Body of Knowledge, and Chair of Cloud & Data Standards.

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Dataquest Higher Education Conference Explores AI, Immersive Tech, and Industry

Dataquest T-School Conference successfully concluded on 25th July, 2024. This event is organized to talk about various key points related to learning, innovation, Collaboration and transformation.

By Bharti Trehan

KEYNOTE SPEAKERS

The conference began with Prabhu Ram, VP – Industry Research Group (IRG), CyberMedia Research, discussing emerging trends in higher education. He emphasized the need for educators to adapt to a changing landscape, focusing on personalized learning and market-oriented strategies.

Satya Sunder Mohanty, Head of User Research Practice, CyberMedia Research, presented findings from a DQ-CyberMedia Research survey, including rankings and detailed analysis. The event officially started with a lamp-lighting ceremony.

Pradeep Gupta, Chairman, CyberMedia Group, delivered the inaugural address, welcoming the audience and keynote speakers. He highlighted the 95th edition of the education survey, which began in 1982.

SPECIAL ADDRESSES ON THE FUTURE OF HIGHER EDUCATION

Vipin Kumar, Additional Secretary, Ministry of Education, spoke about tech-driven education reforms in India, aiming to bridge the skill gap and prepare youth for future job markets. Rajendra Pawar, Chairman, NIIT, addressed transformative shifts in education due to rapid technological advancements and changing societal expectations.

Dr. Abhay Jere, Vice Chairman and Chief Innovation Officer at AICTE, advocated for a modular education system where students can select courses based on career goals and interests. Prof. Dr. Sunil Kumar Khatri, Dean, Amity University UP, highlighted the shift from offline to online education and the need for digitized educational content.

> THE CONFERENCE HIGHLIGHTED THE POTENTIAL OF ARTIFICIAL INTELLIGENCE (AI), AUGMENTED REALITY (AR), AND VIRTUAL REALITY (VR) TO CREATE MORE ENGAGING AND PERSONALIZED LEARNING EXPERIENCES.

PANEL DISCUSSIONS ON EDUCATION

The first panel discussion, moderated by Dhaval Gupta, MD, CyberMedia Group, featured Dr. Madhu Chiykara, Pro-Chancellor, Chitkara University, Dr. Rekha Kashyap, Dean CSE(AI) KIET Group of Institutions, and Rohit Sobti, Regional Sales Manager-Emerging, Fortinet. They focused on integrating data and analytics into education.

Kapil Sharma, Sales Manager, Epson India, and Dhaval Sampat, Manager Systems Engineering-Emerging, Fortinet, delivered a special industry keynote.

The second panel, moderated by Sugandha Srivastava, Senior Analyst, CyberMedia Research, included Faizul Mufti, VP-Information Security, Genpact, Dr. Kavita Bhargave Gupta, Associate Professor, Rishihood University, and Navanit Samaiyar, Head of Future Skills Prime and Industry Initiatives, SSC Nasscom. They discussed enhancing industry-academia collaboration to drive innovation in agriculture.

Vijay Sethi, Chairman and Chief Mentor, Mentor Card, joined the panel to conclude the discussion.

The third panel on accessibility, diversity, and sustainability in education was moderated by Minu Sirsalewala, Executive Editor, Cyber Media. It included Megha Bansal, VP, Supply Chain & Logistics, ONDC, and Prof. Shalini Taneja, Associate Professor & Head, Centre for Sustainable Development, FORE School of Management. They discussed barriers to inclusive and diverse education.

Ashok Pandey, Associate Editor, PCQuest, moderated a panel on the future of immersive education despite the metaverse slowdown, featuring Aditi Jain, Senior Director – Global CoE OD & HR Strategy, Visionet.

CHIEF GUEST AND SPECIAL GUEST ADDRESSES

Chief Guest Ravneet Singh Bittu, Minister of State for Railways and Minister of State for Food Processing Industries, emphasized the importance of higher education in equipping individuals with advanced knowledge and skills. Nirmaljeet Singh Kalsi, former IAS and Chairman of the National Council for Vocational Education and Training (NCVET), discussed the implementation of the new National Education Policy (NEP).

AWARDS AND CONCLUSIONS

Pradeep Gupta and special guests honoured various awardees with the Dataquest Excellence in Tech Education Awards, 2024, based on a survey conducted by Dataquest on higher education. The event concluded with a vote of thanks by Rachna Garga, Sr. VP & Group, who thanked all speakers, moderators, panellists, chief guests, and the audience, as well as the CyberMedia Team for their efforts.

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MoS Bittu Calls for Industry Collaboration to Tackle Skill Shortage

Minister Ravneet Singh Bittu addressed the brain drain issue, emphasizing the need for higher education and skill development to retain talent in India at the Dataquest Higher Education Conference & Awards.

By Punam Singh

In a compelling address at the Dataquest Higher Education Conference & Awards, Ravneet Singh Bittu, Minister of State for Railways & Minister of State for Food Processing Industries, highlighted the pivotal role of higher education and skill development in shaping India's future.

The event focused on the transformation challenges and opportunities presented by the digital revolution in the field of higher education. Experts explored topics like bridging the talent gap through innovative digital learning solutions, the role of government policy in fostering digital transformation, equipping engineering graduates for the digital age, the rise of EdTech, and creating modern learning infrastructures for experiential learning.

Minister Bittu emphasized the significance of higher education in equipping individuals with advanced knowledge and specialized skills necessary for professional success across various fields. "Higher education equips individuals with advanced knowledge and specialized skills needed for professional success in various fields," he noted. He pointed out that higher education opens doors to numerous career opportunities and higher-paying jobs, contributing to economic stability and growth for individuals and the nation.

Addressing the issue of brain drain, he questioned why India's talented youth are seeking opportunities abroad. "Today, our young minds are going abroad, brain drain, they are being utilized by other countries for their developmental works and research works. Why not in India?" he asked.

He acknowledged the allure of greener pastures and higher salaries but stressed the need to retain talent within the country. "Under the able leadership of our Prime Minister Shri Narendra Modi ji, India





is becoming a global brand," he said, highlighting the government's focus on higher education and skill development.

The minister called on the industry to focus on skill development and link higher education with the demands of the corporate sector. He referred to the recent union budget, which emphasized employment, skilling, MSMEs, and the middle class. The budget includes the Prime Minister's package of five schemes aimed at facilitating employment and skilling opportunities for 4.1 crore youth over five years, with a central outlay of ₹2 lakh crore. Additionally, there is a provision of ₹1.48 crore for education, employment, and skills, aiming to skill 20 lakh youth over five years and upgrade 1000 ITIs with new courses for emerging needs.

Minister Bittu also mentioned about the financial support of loans up to ₹10 lakh for higher education in domestic institutions, with e-vouchers for annual interest subvention of 3 percent of the loan amount to be given directly to 1 lakh students each year.

Concluding his address, Minister Bittu congratulated Dataquest and the CyberMedia Group for providing the industry with a significant platform and lauded all awardees and participants. The awards were presented by Minister Bittu along with Pradeep Gupta, Chairman of CyberMedia Group, and N S Kalsi, Board Member of KaramYogi Bharat & Former Chairperson of NCVET, Government of India.

