COAI Additional / Counter Comments on Consultation Paper on Encouraging Research and Development (R&D) in the Telecom, Broadcasting and IT (ICT) Sectors

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Preamble:

1. **India** has come a long way in terms of investment in Research and Development (R&D) since its independence in 1947. Today, Government of India is taking variety of measures, including policy support, Infrastructure support, funding support for education and skilling, research parks, and technology business incubators with the goal of developing India into a global innovation hub and providing an enabling environment that promotes research.

2. COAI appreciate the opportunity provided to the industry to share the inputs and recommendations to enhance the R&D facilities in India and create an encouraging environment to strengthen the R&D further. COAI's members has very strong presence of R&D in India and our commitment to India is deeply engraved in the way we harness the potential of local talent for research and development.

Our Issue -Wise response is as below:

Q1. Whether the current education system adequately promotes scientific temper and skills among students encouraging them to contribute towards Research and Development activities in ICT sector? If yes, please indicate what additional measures are needed to make them effective contributors of innovations to the industry. If not, please identify areas which need to be strengthened to orient students towards research and development activities in ICT sector.

COAI Response:

The effectiveness of the current education system in promoting scientific temper and skills among students for Research and Development (R&D) activities in the ICT sector varies from one educational institution and system to another. However, there are several common areas of challenge and improvement that can be identified for further working:

1. **Challenges in the Current Education System:**

   a. Theoretical Emphasis: Many education systems tend to focus on theoretical knowledge, which may not adequately prepare students for practical R&D work in the ICT sector. Hands-on experience and problem-solving skills are crucial for innovation in this field.

   b. Outdated Curricula: ICT is a rapidly evolving field, and educational curricula may not always keep pace with the latest technologies and industry trends. This can result in a gap between what students learn in school and what they encounter in the real world.

   c. Lack of Research Opportunities: Some students may not have access to research opportunities

within their educational institutions. Limited access to mentors and research projects can hinder their ability to engage in R&D activities.

d. Limited Industry Engagement: Collaboration between educational institutions and the ICT industry may be limited, reducing students' exposure to real-world challenges and opportunities.

e. Insufficient Practical Training: In many cases, students may not receive adequate practical training in ICT, such as programming, software development, and hands-on experimentation.

2. <u>Areas for Improvement and Additional Measures:</u>

a. Practical Learning Emphasis: Educational institutions should place a greater focus on practical learning and hands-on projects, allowing students to apply their knowledge to real-world problems. Incorporating practical components into the curriculum is essential.

b. Updated Curricula: Educational institutions need to regularly update their curricula to reflect the latest ICT tools, technologies, and methodologies. Collaboration with industry experts and professionals can help keep the curriculum relevant.

c. Research Opportunities: Promote a research culture within educational institutions by offering research grants, scholarships, and opportunities for students to engage in research projects. Encourage faculty members to conduct research and involve students in these endeavors.

d. Industry-Academia Collaboration: Strengthen the relationship between academia and the ICT industry through guest lectures, joint research projects, and internship programs. This exposure to the industry can provide students with valuable insights and experiences.

e. Mentorship Programs: Establish mentorship programs that connect students with experienced researchers and professionals in the ICT sector. Mentors can guide and inspire students in their research and development efforts.

f. Critical Thinking and Soft Skills: Encourage critical thinking, problem-solving, and soft skills development, such as communication, teamwork, and project management. These skills are essential for effective collaboration in R&D activities.

g. Inclusion of Emerging Technologies: Introduce emerging and cutting-edge technologies, such as artificial intelligence, cybersecurity, and quantum computing, into the curriculum to prepare students for the future of the ICT sector.

h. Entrepreneurship Education: Offer programs that educate students about entrepreneurship and innovation in the ICT sector, enabling them to take their research findings and turn them into practical innovations.

i. Support for Extracurricular Activities: Encourage students to participate in coding clubs,

hackathons, and technology-related competitions to further develop their skills and passion for ICT.

3. In conclusion, while the effectiveness of the education system in promoting scientific temper and R&D skills in the ICT sector varies, there is room for improvement. By emphasizing practical learning, updating curricula, offering research opportunities, fostering industry-academia collaboration, providing mentorship, and encouraging critical thinking and soft skills development, educational institutions can better prepare students to contribute to R&D activities and innovations in the ICT sector.

Q2. What should be done to further strengthen the roots of R&D ecosystem in general and specially in the ICT sector of the country, which allows;

(a) Increase in number of post-graduates going for doctoral and post-doctoral programs in institutions other than IITs?

(b) Assured career progression opportunities in the field of Research and Development for students graduating from tertiary educational institutions?

(c) Researcher to continue entire career in advanced research.

(d) Increase in employability and career progression skills of students enrolled in STEM courses?

COAI Response:

1. The strengthening of the Research and Development ecosystem, particularly in the Telecommunication and ICT sector involves a multi-faceted approach that encompasses various aspects of academia, industry, policy, and innovation. This lack of research funding to universities is a key factor in decline of the erstwhile good universities to teaching theories only places which continues to weaken the R&D ecosystem. If India is looking to build a strong R&D ecosystem, then the R&D ecosystem in universities must be heavily supported.

