

German experience with grid management, where renewable energy penetration is very high. Krishna Kumar Swaminathan (GE Global Research, Bengaluru) discussed wind energy forecasting from machine learning perspective. He mentioned that creating a digital twin for the wind plant can result in a better level of accuracy in forecasting. Anasuya Gangopadhyay (Divecha Centre

for Climate Change, IISc) spoke about the impact of spatial variation in wind generation in Karnataka. She presented data on wind generation in Karnataka and highlighted the potential for geographical smoothing.

In the concluding session, the need to bridge the gap between academia and industry was emphasized. The importance of greater interaction between different

research institutions to improve the forecasting of wind energy was mentioned. A long-term plan to assess the offshore wind potential in India was highlighted.

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MEETING REPORT

Indian Science and Technology Enterprise Partnership*

Science and Technology (S&T) have emerged as major drivers of innovations and enterprise at present. Thus a systematic and focused effort to utilize S&T in enterprise holds the promise of revolutionizing the economic and industrial landscape of country. However, this potential of S&T-driven enterprise has not yet been realized in India, primarily because a complete ecosystem for such a Science and Technology Enterprise Partnership (STEP) has not yet been identified, let alone established. With the increasing role of S&T in all aspects of society and economical activities, there is an urgent need to develop a comprehensive framework and policy for S&T-driven enterprises. It is clear that such an effort must identify all components, and integrate them in an effective framework for a successful STEP, beginning with a clear statement of vision and goal.

A workshop on Indian Science and Technology and Enterprise Partnership (ISTEP) was organized for characterization of S&T-driven enterprise and to develop a roadmap for realizing the partnership. The primary goal of the workshop was to examine the necessary components for a successful ISTEP and to generate recommendations and a roadmap for its implementation.

Realization of ISTEP would require sustained, significant and synergetic efforts systematically involving thought leaders, established researchers as well as young researchers. Accordingly, the

invitees and the participants in the workshop (through open call) included thought leaders, policy makers, S&T experts, economists, social scientists, industry leaders and young researchers.

The absence and the need for a precise narration of ISTEP as a clearly defined entity with clear and precise agenda was highlighted in the opening remarks. The focus was put on an ecosystem around a product for its development into a marketable asset. It was pointed out that there was a need to complement conventional discipline-driven R&D with product-oriented R&D; such an approach can provide another route for extraordinary science, while seeking enterprise solutions.

Among other issues, the workshop also discussed designing policy interventions, capacity-building challenges by looking at individual and institutional success stories to make India ready for successful STEP. The meeting noted that at the international level also, the importance of S&T-driven enterprise is being realized. A notable development is the BRICS S&T Innovation and Entrepreneurship Partnership (BRICS-STIEP). According to Baldev Raj (NIAS, Bengaluru), NIAS and CSIR-NISTADS have played both pioneering and leadership roles to ensure India's leadership in BRICS-STIEP. However, India being the lead country in BRICS-STIEP, there is an urgent need for developing S&T-driven enterprise leadership. ISTEP is the beginning in this context. An effective BRICS-STIEP could enable pooling of their resources to create a platform for improved quality of life, better techno-

logical leadership, improved innovation index, higher human development index, social security, health care, etc. ISTEP could provide the national initiative.

A discussion session followed a presentation by P. Goswami (Technology and Development Studies, New Delhi) on vision, goal and structure of ISTEP. The session witnessed lively exchange of ideas on STIEP. It was pointed out that connecting science to product has been often crippled due to gaps such as lack of entrepreneurship and that an integrated systems approach of enterprise including education, science, technology, politics and society was required. P. S. Goel (NIAS, Bengaluru) highlighted the need for a mechanism to enhance risk-taking capabilities in decision making on new ideas and their implementation along with an enabling financial policy.