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Educationist MP Sandhu Shares Insights on India's Academic Landscape

At the recently concluded Dataquest Higher Education Conference and Awards, Honourable Rajya Sabha MP Satnaam Singh Sandhu addressed the audience as the guest of honor.

By Bharti Trehan

Satnaam Singh Sandhu, who is also the Chancellor of Chandigarh University, emphasized his role as an educationist rather than an academician. He stated that his position as a Rajya Sabha MP was possible because of his involvement in the education sector. "I take pride in being an educationist. Though I'm not an academician or from a teaching background, I feel that anyone who has contributed to the education field, in terms of infrastructure or other resources, should be recognized as an educationist," he said.

SANDHU SHARED ABOUT HIS ROOTS AND EXPRESSED GRATITUDE FOR HIS RECOGNITION

Sandhu shared his background, highlighting his roots in farming and his subsequent involvement in the education system. He established Chandigarh Group of Colleges (CGC) Landran in Mohali in 2001 and founded Chandigarh University in 2012.

Expressing gratitude for the recognition by the Dataquest T School Conference, Sandhu remarked, "Education is not commercial; I still have debts. Education requires reinvestment." He stressed the importance of quality education and recalled a time when numerous educational institutes were established rapidly, leading to both growth and subsequent closures.

Discussing the demographic shifts in education, Sandhu noted that the southern parts of India initially led in prestigious institutions, but the northern states have since made significant progress. "I want to thank our teachers and educators for their contributions. Now we are facing global competition due to the availability of online content. Every day is a challenge, and there is a shift in student aspirations. Now education is more student-centric," he added.

> SANDHU EMPHASIZES THE PIVOTAL ROLE OF EDUCATION IN SHAPING INDIA'S FUTURE, HIGHLIGHTING ITS IMPORTANCE IN CREATING A DEVELOPED NATION. HE STRESSES THE NEED FOR EDUCATION TO BE ACCESSIBLE TO ALL, INCLUDING WOMEN, YOUTH, FARMERS, AND UNDERPRIVILEGED GROUPS.

THE RAJYA SABHA MP ECHOED BHAGAT SINGH'S VISION

Sandhu spoke about the need to build the nation and referenced Indian martyrs like Shaheed Bhagat Singh and Lala Lajpat Rai, who were thought leaders envisioning a developed India. He emphasized that the core pillars of a developed nation include women, youth, farmers, and the underprivileged, urging educationists to work for their inclusivity and development.

MP SATNAAM TALKED ABOUT HIS INITIATIVES WITH DR. MADHU CHITKARA

He acknowledged the contributions of Dr. Madhu Chitkara in founding the Chandigarh Welfare Trust and the New India Development Foundation, with which he collaborated to improve the education system. "I'm the only representative of the education fraternity in the Rajya Sabha, and I acknowledge my responsibilities. I want all academicians to voice their opinions and send me their views on how we can work for the further betterment of the education system," he concluded.

Finally, Rajya Sabha MP Satnaam Singh Sandhu thanked Dataquest and its founder, Pradeep Gupta, for inviting and recognizing him at the Dataquest Higher Education Conference and Awards.

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Dr. Abhay Jere's Blueprint for the Future

Dr. Abhay Jere advocates for a modular, personalized learning system integrated with industry experience to create a future-ready workforce. Jere's call for a radical overhaul of the education system has sparked a much-needed debate.

By Aanchal Ghatak

In an enlightening address, Dr. Abhay Jere, Vice Chairman & Chief Innovation Officer at AICTE, shared his visionary insights on the future of higher education in India. Dr. Jere, known for his pivotal role in driving the Smart India Hackathon to become the world's largest open innovation model, began by drawing parallels between the evolution of banking and the anticipated transformation of education.

His address paints a picture of a future where traditional educational institutions are challenged to adapt or risk obsolescence.

A MODULAR, PERSONALIZED APPROACH

Dr. Jere advocates for a modular education system where students can select individual courses based on their career goals and interests. This approach, coupled with the integration of working professionals as educators, will create a dynamic and relevant learning environment.

The concept of 'academic banks of credit' is introduced, allowing students to accumulate credits across different institutions and potentially even different fields of study. This flexibility promises to foster lifelong learning and upskilling.

"Just as banking has shifted from physical branches to digital platforms, education will undergo a similar transformation," Dr. Jere stated. "You will require education, but you may not require educational institutes as we know them today."

Highlighting the rapid pace of digitalization, Dr. Jere emphasized the need for higher education institutions to adapt to new models of learning. He underscored that the future of education will be multi-dimensional, necessitating continuous reskilling and upskilling.

> THE FUTURE OF EDUCATION, ACCORDING TO DR. JERE, IS PERSONALIZED, FLEXIBLE, DIGITAL, AND FOCUSED ON LIFELONG LEARNING.

> JUST AS BANKING HAS SHIFTED FROM PHYSICAL BRANCHES TO DIGITAL PLATFORMS, EDUCATION WILL UNDERGO A SIMILAR TRANSFORMATION. YOU WILL REQUIRE EDUCATION, BUT YOU MAY NOT REQUIRE EDUCATIONAL INSTITUTES AS WE KNOW THEM TODAY.

Dr. Jere noted, "This bidirectional learning will benefit both students and working professionals, fostering a deeper understanding and network development."

Furthermore, Dr. Jere discussed the concept of academic banks of credit, enabling students to take individual courses and accumulate credits over time, rather than pursuing a traditional degree program. "Students should only pay for the courses they need, and they can learn at their own pace," he explained. This flexible approach is expected to enhance lifelong learning and adaptability in a rapidly changing job market.

CHALLENGING THE TRADITIONAL MODEL

Dr. Jere also proposed a subscription model for education, similar to how industries like software and media operate. "Imagine if universities offered subscription models for 30, 40, or even 50 years," he suggested. "Graduates could return to their alma mater for reskilling at a discounted rate, ensuring they remain relevant throughout their careers."

Emphasizing the need for a paradigm shift, Dr. Jere called for educational institutions to redefine their value propositions. He pointed out that while digital technologies will play a crucial role, the essence of education lies in mentorship and personal development. "Institutions must focus on providing experiences and mentorship that go beyond what digital platforms can offer," he urged.

Dr. Jere's speech was a clarion call for educational institutions to rethink their strategies and embrace innovative models to stay relevant. "The future of education is not just about digital classrooms or online courses; it's about creating a lifelong learning ecosystem that adapts to the evolving needs of students and professionals," he concluded.

OVERCOMING RESISTANCE

The implementation of such a transformative vision will undoubtedly face resistance. Jere acknowledges this challenge but remains optimistic about the potential benefits. He emphasizes the need for a collaborative approach involving institutions, policymakers, and industry to bring about the necessary changes.

In summary, Dr. Jere's visionary address painted a compelling picture of the future of higher education, one where flexibility, continuous learning, and mentorship take center stage. As educational institutions navigate this transformative journey, they must embrace innovation and rethink traditional models to prepare students for the dynamic challenges of the future.

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India Must Embrace Digital Revolution to Power Future Workforce: Vipin Kumar, Additional Secratary, Ministry of Education, GOI

Vipin Kumar, Ministry of Education, stressed the need for tech-driven education reforms in India to bridge the skill gap and prepare youth for future job markets.