2. To strengthen and increase the R&D ecosystem, especially in the Telecommunication and ICT sector, and encourage more post-graduates to pursue doctoral and post-doctoral programs in institutions outside IITs while ensuring assured career progression, continuous opportunities in R&D, and enhancing employability in STEM fields, a multifaceted approach is essential. This will motivate more post-graduates to pursue advanced academic programs while ensuring robust career prospects. Here are few key strategies to follow for such approach:

   a. **Industry-Academia Collaboration:** Foster closer collaboration between academia and industry by offering structured internships, cooperative programs, and joint research initiatives. These practical exposures will help in enhancing the understanding of industry needs and develop students' interest in pursuing research and development-based careers. Academia institution partnerships with industry players can provide real-world problems for research, and opportunities for students to work on industry-relevant projects.

   b. **Research Fellowships and Grants:** Establish comprehensive fellowship programs and research grants aimed at supporting students interested in pursuing a career in R&D. These should cover not only the tuition fees but also the living expenses during the tenure of doctoral and post-doctoral

programs. This can attract talented individuals to support their research endeavors, even outside the IITs. Academia institutions must ensure sustained funding for long-term research projects, enabling researchers to pursue in-depth studies and attract post-graduates and post-doctoral scholars.

c. **Flexible Career Trajectories:** Offer flexible career paths in R&D, allowing individuals to move between academia, industry, and government research organizations. This promotes a diverse and enriching career experience. Also need to provide avenues for advancement, recognition, and competitive compensation packages to encourage students to pursue advanced research careers.

d. **Promote Interdisciplinary Research:** Encourage interdisciplinary research by fostering collaborations between Telecommunication, Broadcasting, and IT (ICT) related other fields like electronics, medicine, agriculture, energy, etc. This broadens the scope of research and attracts students from diverse backgrounds.

e. **Promotion of Research Culture**: Promote a culture of continuous learning and professional development by encouraging researchers to remain informed of the latest advancements in their fields through workshops, seminars, and conferences. Such events can also include awards, and recognition for innovative projects highlighting the success stories, opportunities, and the quality.

3. The above-mentioned holistic approach focuses on aligning academic programs with industry needs, fostering a culture of innovation, providing practical experience, and support for career progression, ultimately enhancing the R&D ecosystem in Telecommunication, Broadcasting and IT (ICT) while encouraging more new students to pursue advanced programs within or outside IITs.

Q3. What measures should be taken pertaining to the tertiary institutions with a focus to encourage students towards advanced R&D at the university level?

COAI Response:

1. Encouraging students toward advanced R&D at the university level involves creating an environment that fosters curiosity, critical thinking, and innovation. Here are measures that can be taken in tertiary institutions to promote advanced R&D among students:

a. **Research Culture Development:** It is essential to instill a culture of research by integrating research activities into the curriculum. Offer research-oriented courses, seminars, and workshops to expose students to the world of inquiry and discovery.

b. **Early Engagement in Research:** Provide opportunities for undergraduates to engage in research projects alongside faculty members or through dedicated research programs. Encourage participation in conferences and publishing opportunities to showcase their work.

c. **Interdisciplinary Collaboration:** Encourage collaboration across disciplines to solve complex problems. Foster partnerships between various departments to address multifaceted challenges that require diverse expertise.

d. **Ethical and Responsible Research Practices:** Educate students about ethical considerations in research, including integrity, plagiarism, and responsible conduct of research.

e. **Communication and Presentation Skills:** Offer training in effective communication and presentation skills. The ability to articulate research findings and ideas is crucial for disseminating knowledge.

2. By implementing these measures, tertiary institutions can cultivate a conducive environment that nurtures a passion for advanced R&D among students, preparing them for meaningful contributions to the academic and professional research community.

Q4. Whether current science system (network of public and private institutions involved in the production and consumption of R&D and innovation) is sufficient to foster R&D and innovation in India in general and ICT in particular? If not, what additional measures are required to strengthen science system of the country and ensure availability of adequate resources for the same? Please support your answer with justification and best practices being followed in India and abroad in this regard.

COAI Response:

1. In recent years, India has made significant strides in R&D and innovation, particularly in the ICT sector, but there is still a need for improvement in the science system to further foster R&D and innovation in Telecommunication and Broadcasting areas. Here's an assessment and recommendations:

a. **Strengths to be Focused on**:

Many regions in India possess strong academic institutions and research centers, which are fortified by a highly skilled and proficient pool of engineers and researchers. Furthermore, these areas have witnessed a thriving entrepreneurial ecosystem and startup culture. This trend is complemented by a growing government focus on investing in research and development (R&D) projects.

b. **Challenges to Overcome:**

Insufficient collaboration between academia, industry, and government, limited funding for research and development (R&D) compared to other leading nations, gaps in infrastructure and access to cutting-edge technology, need for a more robust intellectual property framework, and insufficient emphasis on translational research and commercialization are some of the major challenges that hinder our progress towards achieving innovation and development objectives.

To overcome the stated challenges, it is essential to create strong partnerships between academia, industry, and government, and to increase the funding for R&D. Additionally, investment in infrastructure and cutting-edge technology is crucial to enhance our capabilities and

competitiveness. Furthermore, a comprehensive intellectual property framework can provide the necessary incentives to promote innovation and safeguard intellectual property rights. Finally, there is a need to increase the focus and investment in translational research and commercialization to ensure that innovative ideas and discoveries are effectively translated into practical applications that benefit society.

2. Some of the Best Global Practices formulated for the boost the R&D:

a. USA's National Science Foundation (NSF): The NSF is an agency that supports fundamental research and education across all fields of science and engineering. It serves as a model for government-funded R&D initiatives.

b. South Korea's Research Institutes: Organizations like KAIST and KIST play a pivotal role in R&D, with strong ties to industry. They emphasize applied research and technology transfer.

c. Germany's Fraunhofer Society: Known for its applied research, Fraunhofer Institutes bridge the gap between academic research and commercial applications. They collaborate extensively with industry partners.

d. Germany's Deutsche Telekom Innovation Labs: These labs focus on cutting-edge ICT research. They involve collaboration between academia, industry partners, and startups to drive innovation in telecommunications.

e. India's Biotechnology Industry Research Assistance Council (BIRAC): The BIRAC fosters innovation and entrepreneurship in biotechnology is the best example to be followed to encourage the R&D in Telecommunication and ICT sector. It promotes the development, validation, and pre-commercialization of products/technologies by accelerating the industry-academia collaboration.