S. Bhattacharya (CSIR-NISTADS) emphasized the importance of model and parameters to ensure success of entrepreneurial framework. Three basic steps for recognition of enterprise were recognized: the nature of consumer demand, creation of product and innovation. It was observed that innovation in India was more driven by technology creation instead of market demand; the need for making market-sensitive products was emphasized by Narendra Pani (NIAS, Bengaluru). The need for strengthening connection between educational institutions and entrepreneurs for a successful ISTEP was also emphasized by M. H. Balasubramanya (IISc, Bengaluru).

Creation of a successful S&T enterprise requires exchange of wisdom of scientists and entrepreneurs in a sharing

*A report on first workshop on Indian Science and Technology Entrepreneurship Partnership (ISTEP).

environment. The need for implementation of Business 2 Business (B2B) rather than B2C strategies in India was emphasized by Ashok Jain (Former Director, CSIR-NISTADS and NIAS, India). However, planning of technology development and investment should be based on careful and systematic analysis. The need for analysis of infrastructure, management, design, investment, ecosystem, techno-economic aspects, feasibility analysis and market strategy to precede investment in any technology development was emphasized by Goswami. It was agreed that a mission mode approach is needed to make enterprise models successful. It was also emphasized that a model needs to be created which links S&T, enterprise and innovation. It was pointed out, however, by Prabhat Ranjan (TIFAC) that there remained several gaps between S&T innovations and enterprise. The lack of a proper market strategy for S&T-driven enterprises was highlighted by G. V. Ramaraju (Lingaya's University). It was pointed out that it was necessary to impart cultural values in enterprises; the importance of methods and cultural practice in enterprise model was emphasized by Nitin Khanna (Aantrisht, Noida). Rekha Singhal (TCS, Mumbai) pointed out that a product-oriented approach was needed as research practices vary from product to product. The distinction between blue skies research and product-oriented approach for enterprises was highlighted by K. Ramachandra (Director, NDRF). Sonkusre (NITI Aayog) mentioned the need for S&T inputs in formulating national policies. Overall, the discussion and inputs provided a narration and characterization of an S&T-driven enterprise

and set the stage for more specific deliberations.

Next, five groups were formed for in-depth discussion on each of the major issues.

Group 1: Narration of ISTEP.

Group 2: STI challenges and strategies.

Group 3: Financial structure and management.

Group 4: Management (design, integration, delivery, etc.).

Group 5: Techno-legal framework.

Following the major observations and recommendations from the five groups, G. Sahni (CSIR, New Delhi and the Chairman, Summary Sessions) observed that in spite of India possessing incredible depth and coverage of talent in essentially all topics of science and technology, an efficient mechanism to harness this talent was still missing. He observed that CSIR with its 38 laboratories essentially covered all applied sciences and technologies. However, S&T-driven enterprise required involvement not only of multiple disciplines, but also integration of S&T with socio-economics, market analysis and management. Emphasizing that entrepreneurship could not be created from nowhere, Sahni stressed the need to create an energetic ecosystem to realize this potential and mentioned that the goal must be to move beyond innovation by integrating innovations into products for value-addition and cost-competitiveness. He expressed hope that ISTEP would be the first step towards a new dimension in S&T enterprise in India.

The observations and suggestions were synthesized into the following major recommendations:

(1) ISTEP would be a major structural innovation in the S&T space creating many S&T-driven enterprises across the country; the aim now should be to identify carefully determined enterprise goals.

(2) The vision of ISTEP should be to trigger, enable and accelerate extraordinary S&T-based enterprise solutions for rapid and transformative economic development through well-defined projects.

(3) ISTEP should be designed for meeting both national aspirations and India's global leadership in S&T-driven entrepreneurship by interfacing through international platforms like BRICS-STIEP.

(4) ISTEP should be designed to close the loop between S&T, product design, demand and delivery, so that the benefits of S&T reach the client/extreme end-users.

(5) S&T-driven enterprises can enable technology leapfrogging; ISTEP should be structured accordingly.

(6) A structured ISTEP should be developed for a critical and sustained effort to realize the goals.

(7) A follow-up workshop should be organized to develop a clear and implementable roadmap for ISTEP.

The meeting ended with a resolve for early and effective follow-up.

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