By Aanchal Ghatak

In a significant address today at the Dataquest Higher Education Conference and Awards., Vipin Kumar, Additional Secretary, Ministry of Education, GOI, underscored the urgent need for India to harness the power of technology to transform its education and skill development landscape. Warning of a looming shortage of skilled engineers, he emphasized the critical role of technology in addressing the nation's burgeoning workforce demands.

Highlighting the rapid pace of technological advancements, Shri Vipin Kumar stressed the importance of adapting to the changing dynamics of the job market. "We are witnessing an unprecedented transformation brought about by converging technologies," he said, adding that the skills required for today's workforce may be obsolete in the near future.

To bridge the skill gap and equip India's youth for the future, he proposed a multi-pronged approach. This includes revamping education curricula to align with industry needs, leveraging digital platforms for accessible learning, and fostering a culture of innovation and entrepreneurship.

Vipin Kumar also emphasized the role of higher education institutions in driving this transformation. "Universities must become catalysts for change, embracing technology to enhance learning outcomes and fostering a research culture," he said.

India's demographic dividend, with a young population, presents a unique opportunity for the country, but he cautioned that this potential can only be realized through a concerted effort to invest in education and skill development. He called for increased public-private partnerships and strategic investments in infrastructure to support the digital revolution.

He concluded his address by expressing confidence in India's ability to become a global leader in education and innovation. He urged stakeholders, including government, academia, and industry, to work together to create a skilled and empowered workforce that can drive the nation's progress.

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The 21st Century - The Century of the Mind: Pawar Calls for Education Overhaul

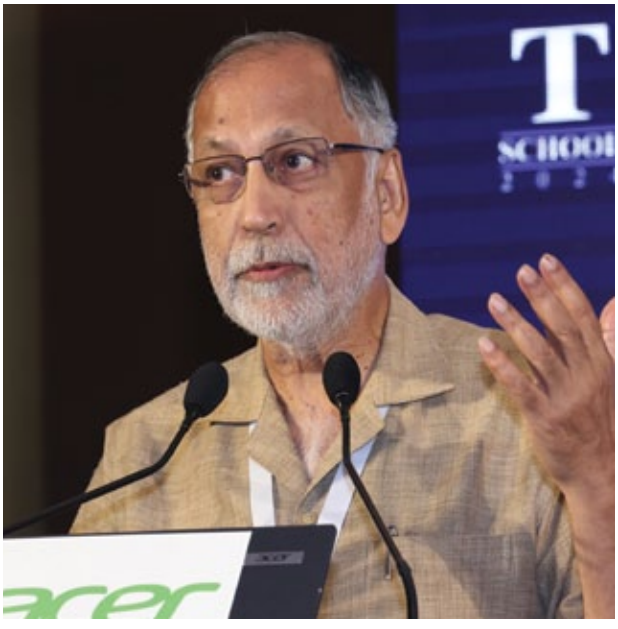
As the world rapidly transforms into a digital economy, the role of education is undergoing a critical reassessment. Rajendra S. Pawar, a leading figure in the education sector, believes that the key to success in this new era lies in cultivating a strong foundation of cognitive skills. In a recent keynote, he outlined a vision for higher education that emphasizes work-integrated learning, technology, and entrepreneurship.

By Aanchal Ghatak

Education should focus on cognitive skills like problem-solving and critical thinking. Universities should bridge the gap between academia and the workplace, integrating real-world experience into the curriculum.

In the keynote "Future of Higher Education in the Digital Economy" by Rajendra Pawar, Chairman, NIIT emphasizes there's no one-size-fits-all solution, but emphasizes the need for education to adapt to the changing world. Institutions and students should focus on areas that are work-integrated, science-driven, and nurture entrepreneurship.

He explored the transformative shifts in education necessitated by our rapidly evolving world. Standing at the intersection of unprecedented advancements in technology and profound changes in societal expectations, Pawar highlighted the need to reevaluate how we educate and prepare future generations. He touched upon four key themes: life expectancy, the Century of the Mind, the critical skills required for the future, and the evolving role of universities.



LIFE EXPECTANCY AND ITS IMPLICATIONS ON LEARNING

Pawar pointed out that we are witnessing a significant increase in life expectancy. While his generation anticipated a work life of around 40 years, the Gen Z and Gen Alpha cohorts can expect to live well into their 100s, resulting in work lives spanning up to 70 years. This elongation of productive years challenges the traditional notion of a single career path. Today, young people must prepare for multiple, diverse professions throughout their lifetimes. Educational systems must adapt to this reality, fostering versatility and lifelong learning to equip individuals for such dynamic careers.

THE CENTURY OF THE MIND

Pawar noted that society has transitioned through various epochs: from the agrarian era, focused on land, labor, and capital, to the industrial era, centered on machines, and then to the knowledge era, emphasizing information. We are now entering what he calls the Century of the Mind. This era

> THE 21ST CENTURY DEMANDS A SHIFT IN EDUCATIONAL FOCUS FROM ROTE LEARNING TO COGNITIVE SKILL DEVELOPMENT. CRITICAL THINKING, PROBLEM-SOLVING, AND CREATIVITY ARE ESSENTIAL FOR SUCCESS IN THE DIGITAL AGE.

is marked by the dominance of information and cognitive skills over physical resources. Unlike the scarcity-driven industrial age, where value was derived from transforming physical materials, the Century of the Mind thrives on the limitless potential of information. This shift necessitates an educational focus on developing cognitive capabilities, such as critical thinking, creativity, and continuous learning.

COGNITIVE SKILLS FOR THE FUTURE

In this new era, the skills of the mind are paramount. Pawar highlighted the growing importance of soft skills, which he categorizes as critical cognitive skills. These include:

- **Critical Thinking:** The ability to analyze and evaluate information critically.
- **Creative Problem Solving:** The capacity to devise innovative solutions to complex problems.
- **Communication:** Effective conveyance and exchange of ideas.
- **Collaboration:** Working efficiently and harmoniously with others.
- **Continuous Learning:** The willingness and ability to constantly update one's knowledge and skills.

Educational systems must prioritize these skills to prepare individuals for the future's unpredictable and diverse career landscapes.

THE EVOLVING ROLE OF UNIVERSITIES

Pawar reflected on the evolving role of universities in this transformative era. At NIIT University, four core principles guide their educational philosophy:

- **Work-Integrated Learning:** Bridging the gap between academia and industry. Students engage in real-world projects, blending theoretical knowledge with practical experience.
- **Technology-Based Learning:** Leveraging technological advancements to enhance learning. The focus must shift from teaching to learning, using technology to personalize and enrich educational experiences.
- **Research, Discovery, and Entrepreneurship:** Fostering a culture of curiosity and innovation. Encouraging students to explore, discover, and create economic value through entrepreneurial endeavors.
- **Seamlessness Across Disciplines:** Promoting multidisciplinary approaches to problem-solving and integrating societal and environmental contexts into education. This holistic approach ensures that students develop well-rounded perspectives and capabilities.

As we navigate through the 21st century, it is imperative to reimagine education to align with the evolving demands of society and the economy. By focusing on developing cognitive skills, embracing technological advancements, integrating real-world experiences, and fostering a culture of curiosity and innovation, future generations can be equipped to thrive in this Century of the Mind.