3. To strengthen India's science system, a collective effort is required that involves increased investment, improved infrastructure, streamlined policies, enhanced collaboration, and a supportive ecosystem for innovation. There is a need to learn from successful models globally, which can help in identifying strategies to boost research and development (R&D) and innovation, particularly in the information and communication technology (ICT) sector. This will ensure that India remains at the forefront of technological advancements.

Q5. How can the participation of public sector enterprises involved in R&D be augmented towards a synergized national effort in research, development, and innovation in ICT? Please support your answer with justification and best practices being followed in India and abroad in this regard.

COAI Response:

1. The international examples shared by TRAI of LINC (Leaders Industry-university Cooperation) programs of South Korea, that focuses on the amalgamation of industry and academia by providing training to start-ups is very useful and should be imbibed.

Q6. What should be the prerequisites and key characteristics of an effective next generation technology testbeds in India? Will defining national-level mission and strategic objectives for ICT help in their effective utilization? Please support your answer with justification and best practices in India and abroad in this regard.

COAI Response:

1. Setting up technology test beds is a long-drawn process and requires detailed planning and investment and a certain level of skills. Once the Government has decided the objective of the testbed, it is critical to identify the skillsets required to facilitate such testbed and seek collaborations with international experts, global OEMs etc. to set up the test bed. This is followed by building up the infrastructure and facilities required to set up the test bed. The infrastructure should be flexible, scalable and capable of interoperability testing.

Q7. What role do you envisage for the service providers and industry in facilitating indigenous R&D in the ICT sector respectively? How can industry participation in R&D in the ICT sector be further improved? Please support your answer with justification and best practices in India and abroad in this regard.
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Q11.What are the steps required to strengthen government-industry-academia linkages in the ICT sector on long terms basis? Please support your answer with justification and best practices in India and abroad in this regard.
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Q12 Whether the current institutional mechanism is adequate to cater to the needs of R&D in ICT sector in India? Is there a need to create a separate agency to coordinate and look after R&D functions specifically in ICT sector? If yes, suggest a suitable framework for the overarching agency. If not, how can synergy between stakeholders be established to ease out processes and monitor timebound R&D outcomes? Please support your answer with justification and best practices being followed in other sectors nationally or internationally.
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Q24 What are the best practices which need to be adopted by India to promote private sectors investment in R&D activities? Please support your answer with suitable examples or frameworks and best practices in India and abroad in this regard.

COAI Response:

1. While the nature of the paper and the questions are related to ICT in general, our responses specifically focus on telecom sector, in particular the 6G technology development cycle and the national program and mission setup in the context of 6G.

2. We would like to draw attention to insights from successful R&D initiatives across the globe –

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a. The R&D agenda should be based on the objective that effort is transformed into commercially relevant technology, products, and solutions, at a global level.

b. For any indigenous R&D mission to be successful, this is crucial that the agenda must be developed and pursued in close collaboration with both demand and supply sides in the sector. The plan, effort and investment must ensure that the outcome of the R&D is consistent with the market requirements.

c. In this context, on the demand side, TSPs are the ones who lead the evolution of transformation of their infrastructure subject to market pressures, capex constraints and business models. R&D plans should be developed in integral and close engagement with TSPs. Therefore, the role of service providers is immensely important in that they create the market demand. R&D efforts should directly address their priorities and requirements in a standardized manner to derive the best returns.

d. On the supply side, the OEMs / manufacturers are the ones who understand the industrial value and implementation aspects of the concept and its competitive relevance at global scale. During this initial phase when our nation is kickstarting the ambition to become a significant player in global markets, indigenous industry lacks this vital experience as to the commercial and implementation aspects of the concepts.

e. The telecom industry works on volumes and global interoperability. The prime strength of global OEMs lies in their longstanding experience in standards and technology development, their ability to benchmark what innovation and breakthrough can fructify and what not.

f. India is known to be a major market, as a consumer of technology, but now India is becoming a technology producer with its vibrant academic and startup ecosystem. This is also backed by policy directions like “Atmanirbhar Bharat”, Semiconductor Industry push, PLI schemes to encourage technology development in India. Due to these concrete steps, things are moving on the ground in a unified manner.

g. Global companies have been a critical part of communication services infrastructure for decades. They possess the ability and desire to engage in a constructive and collaborative DGD experience by virtue of consistent and continuous participation in the 3GPP standardization process over decades and gained the visibility as to how this machinery works. 3GPP process imparts vital expertise as to what works and what does not, and how to secure the global harmonization of your solution and concepts. This is time-consuming and comes at an enormous cost and decades old engagement in global process. Therefore, global OEM majors like Ericsson and Nokia offer a critical value to help shape and nudge the concepts in a direction that could secure larger acceptance and endorsement in 3GPP/ITU-R etc. Secondly in the technological development cycle they have reached a point where they have state-of-the-art research facilities and skills that are unmatched. Indigenous industry can reach that stage with sustained investment of funds, resources, and time in the process. Therefore, to expect a grand success for R&D, this is inevitable to leverage the strength and experience of global OEMs as an invaluable offering. Otherwise also, standardization process is by nature a complex process which entails local and global industry to join hands and work in collaboration for greater harmonization of concepts and solutions.

h. Global OEMs have the critical capability and experience to benchmark the potential of the technology concepts, which can come from academia, and convert these into real-life products at a global scale. The role of global standards is fundamental to global relevance and scale. Any R&D mission must keep in view that concepts and solutions are implementable and acceptable into global standards therefore a close coordination and collaboration of industry and local R&D stakeholders is fundamentally important. In global standards, proposals have to pass through a rigorous process of securing support from relevant stakeholders before getting accepted. The factors that govern the success are the viability of concept / solution, technical merit, and the support which it commends on the floor. This should start from local SDO level and evolve into converged and competitive view before tabling to 3GPP etc. A strong pre-standards framework facilitating collaboration and constructive alignments is essential.

i. There are clear zones of industry and academia as far as research is concerned (please refer to Figure 1). The first zone is predominantly of academia, where its strength in exploring new frontiers, novel concepts and algorithms for upcoming technologies is leveraged. This is the zone where there is little visibility as to the practical utility in commercial products and hence ridden with high risk and uncertainty. For their concepts and novelties to be converted to real-life commercial products, academia should seek collaboration and partnership with industry who can benchmark their potential and shape them to commercially viable solutions. This is the second zone, where there is a collaborator from industry, and both should work together to experiment, prototype and validate the concepts. The strength of the industry partner is to lead the concept for validation and subsequent standardization phase. After that, the third zone is the remit of pure product development, which is led by product manufacturers. Therefore, this cycle comprises of three clear zones. Any attempt by academia to run in isolation from concepts development and jump directly to standardization will be faced with failure. The experience in 5G cycle confirms that. A clear demarcation would avoid unnecessary conflicts and produce optimum results. It is essential that policy makers ensure clear separation of roles and help remove any overlap between industry and academia to see large-scale successful commercialization of concepts.

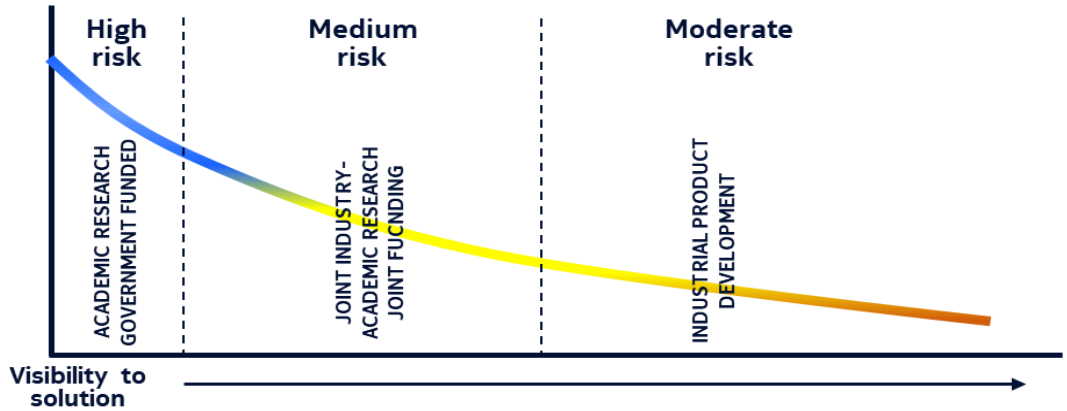

Figure 1 Segregation of roles in Innovation Development

j. Due to high risk and uncertainties involved in fundamental research phase, academic research needs to be funded by the governments. The second phase, industrial research is the area where both work in collaboration can be funded in PPP mode by industry and government. The last phase for product development R&D is the exclusive zone for the industry.

k. Therefore, this is imperative for the policy makers to plan and design the R&D programs and fund mechanisms properly. The role and scope of national technology development programs like Bharat 6G Mission is entirely different. Its objectives and leading stakeholders are completely different. These programs are where industry is the leading stakeholder. Academia should leverage these programs and engage to seek partners and collaborators for their topics and idea / concepts. Specific to these programs, their success depends on how best industry can lead academia-work towards its practical implementation in commercial technology.

i. Programs like Bharat 6G must initiate call for R&D projects (which target system level aspects) and not individual topics of research. For example, the project may be defined for Green Telecom, which includes multiple sub-topics like waveforms, error coding, modulation formats, cloud/AI architecture etc.

ii. Such project proposals must ensure that it is led by a strong demand-side stakeholder like TSPs / vertical industry and proven OEM / manufacturers which in turn should be equipped in order to be commercially viable. A project comprising of only academia creates conflict from the beginning to the end of the entire development cycle which should be averted. The academic research is an area which falls under the Department of Science & Technology under HRD ministry and MeitY, In order to develop academic research programmes of a similar nature, the Department of Telecommunications should provide expert supervision and collaborate with industrial partners.

iii. The strength and capabilities of global OEMs must be leveraged to lead and guide the execution of these programs to enhance the success potential of R&D efforts in global standardization and commercialization phase. Any exclusion of global players will fail to deliver the expected success of these programs in real terms. This is more important when we don't have global majors in indigenous industry with state of art facilities for research and commercialization. Experience in the 5G era confirms this.

Q8. How Telecom Centres of Excellence (TCOEs) can be made hubs of innovative product delivery to telecom industry? What can be done to further strengthen the TCOEs in order to provide an impetus to innovations in the telecom sector? Please support your answer with justification and best practices in India and abroad in this regard.

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Q9. Is there a need to establish new Centers of Excellence for the broadcasting sector? What can be done to synergize the telecom and broadcasting sectors for the objective of convergence? Please support your answer with justification and best practices in India and abroad in this regard.

COAI Response:

1. Telecommunication Centers of Excellence (TCOEs) have not yielded the expected results and thus requires a restructuring. The Government should encourage participation by associated sectors like Broadcasting, device manufacturers and also involve the beneficiary sectors under Industry 4.0 to collaborate with TSPs for innovation. This will ensure adequate financial resources for cutting-edge research and development activities involving the emerging technologies under 5G, Internet of Things (IoT), artificial intelligence (AI), and edge computing. by focusing on several key strategies as listed below:

   a. Industry-Academia Collaboration: It is imperative to foster stronger partnerships between industry players and academia by encouraging joint research projects, collaborative initiatives, and knowledge sharing forums to address industry challenges and develop innovative solutions.

   b. Ecosystem Development: There is a need to create a vibrant environment by involving startups, SMEs, and larger companies. Incubate and support innovative ideas, providing resources, mentorship, and funding to develop these concepts into viable products.