Rajendra S. Pawar's insights call for a critical dialogue on the future of education, emphasizing the need for a transformative vision to meet the challenges and opportunities of our time.

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Kalsi advocates Credit-Based Framework and Future Skills for Education Transformation

Nirmaljeet Singh Kalsi, former IAS and chairman of the National Council for Vocational Education and Training (NCVET) graced the Dataquest Higher Education Conference.

By Bharti Trehan

PREPARING FOR EDUCATION 5.0

While addressing the audience, Kalsi emphasized the critical need for reskilling and upskilling the youth to adapt to the evolving educational landscape. He also highlighted that the educational ecosystem has expanded significantly, encompassing a broader array of stakeholders in education, skilling, and employment. The shift towards Education 4.0 signifies a focus on innovation and skill-based learning, paving the way for Education 5.0.

THE NEW EDUCATION POLICY AND NATIONAL CREDIT FRAMEWORK

Kalsi discussed the implementation of the new National Education Policy (NEP), introduced on July 29, 2020. Over the past four years, this policy has brought significant changes to the educational architecture in India. A notable development is the National Credit Framework (NCF), collaboratively developed by various educational regulators, including the University Grants Commission (UGC) for higher education, the All India Council for Technical Education (AICTE) for technical education, and the National Council of Educational Research and Training (NCERT) for school education.

The NCF is built on three qualification frameworks: the National Higher Education Qualification Framework, the National Skill Qualification Framework, and the National Study Development Framework. This integration allows students to earn degrees by combining credits from academics, skilling, and experiential learning. This flexibility

> THE NEW EDUCATIONAL FRAMEWORK REMOVES THE TRADITIONAL SEPARATION BETWEEN EDUCATION AND SKILLS. STUDENTS CAN COMBINE SUBJECTS FROM VARIOUS DISCIPLINES AND INTERNSHIPS, APPRENTICESHIPS, AND WORK EXPERIENCE ARE RECOGNIZED FOR CREDIT.

ensures that internships, apprenticeships, and work experience are recognized and counted towards degree requirements.

INTEGRATING SKILLS AND EDUCATION

Kalsi emphasized that the new educational architecture removes the traditional separation between education and skills. Students can now combine subjects from various disciplines, such as integrating psychology with electrical engineering. The system promotes equivalence and mobility between general and vocational education, offering multiple entry and exit options.

Technological skills, emergent technologies, and future skills are integral to this framework. Blended learning and the recognition of prior learning are key components. Lifelong learning is supported, and internationalization ensures that Indian education meets global standards.

THE THREE DIMENSIONS OF ACCESS

The framework provides three dimensions of access: academic, skill, and experiential learning. Academic access covers levels 1 to 4 for school education and levels 4.5 to 8 for higher education. Skill access spans levels 1 to 8. For example, entry at level 4.5 requires either a degree or a diploma with relevant experience. This system allows for the integration of 50% credits from academics and 50% from skills, ensuring a balanced and comprehensive education.

STANDARDIZING AND STREAMLINING EDUCATION

The system ensures that education, skilling, and experiential learning are streamlined and standardized. The credit system has been established, and guidelines for deployment, accumulation, storage, reduction, and transfer have been notified. Activities such as sports, arts, social work, and community service can be quantified and credited. Learning outcomes are defined and mapped to specific qualifications, with appropriate credit levels assigned.

INTEGRATING QUALIFICATIONS AND FUTURE SKILLS

The framework includes a wide range of qualifications, from foundational to doctoral levels, available in the public domain. These qualifications can be integrated into higher education courses, ensuring relevance and adaptability. National application standards and various credential types, such as micro-credentials and nano-credentials, are available for a range of skill-based and vocational qualifications. Private and public institutions, including multinational corporations like Microsoft and IBM, can offer these qualifications.

EMPHASIZING FUTURE SKILLS AND TECHNOLOGIES

Kalsi highlighted the importance of future skills and technologies, including AI, data science, 5G, and 6G. Cross-sectoral skill and capacity building are essential to prepare for emerging technological advancements. The integration of technologies such as robotics, machine learning, and the Internet of Things in agriculture was cited as an example of how technological integration can revolutionize traditional sectors.

EDUCATION 5.0: THE PATH FORWARD

Looking ahead to Education 5.0, Kalsi emphasized the need for futuristic classrooms, outdoor learning environments, and home learning environments. The shift towards blended learning and the virtualization of education will play a crucial role. Education 5.0 will focus on a learner-centered approach, lifelong learning, interdisciplinary and collaborative learning, and the integration of technology education. Preparing for this future requires readiness and adaptation from all stakeholders.

CONCLUSION

Nirmaljeet Singh Kalsi outlined a comprehensive vision for the future of education in India. The emphasis on reskilling, upskilling, and integrating skills with traditional education aims to create a holistic and adaptable educational system. The transition to Education 5.0 will require concerted efforts to embrace technological advancements and innovative learning approaches.

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FUTURE OF HIGHER EDUCATION IN THE DIGITAL ECONOMY

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INDUSTRY KEYNOTES

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INTEGRATING DATA AND ANALYTICS INTO EDUCATION

(L to R) **Dr Madhu Chitkara,** Chitkara University, **Dr Rekha Kashyap,** KIET Group of Institutions, **Rohit Sobti,** Fortinet, **Dhaval Gupta,** CyberMedia Group

TAKING INDUSTRY-ACADEMIA COLLABORATION TO THE NEXT LEVEL

(L to R) **Faizul Mufti,** Genpact, **Dr Kavita Bhargava Gupta,** Dus Dishaa, **Abhishek Gaur,** Nasscom, **Sugandha Srivastava,** CyberMedia Research

ACCESSIBILITY, DIVERSITY AND SUSTAINABILITY IN EDUCATION

(L to R) **Megha Bansal,** ONDC, **Prof Shalini Taneja,** FORE School of Management, **Minu Sirsalewala,** Cybermedia

IS IMMERSIVE EDUCATION THE FUTURE?

Aditi Jain, Visionet, **Saurav Bhaik,** Tagbin & Stylin, **Ashok Pandey,** PCQuest

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Data, Analytics, and Industry Collaboration are the Future

Dataquest Higher Education Conference and Awards concluded on July 25th, 2024. The conference focussing on innovation in education. Different panels discusses various aspects related to new age education.

By Bharti Trehan

Dataquest Higher Education Conference and Awards concluded on July 25th, 2024. The conference focussing on innovation in education. Different panels discusses various aspects related to new age education.

In one such panel discussion about – Integrating Data and Analytics into education, Dhaval Gupta, MD, CyberMedia Group moderated a panel discussion with academicians and industry experts. Dr. Madhu Chitkara, Pro-Chancellor, Chitkara University, Dr. Rekha Kashyap, Dean CSE(AI), KIET Group of Institutions, and Rohit Sobti, Regional Sales Manager – Emerging, Fortinet.

Dhaval Gupta started the discussion with his question about how Chitkara University is implementing data analytics in shaping the future of Higher Education.