   c. Specialized Skill Development: It is essential to provide special training programs, workshops, and certifications in cutting-edge technologies and telecom-specific areas. Additionally, equip professionals with the skills necessary to lead innovation in the industry.

   d. Government Support and Funding: Garner government support through grants, subsidies, and policies that promote innovation in the telecom sector. This support can assist in infrastructure development and R&D initiatives.

   e. International Collaboration: It is necessary to facilitate collaboration between the global research institutions and telecom centers such as Exchange programs, joint ventures, and partnerships can provide diverse perspectives and accelerate innovation.

   f. Intellectual Property Protection: It is necessary to create mechanisms to safeguard intellectual property generated within TCOE. This will encourage researchers and innovators to freely explore specific ideas without the fear of intellectual property theft.

   g. Open Innovation Platforms: Establish open innovation platforms that allow collaboration between various stakeholders including academia, industry, startups, and government. Such platforms facilitate the sharing of ideas, resources, and expertise.

2. Some of the Best practices from India and abroad include:

   a. Indian Institute of Technology (IIT) Research Parks: These provide a platform for collaboration between academia and industry. They offer incubation facilities, mentorship, and access to resources to foster innovation.

b. Silicon Valley Innovation Centers: Internationally, places like Silicon Valley have innovation centers that serve as hubs for technology development, collaboration, and entrepreneurship. They offer a supportive ecosystem for startups and established companies to innovate and collaborate.

c. University-Industry Partnerships in Europe: Countries like Germany and Sweden have successful university-industry partnerships that drive innovation in the telecom sector. These partnerships focus on joint research, technology transfer, and commercialization of ideas.

3. Hence, implementing these strategies and learning from successful models both within India and abroad, would ultimately help in delivering impactful and transformative products and services to the industry.

Q10. What are the reasons behind MNCs primary focus on software rather than hardware in India? What measures can be taken to promote basic/applies research by MNCs strengthening the current R&D efforts in software and improving R&D efforts in hardware? Suggest a suitable mechanism to establish a balanced R&D Science System in the country.

COAI Response:

1. The primary reasons of cost efficiency and skilled workforce proficient in English language provided by India are well documented and recognized by the Government and relevant Authorities. The lower cost of investment and OPEX in software implies that most technology companies make initial forays only in software. Further, software development has a smaller incubation timeframe and has the agility to keep up with the fast -moving innovation cycles instead of hardware.

2. The government has taken major steps in last few years to address the Ease of Doing Business (EODB). Hardware R&D also needs linkages to the prototyping. The Make in India and innovative PLI schemes have been launched to facilitate manufacturing in India which would also help in prototyping. Thus, the Government is already providing incentives and benefits to MNCs to invest in hardware manufacturing facilities in India and this can be further augmented by tax breaks, subsidies, or other financial incentives.

Q13. What steps must be taken to ensure a transparent mechanism for adequate and timely disbursement of funds for R&D programs? What should be indicators for the tracking mechanism for the funds and outcomes of R&D programs? Please support your answer with suitable examples or frameworks and best practices in India and abroad in this regard.

COAI Response:

1. The existing models of disbursement of funds for R&D programs are sufficient.

Q14. How can participation of private sector in R&D be encouraged? Which incentivization model(s) or combination thereof would produce better results:

(i) Tax-break model, or
(ii) Product-Linked Incentivization model
(iii) Any other model.

Please provide details of the suggested model(s) in terms of structure, functioning, monitoring, and evaluation.

COAI Response:

1. We submit that the PLI model is a popular model for manufacturing, however, in case of R&D, there may not be sufficiently quantitative measurables for encouraging the participation of private sector in R&D, therefore, it seems that the tax-break model might be most suitable model.

2. Further, we would like to submit that Telecom operators should be encouraged through graded incentives of reduction in license fees, for procurement of products which have been developed and manufactured basis domestic R&D. TSPs should be free to purchase product or equipment manufactured/made in India or elsewhere and there should not be any penal provisions for non-procurement of any defined value/quantity from indigenous sources.

3. The incentives to telecom operators for procuring domestically manufactured products, should apply equally for Indian suppliers as well as for foreign suppliers, who are manufacturing in India.

4. However, there should not be any retrograde policy step of mandating telecom service providers or industry either for facilitating indigenous R&D in the ICT sector or for purchase of equipment having domestic R&D.

Q15. Is there a need for a mechanism to promote research, development and innovation at the state level? Will a ranking mechanism for the states help to promote the spirit of innovation? If yes, please comment on the structure of such a mechanism with key performance indicators.

COAI Response:

1. Private sector investment can be in the form of grants, aids, setting up school level laboratories, Start up support and collaboration with academia. All these activities should be considered for tax breaks. Government could also bring in Innovation Challenges like it did for Video Conferencing solution where it supported in the 3 stages i.e. Ideation, prototype and solution building.

Q16. How can awareness about IPR be increased among the researchers and industry in ICT sector? Suggest action points for making IPR as a part of syllabus in graduation / post-graduation level in colleges. Please support your answer with justification and best practices in India and abroad in this regard.

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Q17. What essential steps can be taken to further improve the speed and efficiency of the patent approval process for ICT in India? Please support your answer with justification and best practices in India and abroad in this regard.

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Q18. Is there a need to reduce the cost of filing patents in India? If yes, how can it be done? Please support your answer with justification and best practices in India and abroad in this regard.

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Q19. As far as the ICT sector is concerned, suggest measures to enhance filling of patents in India in general and by resident Indians in particular. Do we need a mechanism for handholding in patent filing? Do we need a mechanism of IPR sharing for collaborative research projects? Please support your answer with justification and best practices in India and abroad in this regard.