Dr. Madhu Chitkara, while answering thanked Dataquest. How educationst analyse the data is upto us. It is the need of the hour for institution like theirs

> Data analytics is crucial for institutions like ours. We're embedding data into everything from question paper design to skill development. It's about understanding what works and where we need to improve.
>
> **- Dr. Madhu Chitkara,** Pro-Chancellor, Chitkara University

> We're piloting an ERP-based career modeling tool. It helps students visualize their career paths and stay on track. We're using data analytics to monitor their progress and offer personalized guidance.
>
> **- Dr. Rekha Kashyap,** Dean CSE(AI), KIET Group of Institutions

> While teaching cybersecurity, we must ensure students are ethical hackers, not the other kind. It's a delicate balance, and industry involvement is key.
>
> **- Rohit Sobti,** Regional Sales Manager – Emerging, Fortinet

to talk about the data. "When we draft a question papers, we connect it to skills, and its application using the data and AI.

UNIVERSITY IMPLEMENTS ERP-BASED CAREER MODELING TOOL

Moving forward, Dr. Rekha Kashyap discussed a pilot project at her university involving an ERP-based campus career modeling tool. This tool gathers students' career aspirations upon their entry to the campus, whether they aim for placements, entrepreneurship, or higher studies. The tool uses these inputs to model personalized career paths, aligning them with the university's autonomous curriculum, which includes multidisciplinary tools and specialized tracks. The system continuously tracks student progress through dashboards and data analytics, offering reminders and adjustments as needed. The career path remains flexible to accommodate any changes in students' ambitions during their study period. Future plans include incorporating machine learning into this tool.

INDUSTRY-ACADEMIA COLLABORATION IN TECHNOLOGY AND CYBERSECURITY EDUCATION

Rekha discussed partnerships with IBM for AI and machine learning specializations and with cybersecurity experts and companies for teaching cybersecurity tracks. Similar collaborations exist for post-education development and cloud frameworks.

Dhaval raised concerns about teaching ethics, noting its inclusion in the current curriculum but emphasizing the need for industry involvement to teach innovation due to their access to the latest technology.

Rohit highlighted the fine line in cybersecurity education where students might lean towards unethical practices. He stressed the importance of guiding students correctly and producing certified ethical hackers rather than actual hackers, emphasizing this as a business contribution to society.

Dr. Madhu Chitkara discussed the evolving nature of technology and education. She emphasized the need for humility and adaptation to new technologies, noting how the pace of change has accelerated over time. Dr. Chitkara highlighted the importance of staying connected with the industry to integrate relevant programs into education, referencing NEP 2020's Academic Bank of Credit, which allows students to accumulate and use credits from additional industry programs for future studies or business. She concluded by stressing the value of industry collaboration in enhancing educational offerings.

CONCLUSION AND SUMMARY

This panel discussion emphasized the importance of data analytics, flexible career modeling tools, and industry-academia collaboration in enhancing educational outcomes. The discussions underscored the need for continuous adaptation to technological advancements and the vital role of ethical guidance in cybersecurity education. Overall, the conference showcased the collaborative efforts required to drive educational innovation and prepare students for future challenges.

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Beyond the Classroom: Industry Partners with Academia to Shape the Future

The imperative to cultivate a skilled workforce capable of navigating the complexities of a rapidly evolving economy has never been more urgent. A recent panel discussion brought together industry and academic leaders to delve into the critical role of industry-academia collaboration in addressing this challenge.

By Aanchal Ghatak

THE SKILL GAP: A PERSISTENT CHALLENGE

Sugandha Srivastava, a seasoned analyst at CyberMedia Research, painted a picture of progress amidst challenges. "While we've witnessed a remarkable surge in internships and industry-academia partnerships in recent years, the persistent skill gap highlighted by HR professionals is a stark reminder that there's still significant ground to cover," she observed.

Abhishek Gaur, Regional Lead North at NASSCOM, echoed these sentiments, underscoring the stark disparity between the number of graduates and industry-ready talent. "The reality is sobering," he stated, "with a mere 50,000 industry-ready graduates emerging from a pool of 7 million. This chasm between supply and demand is a pressing concern for the industry."

BUILDING BRIDGES

Dr. Kavita Bhargava Gupta, Associate Professor at Rishihood University, emphasized the importance of a gradual transition for students into the world

> DESPITE INCREASED INTERNSHIPS AND INDUSTRY-ACADEMIA PARTNERSHIPS, THERE REMAINS A SIGNIFICANT SKILL GAP, WITH ONLY 50,000 INDUSTRY-READY GRADUATES FROM A POOL OF 7 MILLION.

> INFRASTRUCTURE CHALLENGES, PARTICULARLY IN REMOTE AREAS, AND THE NEED FOR SOFT SKILLS AND CULTURAL ADAPTABILITY ARE KEY ISSUES. PROGRAMS THAT BRIDGE THE GAP BETWEEN ACADEMIC LEARNING AND CORPORATE DEMANDS ARE ESSENTIAL.

of work. "Exposing students to real-world projects, starting with small steps like case studies and progressing to internships, is crucial," she explained. "It's about fostering a mindset where students not only acquire knowledge and skills but also develop the resilience and adaptability needed to thrive in the industry."

Faizul Mufti, Vice President of Information Security at Genpact, concurred, stating, "Industry needs graduates who are not just survivors but excel. Our focus should be on bridging the gap between academic learning and real-world demands." He highlighted the significance of identifying critical areas like data analytics, cybersecurity, and AI for focused collaboration between academia and industry.

INVOLVING THE SMES

Sugandha Srivastava posed a pertinent question: "While large enterprises are actively engaging with academia, how can we encourage SMEs to participate more effectively in this ecosystem?"

Faizul Mufti responded, "It boils down to identifying their specific needs. SMEs should recognize that collaboration is key to acquiring the skills they require. By working closely with educational institutions, they can ensure a steady supply of talent aligned with their business objectives."

Abhishek Gaur introduced the concept of 'Demand-Led Skilling', emphasizing the importance of industry-driven skill development. "Understanding the industry's needs is paramount," he said. "Our initiative with the Ministry of Industry aims to bridge this gap by communicating specific skill requirements to academic institutions."

Dr. Kavita Bhargava Gupta introduced the concept of KSA (Knowledge, Skills, and Attitude), asserting that attitude is often the differentiating factor in employability. She attributed the growing emphasis on holistic development from a young age to the influence of the National Education Policy (NEP).

CHALLENGES AND OPPORTUNITIES

When asked about the challenges of industry-academia collaboration, Dr. Kavita Bhargava Gupta acknowledged the issue of overconfidence among students returning from industry internships. Abhishek Gaur highlighted the infrastructure challenges faced by many colleges, especially in remote areas.

Faizul Mufti emphasized the importance of soft skills and cultural adaptability. He shared insights into programs that help students understand the corporate world, contributing to their overall development.

Abhishek Gaur announced a significant initiative by NASSCOM and Genpact to engage and employ over 20,000 students from economically weaker sections, showcasing the industry's commitment to social impact.

THE ROLE OF GOVERNMENT AND POLICY

The panelists expressed optimism about the role of government policies in fostering industry-academia collaboration. Dr. Kavita Bhargava Gupta praised the NEP but emphasized the need for effective implementation.

CONCLUSION

The panel discussion underscored the complex interplay between industry and academia in shaping the future workforce. While challenges persist, the growing recognition of the need for collaboration offers hope for a brighter future. By aligning academic programs with industry demands, investing in infrastructure, and fostering a culture of innovation, India can bridge the skill gap and emerge as a global talent hub.