COAI Response:

No Comments

Q20. (a) Is the Fair, Reasonable and Non-discriminatory (FRAND) mechanism for licensing of Standard Essential Patents (SEPs) functioning satisfactorily and effectively? Is there a need for any reforms in this aspect?

(b) How can small innovators be protected from the predatory practices?

Please support your answers with justification and best practices in India and abroad in this regard.

COAI Response:

1. We would like to stress that achieving TRAI's objectives of encouraging R&D requires a balanced approach on the enforcement of SEPs which creates a fair and efficient licensing ecosystem and incentivizes both sides to timely conclude SEP licenses on FRAND terms. To achieve this goal, policy makers should recognize that:

   a. It is important to unambiguously define what constitutes "fair" and "reasonable" to avoid disputes. Different interpretations of FRAND can result in legal battles and market uncertainty and risk for small innovators.

   b. There is a need for determining reasonable royalty rates for SEPs. Small innovators or new entrants might face difficulties negotiating fair rates with established patent holders.

   c. Injunctions and Hold-Up are not the solution: Patent holders, especially large companies, can employ injunctions and the threat of litigation to extract higher royalties, potentially stifling innovation and competition.

2. While no regulatory intervention is needed, it might be helpful if trusted public authorities, such as

TRAI or perhaps TSDSI as well,[1] were to provide more information, education and guidance about standardization, SEPs, and best practices for licensing aimed especially at the sectors of the economy which are increasingly keen to embrace and implement connectivity standards.

3. This could include greater efforts in educating industries, including SMEs, who may be new to SEP licensing about SEPs and relevant legal and practical considerations so they can build this into their business modelling in an informed way.

4. With respect to small innovators, we would like to emphasize that all the evidence shows that start-ups and small and medium sized entities (SMEs) are unlikely to be the target of either SEP licensing or litigation. However, this is a valid concern and should be addressed, Litigation is an expensive and risky enterprise therefore there is a need for independent mediation as well.

5. Some have expressed concern that start-ups and SMEs, perhaps in the IoT space, may not have the resources or the sophistication necessary to deal with SEP licensing matters. And indeed, start-ups and SMEs are unlikely to have internal teams of dedicated experts experienced in dealing with issues such as SEP licensing. The Government should try to provide legal aid for such entities and Patent Pools should be encouraged, which can provide collective bargaining power and reduce the risk of patent infringement lawsuits.

6. SME implementers should be aware that when including standardized technologies in their products or services they may need to take SEP licenses at some point in the future and build this into their business models to avoid surprises later. This is a matter of education and awareness around SEPs, particularly for SMEs and start-ups. Businesses are accustomed to dealing with imprecise information in many aspects of their business, particularly in the early stages, and the same is no different for SEPs and their licensing.

Q21. (a) What additional measures should be taken to strengthen IPR dispute resolution mechanism to ensure confidentiality of the innovation and time-bound disposal of IPR-related disputes?
(b) How can Alternate Dispute Resolution (ADR) mechanisms for IPR disputes be improved?
Please support your answers with justification and best practices in India and abroad in this regard.

COAI Response:

1. ARD mechanisms, such as mediation and arbitration, should be desirable to both patent holders and implementers in the FRAND licensing context.

2. Mediation can be useful, depending on the independence and skills of the mediator and the willingness of both parties to conclude the disputes.

3. Arbitration is very useful if it is binding, and the parties seek to reasonably limit the issues between

[1] Telecommunications Standards Development Society India.

themselves and the evidence to be exchanged - in order to limit the costs and length of the arbitration. However, arbitration requires both parties to agree to it, which means that it is unfortunately rarely used to settle FRAND disputes, as it is often difficult to agree to the terms under which it will be conducted. Also, as FRAND is functionally a commercial issue, it is important that the arbitrators and institutes appointed have experience in dealing with these types of disputes, as well as handling technical issues. As it is difficult in getting the other parties to agree to arbitrate, it would be a welcoming step towards the creation of a possible incentive to spur implementers to use the process.

4. TRAI, together with other governmental bodies and TSDSI, may consider working with WIPO and other ADR providers to attempt to publicize the availability of ADR mechanisms and increase their attractiveness.

Q22. Whether there is a need to introduce IP-backed financing system in India for ICT sector? If yes, what could be the framework to recognize IP as a collateral? Please support your answer with suitable examples or frameworks and best practices in India and abroad in this regard.

COAI Response:

No Comments

Q23. What measures should be taken to strengthen international collaborations in the field of STEM by the Government of India? Please support your answer with suitable examples or frameworks and best practices in India and abroad in this regard.

COAI Response:

1. Science, Technology, Engineering, and Mathematics (STEM) are the most critical ingredients for fostering innovation and R&D. Although Indian students are known to be leaders in STEM, we can certainly improve the institutional framework to strengthen STEM basis global experiences. We should target that a large number of our STEM institutions are of global standards and competitive on a global scale. For this, the Government needs to take lead and have partnership with other leading countries for STEM and have educational and research partnerships, while maintaining a sizable presence at global forums.

Q25. Is there a need to introduce avenues for continuing patents in India such as provisions like "*Continuation-in-part Application*" in the USA? Please support your answer with justification, strategies and best practices in India and abroad in this regard.

COAI Response:

1. The Indian legislature had the foresight to provide all tools necessary for an innovator to continue to innovate and protect his/her patent rights. This is apparent from the provision related to "Patent of Addition" under Section 54, which is akin to continuation-in-part applications under the US patent system. Thus, any innovator could file for protection of any improvements made on the parent

application.

2. Moreover, the Indian patent system also has provisions akin to continuation applications under the US patent system wherein the subject matter "disclosed" in the parent application could be covered under one or more further applications by dividing the parent application under Section 16.

3. Therefore, the Indian patents act already incorporates relevant provisions to provide for continuation of patents and hence no additional measures are required.