As Abhishek Gaur aptly summarized, "This is not just a decade of change; we are living through it. The industry is evolving rapidly, and academic institutions need to keep pace."

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Transforming Education: Accessibility, Diversity, and Sustainability

Discover insights on accessibility and sustainability in education from Prof. Shalini Taneja and Megha Bansal at the Dataquest T-School 2024 Conference.

By Manisha Sharma

In an engaging session at the Dataquest T-School 2024 Conference in the Panel discussion titled: 'Accessibility, Diversity, and Sustainability in Education', Prof Shalini Taneja, Associate Professor and Head-Center for Sustainable Development (CSD) FORE School of Management and Megha Bansal - VP, Supply Chain & Logistics, ONDC engaged in an insightful discussion with Minu Sirsalewala, Executive Editor at Dataquest to Discuss Accessibility, Diversity, and Sustainability in education.

OVERCOMING BARRIERS TO INCLUSIVE AND DIVERSE EDUCATION

Prof Shalini Taneja initiated the discussion by discussing the barriers that are making the shift from being more inclusive and diversifying our education system. One of the major barriers to making education more inclusive and diverse is determining if students are ready to learn new areas, such as how to measure the impact of Corporate Social Responsibility (CSR) on the ground, or understanding Environment, Social, and Governance (ESG) structures. For

> IT'S NOT JUST THE GOVERNMENT'S RESPONSIBILITY TO ADDRESS THIS; EDUCATIONAL INSTITUTIONS, ACADEMIES, AND INDUSTRY LEADERS WHO ENGAGE IN CSR INITIATIVES MUST ALSO PLAY A CRUCIAL ROLE.

> THE PANEL EMPHASIZED THE IMPORTANCE OF A HOLISTIC APPROACH TO EDUCATION THAT INCLUDES ACCESSIBILITY, DIVERSITY, AND SUSTAINABILITY. BY ADDRESSING THE IDENTIFIED CHALLENGES AND IMPLEMENTING THE PROPOSED SOLUTIONS, EDUCATIONAL INSTITUTIONS CAN BETTER PREPARE STUDENTS FOR THE FUTURE AND CONTRIBUTE TO A MORE SUSTAINABLE SOCIETY.

instance, companies may allocate significant funds for CSR activities, but measuring the social impact of these expenditures is a challenge, especially when dealing with communities with no direct economic relationship to the company. To address this, it's essential to train students in CSR and related areas such as integrated reporting and green supply chain initiatives. Additionally, courses like Responsible and Ethical AI are crucial to preparing students for future challenges. Educators must stay updated on public policy, academia, and regulatory pressures, such as those from the United Nations Sustainable Development Goals (SDGs) or national guidelines for different industries like banking. Preparing students to meet these expectations, whether they join the banking or automotive industries, involves teaching them how to implement sustainable practices.
The same challenges faced by industries are also encountered by NGOs and the development sector, making it essential to co-create solutions and prepare for a holistic ecosystem.

THE IMPORTANCE OF AWARENESS IN SUSTAINABLE EDUCATION

Megha Bansal Continued the discussion by sharing her perspective on the Importance of Awareness in Sustainable Education and said: I believe the fundamental issue we face is a lack of awareness. Even though we, as educated individuals, are present in this room, how many of us are truly aware of the sustainable practices available or how to incorporate sustainability into basic education? This lack of awareness extends to students entering academia, who often struggle to succeed in their studies and graduate in a way that allows them to earn a good living. The issue persists because half of the country remains unaware of the opportunities and possibilities available to them. It's not just the government's responsibility to address this; educational institutions, academies, and industry leaders who engage in CSR initiatives must also play a crucial role. Even those who do not engage in CSR must recognize their responsibility to raise awareness about the options and opportunities available in the country.

Further, she spoke about how Identifying technology that could aid in developing awareness and implementation is crucial and gave an instance, Bhashini, a tool inaugurated by our Honorable Prime Minister in 2022, plays a significant role in addressing language barriers and enhancing public awareness. Bhashini offers digital public infrastructure and technology tools in 22 languages, making it an effective transmission tool for diverse linguistic groups across India. Given that India is essentially a collection of 22 to 23 linguistic regions, such tools are vital for ensuring that information reaches everyone. Before delving into advanced technologies like AI, it's essential to address these foundational issues to ensure comprehensive awareness and implementation.

TRAINING AND CAPACITY BUILDING: A CALL TO ACTION

Talking about the critical issue of skilling and training Prof Shalini Taneja discussed about issue of skilling, which affects both students and teachers, and said, not just for students but also for teachers. It raises the question: is this a significant problem that requires immediate attention? I believe it is. Therefore, I urge all Chancellors and Vice-Chancellors present here to allocate a separate budget for training purposes. It is crucial for us, as educators, to also invest in our own professional development. Personally, I aspire to further my education, either by studying in India at renowned institutions like those in Ahmedabad or Bangalore, or abroad.

Moreover, there should be scholarships or sponsorships available for academicians. Capacity building is essential and should be viewed as a dynamic process, not a static one. For instance, my institute, the School of Management, has evolved from offering basic PCBM courses and international business programs to now providing advanced PGDPM courses in Financial Management and Big Data Analytics. We have developed specialized labs for our students and actively invite corporates for interactions to ensure they stay updated with industry trends. We also engage our students in CSR

> EDUCATION MUST EVOLVE TO ADDRESS THE CHALLENGES OF SUSTAINABILITY AND INCLUSIVITY BY FOSTERING COLLABORATION BETWEEN ACADEMIA AND INDUSTRY, EMPHASIZING PRACTICAL LEARNING, AND LEVERAGING TECHNOLOGY TO REACH DIVERSE LEARNERS.

and community development initiatives to offer practical experience.

It is important to recognize that CSR cannot be taught solely within classroom walls; it requires a hands-on approach to understanding community needs. This understanding is vital for formulating effective CSR policies tailored to different types of companies, whether family-owned, multinational, or state-owned. Capacity building and ongoing training are essential not only for professors but also for staff members. Appreciation and incentives for continuous learning and development should be integral to academic institutions.

Creating a supportive ecosystem within educational institutions will motivate faculty, staff, and students alike. Currently, there is a tendency among students to prefer placements in fields like finance, supply chain, or marketing over CSR or sustainability roles. We must work to shift this perception by demonstrating the value and impact of these fields.

Courses that emphasize real-world applications, such as ESPs, PSRs, and live projects, are crucial. I urge corporate partners to provide opportunities for students to engage in live projects, ranging from one to three months. This exposure will help bridge the gap between academia and industry, benefiting both students and the organizations they work with.

THE IMPORTANCE OF A PRACTICAL AND INDUSTRY-ALIGNED CURRICULUM

Megha Bansal then shared her thoughts about the Importance of a Practical and Industry-Aligned Curriculum and spoke about how Having a curriculum that is practical and closely aligned with industry needs is crucial for preparing students for real-world challenges. Incorporating elements like sustainability and other less common subjects into the curriculum can offer students a more hands-on and practical education. My own experience highlights this need; despite working in electronics engineering for over ten years, I found that the management and practical aspects of my work were not covered by my formal education. Internships have become more prevalent, but there is still a gap in ensuring that these opportunities are truly beneficial. Educational institutions need to collaborate with companies to ensure that internships provide meaningful projects, allowing students to gain practical experience and be better prepared for their careers.

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Metaverse Slowdown: The Impact of Immersive Education on the Future

Panel discussion on the future of immersive education with experts Aditi Jain and Saurav Bhaik moderated by Ashok Pandey. Discover how AR, VR, and MR are revolutionizing learning and HR practices.

By Manisha Sharma

In a recent panel discussion titled: Despite Metaverse slowdown, is immersive education the future, moderated by Ashok Pandey, Associate Editor at PCQuest, industry experts Aditi Jain and Saurav Bhaik delved into the evolving landscape of immersive education. Aditi Jain, Senior Director of Global CoE OD & HR Strategy at Visionet, and Saurav Bhaik, Founder & CEO of Tagbin & Stylin, shared insights on the potential and challenges of using technologies like augmented reality (AR), virtual reality (VR), and mixed reality (MR) in education.

THE FUTURE OF IMMERSIVE LEARNING IN EDUCATION

Aditi Jain initiated the discussion by speaking about The evolution of technology, particularly in augmented reality (AR), artificial intelligence (AI), and virtual reality (VR), which is set to revolutionize education by enhancing immersive learning experiences. These advancements follow the digital transformation initiated by computers and virtual learning platforms, which connect learners worldwide. The integration of AI and VR tools holds immense potential to further transform learning, particularly in the corporate sector, where gamification and simulations have been employed to bridge the gap in practical skills. These technologies offer hands-on experiences that closely mimic real-world scenarios, crucial for fields like health sciences, defense, and aviation, where simulations have long been used to train professionals safely. While challenges such as cost remain, the future of education will undoubtedly involve more immersive learning experiences, helping learners to not only understand but also apply their knowledge in realistic settings.

THE EVOLUTION AND FUTURE OF IMMERSIVE TECHNOLOGIES

Saurav Bhaik discussed the complexity and

> ADITI JAIN IDENTIFIED COST, CONTENT CREATION, AND DATA PRIVACY AS KEY CHALLENGES IN IMPLEMENTING IMMERSIVE LEARNING TECHNOLOGIES. SHE STRESSED THE NEED FOR NEW EDUCATIONAL PROGRAMS TO ADDRESS THESE ISSUES.

evolving nature of immersive technologies such as Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR). He noted that while many talk about these technologies, few truly understand them. AR integrates 3D objects into the real world, as seen with Snapchat filters, while VR immerses users in entirely different environments through headsets. MR combines elements of both, allowing users to interact with virtual and real-world elements simultaneously. Bhaik highlighted the challenges in VR, such as discomfort and limited usage time, which companies like Oculus and Apple are addressing through hardware innovations.
He observed significant advancements from early devices like Google Cardboard to sophisticated products like the Apple Video Pro, predicting that in 5-10 years, these technologies will become more user-friendly and widely adopted. He emphasized the importance of further technological refinement and affordability for mass adoption, envisioning a future where immersive technologies are seamlessly integrated into everyday life.

OVERCOMING EDUCATIONAL CHALLENGES WITH TECHNOLOGY

Saurav Bhaik further discussed that Education faces significant challenges in accessibility, particularly when limited to institutional settings. Our approach aims to democratize education, making it accessible to individuals by leveraging cutting-edge technologies like virtual reality (VR) and augmented reality (AR). We have successfully applied these technologies in various projects, such as the Prime Minister Museum and museums at Rakhigarhi and Nalanda, recreating historical experiences in immersive ways. The goal is to eventually make these technologies as affordable as smartphones, enabling widespread use as educational tools. As we move towards a Web 3.0 environment, where digital experiences are seamlessly integrated into daily life, the potential for these tools to revolutionize learning grows. The future will likely see more accessible and affordable digital infrastructure, with early adopters and creators gaining significant advantages in this evolving landscape.

CHALLENGES IN IMPLEMENTING IMMERSIVE LEARNING TECHNOLOGIES

Aditi Jain further spoke about the different challenges The implementation of immersive learning technologies in organizations presents several challenges, with cost being a primary concern. The high expense of acquiring advanced hardware, particularly in the private and corporate sectors, limits accessibility. Additionally, creating relevant and up-to-date content tailored to an organization's specific needs is another significant challenge. This gap underscores the need for new educational streams and skill-building initiatives. Furthermore, while many organizations strive to incorporate practical, hands-on learning approaches, the adoption of advanced technologies like augmented reality (AR) and virtual reality (VR) remains limited due to costs and accessibility issues. Another crucial aspect to consider is data privacy. As immersive technologies become more prevalent, there is a growing need for regulations to protect learners' data and prevent unauthorized access or misuse. Therefore, collaboration among regulators, technologists, and policymakers is essential to establish guidelines that ensure the ethical and secure use of these technologies.

THE NEED FOR CYBERSECURITY AND REGULATION IN THE METAVERSE

Saurav Bhaik spoke about the need for cybersecurity and regulation in the Metaverse and mentioned that Cybersecurity has become a critical concern, especially as digital personas and the metaverse gain prominence. The digital space is an open world where anyone can assume any identity, raising significant challenges. As we discussed earlier, this openness extends to training, education, and the workforce, highlighting the need for robust security measures. The rise of the metaverse has brought issues like online abuse and harassment to the forefront, often under the guise of anonymity. This anonymity can lead to harmful behaviors, as seen with the troubling reports of abuse within virtual environments. As the adoption of digital platforms increases, so does the urgency for regulations and safeguards. It's crucial to establish mechanisms that

link digital identities to real-world accountability, ensuring responsible online behavior. This growing problem underscores the need for comprehensive regulations and oversight to protect individuals and maintain a safe digital environment.

THE FUTURE OF TECH & LEARNING: ADITI & SAURAV'S VISION

In an engaging session, Aditi and Saurav shared insights on the future of technology and immersive learning. They discussed the idea that while certain technologies may not be available now, they could become more accessible and affordable in the next 5 to 10 years. Aditi described a vision of a future where everything is light, affordable, and seamlessly integrated, eliminating the need to carry physical devices like phones. Saurav shared examples from their work with NACIN, a national academy for narcotics and indirect access, where they train officers using advanced scanning technologies to identify suspects. He emphasized the importance of privacy considerations in this context. Aditi added that immersive learning technologies, such as 3D simulations, are already being used to enhance global training programs, overcoming the challenges of geographical separation and limited attention spans. She envisioned a future where digital personas allow people to collaborate in a virtual space, feeling as if they are together in person, which would be a significant leap forward for corporate training and global communication.

THE EVOLUTION AND IMPACT OF AI IN CONTENT CREATION AND HR PRACTICES

Saurav Bhaik further discussed about Impact of AI on Content Creation and HR Practices and said, that AI is rapidly evolving, significantly transforming various sectors, including content creation and HR practices. By leveraging AI technologies, such as large language models and holograms, innovative solutions are being developed to enhance user engagement and experience. For instance, at the Gita Museum in Gujarat, AI has been used to create a hologram of Lord Krishna, allowing visitors to engage in conversations based on the Bhagavad Gita. This application showcases how AI can interpret religious texts to provide answers to philosophical questions, demonstrating its potential in content creation and education.