Q26. In view of the best practices being adopted by the global leaders in R&D in general and ICT in particular, which are the policies, programs and incentives which need to be adopted by India? Please support your answer with suitable examples or frameworks and best practices in India and abroad in this regard.

The global best practices that stand out and can be introduced in India are detailed in following paras.

1. Large spend on R&D, many countries spend is as high as over 5% of the GDP. Even neighboring countries like China have R&D spend over 2% of GDP.

2. Extensive spend on education with Sweden going as high as around 7.6% of the GDP.

3. Prevalence of Top-down approach with heavy investment and dedicated programs to fostering innovation and R&D. We can imbibe the toolbox approach of Israel with dedicated divisions for start-ups, growth, infrastructure, and international collaboration etc. and a customized and comprehensive incentive program.

4. Extensive support to start-ups, with investments, tax breaks, dedicated industrial areas. Leading example of South Korea with incentive programs for start-ups in the form of R&D support; Safe Harbor for SMEs and support for global expansion.

5. Programs for private participation like LINC (Leaders Industry-university Cooperation) program of South Korea, discussed in a previous section. Triple Helix Model of Sweden which brings together government, industry, and academia to work on innovative technologies.
6. Most leading countries provide massive tax reliefs and R&D expense deduction schemes to the companies involved in R&D activities. A few of the examples that can be implemented in India are as below:

    a. **Israel:** Under business asset rollover relief scheme, capital gains tax relief is provided to R&D intensive companies that transfer certain assets to another company to raise capital for R&D activity.

    b. **South Korea:** Hybrid Tax carry-forward for 10 years; Tax exemptions for companies in R&D Special Zone (Technology Zones); The expenses incurred for innovative growth-related

technology investments are covered under tax exemptions. 100% tax-free for investments by Angel investors

c. **United States:** Tax Carry-forward: In case of insufficient tax liability, unused tax credits can be carried forward for 20 years. Unused research credits may be carried back for 1 year and carried forward for 20 years. Eligible start-up companies that do not have a federal income tax liability because they may be eligible to use the credit to offset up to $250,000 of their federal payroll tax liability. The tax deduction is permitted for 100% of R&D expenses for federal and state tax purposes.

d. **Japan:** Tax credits of up to 10% are provided for general R&D expenses and credit for special open innovation R&D expenses.

e. **Germany:** 25% tax incentive for in-house R&D activities. The incentive is provided as a tax credit.

f. **Finland:** Entities that are conducting R&D activity with a research organization can make a 150% deduction on R&D subcontracting costs.

Q27. What should be the regulatory framework for R&D efforts in the ICT sector for establishing an outcome-based measurable system? Please suggest changes required in the present laws or creating new policies or regulatory frameworks with regard to carrying out R&D, testing of products allotment of spectrum and commercializing of products in ICT Sector.

COAI Response:

1. The most important outcome for any R&D effort in telecom is its successful inclusion in global standards. Inclusion in global standards is a prerequisite for it to be successfully implemented in commercial products which are relevant to global markets. In this direction, standards-driven research is the key principle to follow. Therefore, any R&D work should be benchmarked for its technical, commercial and implementation potential.

2. To achieve this, national research / R&D programmes should enable and encourage Public Private Partnership (PPP) Model that allows all stakeholders to join their strengths together in not only technology research to address challenges of the highest priority for India, but also to create an ecosystem for successful deployment to deliver the promise of technology to the society. It is to be noted that such a collaborative PPP consortium-based model has also been included as part of the recommendations in the Bharat 6G vision document released by honourable Prime Minister Mr Narendra Modi in March 2023.

3. A leading example of a successful PPP model is in Europe. The 5GPPP (5G Infrastructure Public Private Partnership Project) initiative, launched in 2013, between the European Commission and the European and ICT industry, including manufacturers, telecom operators, service providers, SMEs and research institutions, with an aim to accelerate research developments in 5G technology has been a

successful example of how a structured and inclusive approach enabled leadership in critical technology development and adoption.

4. Inclusivity and collaboration have been the bedrock of the PPP model, and these best practices should be considered in the regulatory and funding framework as we plan for India's leadership journey towards 6G.

Q28. In the context of India, whether top-down or bottom-up approach, or combination thereof should be preferred to facilitate indigenous R&D? Please support your answer with suitable examples or frameworks and best practices in India and abroad in this regard.

COAI Response:

1. The fact that the current mixed approach of bottoms up and top-down model for R&D, has not yielded satisfactory results indicates that we need to follow well defined process to foster R&D in the country. We agree with the Authority that there is a need for an enabling regulatory framework with streamlined and simplified regulatory processes, robust guidelines, high predictability, increased capacity, and strong governance is one of the building blocks of a strong innovation ecosystem for the ICT sector.

2. From the international experiences we can deduce that barring some exceptions, the Top-Down approach has been more successful. Therefore, we should follow a centralized approach governed by existing agencies.

Q29. Apart from the measures indicated under New Education Policy what additional measures should be taken to establish a framework at initial stages of education to encourage students for opting experiment-based learning (learning by doing), rather memory-based learning? Please provide your answer quoting the best practices being followed internationally.

COAI Response:

1. The focus should be rather holistic to ensure that knowledge-based economy prospers in the country. India with a large pool of young population and large number of students going for engineering studies, has sufficient resources to quickly turn into a knowledge-based economy. This will require focused education and training, facilitative regulatory framework supportive of innovation and entrepreneurship, easy access to finance and tax reliefs for Corporates to invest in R&D. Additionally, a well-developed IPR regime is a prerequisite for a knowledge-based economy as a strong patenting system is required for technological innovation and scientific research. We agree with the Authority that we should fast track setting up of effective intellectual property (IP) system to enable the thriving startup ecosystem in India to help transform India to a knowledge-based economy.

Q30. What interventions are necessary at policy or governance level to facilitate the growth of knowledge-based industries in India with respect to ICT sector?