Moreover, AI is being utilized to develop personalized learning experiences and HR solutions. AI-powered bots are being employed to answer HR queries, provide information about employee benefits, and assist in creating personalized learning paths. These bots can tailor educational content to individual learning styles, such as auditory, visual, or kinesthetic, and adapt to the learner's pace and preferences. This personalized approach not only enhances the learning experience but also helps in addressing specific knowledge gaps.

In addition to content creation, Aditi mentioned that AI is being integrated into corporate services to streamline processes and improve efficiency. For example, virtual HR heads powered by AI can provide consistent and unbiased responses to employees' questions, ensuring clear communication and support. This integration of AI into HR practices highlights its role in transforming traditional business processes, making them more efficient and responsive to individual needs.

Overall, AI's impact on content creation and HR practices is profound, offering innovative solutions that enhance user engagement, personalization, and operational efficiency. As AI continues to evolve, its applications in various fields are expected to expand, providing even more opportunities for innovation and growth.

THE IMPORTANCE OF CHOOSING THE RIGHT APPLICATION FOR IMMERSIVE LEARNING

Further Aditi and Saurav mentioned a key feature they appreciated about immersive learning was its potential to prepare individuals for the future. They emphasized the importance of carefully selecting the right application for immersive technologies. While the allure of VR and immersive experiences can be tempting, it is crucial to ensure that the technology is applied where it is genuinely beneficial. Aditi and Saurav highlighted that not all scenarios require immersive technology; its use should be deliberate and thoughtfully integrated, particularly in fields like STEM education, language skills, and practical hands-on learning environments. They stressed that the effectiveness of immersive learning depends on choosing applications that truly benefit from such technology. This careful selection not only enhances the learning experience but also ensures that individuals are better prepared and equipped to handle real-world challenges, such as making important business pitches or navigating complex situations.

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Dataquest Higher Education Awards Recognize Top Institutes

Celebrate the excellence in Indian education with the Dataquest Higher Education Awards 2024. Learn about the top institutions recognized for their outstanding achievements and the distinguished guests who presented the awards.

By Aanchal Ghatak

The Dataquest Higher Education Awards recognize the top institutions in India for their achievements in teaching, research, and innovation. The awards are based on a rigorous evaluation process that takes into account a variety of factors, including the institute's academic performance, research output, industry partnerships, and social impact.

The prestigious event saw Nirmaljeet Singh Kalsi, former IAS and chairman of the National Council for Vocational Education and Training (NCVET), and Ravneet Singh Bittu, Minister of State for Railways & Minister of State for Food Processing Industries, presenting the awards to the deserving winners.

TOP AWARDS AND RECIPIENTS

International Institute of Information Technology, Hyderabad

- Ranked 1st in Dataquest T-Schools Survey 2024 (March 2024)
- Ranked 1st in Dataquest Tech-enabled T-Schools Survey 2023 (December 2023)
- Ranked 1st in Dataquest T-Schools Employability Survey 2023 (September 2023)

National Institute of Technology, Delhi

- Ranked 2nd in Dataquest T-Schools Survey 2024 (March 2024)
- Ranked 3rd in North Region Dataquest Tech-enabled T-Schools Survey 2023 (December 2023)

- Ranked 1st in North Region Dataquest T-Schools Survey 2024 (March 2024)
- Recipient: Dr. Obbu Chandra Sekhar, Associate Professor, NIT Delhi

Indraprastha Institute of Information Technology, Delhi

- Ranked 3rd in Dataquest T-Schools Survey 2024 (March 2024)
- Ranked 2nd in North Region Dataquest T-Schools Survey 2024 (March 2024)
- Ranked 1st in North Region Dataquest T-Schools Employability Survey 2023 (September 2023)
- Ranked 2nd in Dataquest T-Schools Employability Survey 2023 (September 2023)
- Recipient: Pallavi Kaushik, Deputy Manager, Corporate Communications and Alumni Relations, IIIT-Delhi

Netaji Subhas University of Technology, New Delhi

- Ranked 4th in Dataquest T-Schools Survey 2024 (March 2024)
- Ranked 3rd in North Region Dataquest T-Schools Survey 2024 (March 2024)
- Ranked 2nd in North Region Dataquest Tech-enabled T-Schools Survey 2023 (December 2023)
- Ranked 2nd in North Region Dataquest T-Schools Employability Survey 2023 (September 2023)
- Ranked 3rd in Dataquest T-Schools Employability Survey 2023 (September 2023)
- Recipient: Prof. MPS Bhatia, Head of CSE, Netaji Subhas University of Technology, New Delhi

B. S. Abdur Rahman Crescent Institute of Science and Technology, Chennai

- Ranked 5th in Dataquest T-Schools Survey 2024 (March 2024)
- Ranked 2nd in South Region Dataquest T-Schools Survey 2024 (March 2024)

Maulana Abul Kalam Azad University of Technology, West Bengal

- Ranked 2nd in Dataquest Tech-enabled T-Schools Survey 2023 (December 2023)
- Ranked 4th in Dataquest T-Schools Employability Survey 2023 (September 2023)
- Ranked 1st in East Region Dataquest Tech-enabled T-Schools Survey 2023 (December 2023)
- Ranked 1st in East Region Dataquest T-Schools Employability Survey 2023 (September 2023)
- Ranked 1st in East Region Dataquest T-Schools Survey 2024 (March 2024)
- Recipient: Dr. Saikat Basu, Associate Professor, CSE & Dr. Md. Aftabuddin, Information Scientist, Maulana Abul Kalam Azad University of Technology, West Bengal

RECOGNITION OF REGIONAL EXCELLENCE

Several institutions were recognized for their regional excellence in specific categories:

College of Engineering, Pune received top honors in the West Region for the Dataquest Tech-enabled T-Schools Survey 2023 but had no representative to accept the award.

Bannari Amman Institute of Technology, Sathyamangalam was awarded for its excellence in the South Region and received the award by Mr. V Sai Kumar, Assistant General Manager.

Chitkara University, Patiala was recognized as the top Tech-enabled T-School in the North Region, with Dr. Madhu Chitkara, Pro Chancellor, and Dr. Rajnish Sharma, Vice Chancellor, accepting the award.

Amity School of Engineering & Technology, Lucknow and Pimpri Chinchwad College of Engineering, Pune were also celebrated for their outstanding performance in the North and West Regions, respectively.

SPECIAL AWARDS FOR INNOVATION AND ENGAGEMENT

Hindusthan Institute of Technology, Coimbatore and Puducherry Technological University were awarded for their Industry Engagement and Innovation & CSR initiatives, respectively.

IMPACT OF THE AWARDS

The Dataquest Higher Education Awards are highly respected in the Indian education sector. They provide a valuable platform for recognizing and celebrating the achievements of top institutions and individuals. The awards also help to raise awareness of the importance of higher education in India's development.

The Dataquest Higher Education Awards are a testament to the hard work and dedication of India's top educational institutions and individuals. The awards provide a valuable platform for recognizing and celebrating excellence in higher education.

As these institutions continue to excel, they set a benchmark for others to follow, fostering a culture of excellence and innovation in the academic landscape.

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