1. The focus should be rather holistic to ensure that knowledge-based economy prospers in the country. India with a large pool of young population and large number of students going for engineering studies, has sufficient resources to quickly turn into a knowledge-based economy. This will require focused education and training, facilitative regulatory framework supportive of innovation and entrepreneurship, easy access to finance and tax reliefs for Corporates to invest in R&D. Additionally, a well-developed IPR regime is a prerequisite for a knowledge-based economy as a strong patenting system is required for technological innovation and scientific research. We agree with the Authority that we should fast track setting up of effective intellectual property (IP) system to enable the thriving startup ecosystem in India to help transform India to a knowledge-based economy.

Q31. How educational institutions can be linked with industries on long term basis for basic R&D, development and commercialization of innovative products on self-sustainable model? Is there any policy intervention also needed? Please support your answer with the best practices being followed in India, or internationally.

COAI Response:

No Comments

Q32. Start-ups are carrying out some outstanding work in all kinds of industries. What additional incentives can be given to start-ups to take up R&D activities in the ICT sector? In this regard, will establishing an exclusive venture capital (VC) fund for ICT help startups in the ICT sector to flourish and prosper in India? If yes, please provide a mechanism for the same.

COAI Response:

1. Special fiscal incentives for increased spending on R&D by Start-ups are required. We should follow the global examples of redesigning R&D tax incentives to make them more effective for budding entrepreneurs. The Authority has rightly proposed that in India the funding programs should be for the entire innovation lifecycle (Ideation, POC, Prototype, Commercialization). This will help overcome the final barrier of commercializing the inventions.

Q33. Suggest ways and means to improve the acceptance of Indian technological innovations globally? Do you envisage the need for a Technology Transfer Organization at the national level to help towards commercialization of innovations in ICT? Please support your answer with justification, frameworks and best practices in India and abroad in this regard.

COAI Response:

1. There are no short cuts for global acceptability of technological innovations at global scale. The idea is to make all innovations as much as relevant as possible and the global acceptability will come if the

innovations are relevant and save costs or provide new solutions. Further, we do not think that global acceptance should be the guiding benchmark. The size of Indian economy and the disparity in incomes, digital inclusion, availability of education, healthcare etc. indicate that any innovation that can solve Indian problems would have huge economic potential at this national level only and can be modified and scaled up later for global acceptance.

Q34. ICT sector is enabler for fin-tech, health-tech, ed-tech and a host of other applications. In such a scenario, what should be the specific focus areas for R&D in ICT sector? Please support your answer with suitable examples or frameworks and best practices in India and abroad in this regard.

COAI Response:

1. Industry 4.0, IOT, AIML and Big Data, ICT sector has its footprints all over the economic spectrum and we need innovations and R&D in all sectors for holistic and inclusive growth. Therefore, there is no need to mandate focus areas for research and instead a comprehensive and facilitative framework should be provided for innovations and R&D at holistic levels.

Q35. Is there a need for additional tax or fiscal incentives to support R&D activities in emerging technologies in ICT sector? If yes, please give suggestions with justifications and best practices in India and abroad in this regard.

No Further Comments

Q36. What should be the best practices followed in India to make it a favorable destination for IPR and Patent award nation? Please support your answer with justification, frameworks and best practices in India and abroad in this regard.

COAI Response:

Already addressed in previous sections.

Q37. What measures should be taken for quick disposal of IPR or Patent related disputes? Is there a need to create a specialized legal platform for the same? If so, what steps may be taken to adopt them? Please provide your answers for above questions, quoting the best practices being followed globally.

COAI Response:

1. The Indian statutes governing patents, contracts, etc. are robust, and Indian judiciary is competent and able to apply the law, as written, to licensing related disputes. Licensing negotiations that lead to FRAND outcomes work quite well, as evidenced by thousands of FRAND license agreements signed between IP-rights holders and implementors since the early days of 2G standards.

2. While India has taken some cues, from some of the most robust patent systems to strengthen its IP

system, there still are several challenges which need to be tackled. The effectiveness of any patent system depends majorly on the speed of disposal of cases. Today, any patent application being pursued through the normal route of patent prosecution may take approx three years to reach the final disposal stage. To be considered a favorable destination for IPR filings, India needs to considerably reduce the disposal time. This shall require more examiners/controllers who are adept in legal intricacies, besides being adept in the technical field, to evaluate the patent applications efficiently and effectively. The patent examiners/controllers need to continually update themselves with the global developments in the IP field as well as practical aspects of IP and thus, there needs to be an emphasis on legal training of the examiners/controllers by engaging patent practitioners besides academicians as the examiners/controllers need to be trained on practical aspects of IP besides the academic aspects.

Q38. Please comment on any other related issue to promote R&D in the ICT sector in India. Please support your answer with suitable examples and best practices in India and abroad in this regard.

COAI Response:

1. The benefits of open standards and licensing on fair, reasonable and non-discriminatory (FRAND) terms and conditions are widely acknowledged. Open standards development supports market entry, encourages innovation, and benefits society generally by increasing consumer choice. The global framework for the FRAND licensing of SEPs enables broad access to standardized wireless technology to users across numerous sectors and for all actors in the relevant value chains.

2. Indeed, open standards and SEP licensing have fostered a thriving ecosystem, that enables new manufacturers to enter markets without having to invest in the high-risk technological research by themselves. For example, in the smartphone sector, historically there were few handset makers, and most consumers had devices from Nokia, Ericsson and Blackberry. However, in the 2000s, Apple and Samsung entered the global market, as did many others such as Huawei, LG, Lenovo and Xiaomi. India also has many important smartphone manufacturers such as Lava, Karbon Mobiles and Micromax.

3. It is unsurprising therefore that the benefits of open standards and FRAND licensing have been recognized by authorities across the globe. For example, the European Commission's recently revised Horizontal Guidelines provide that:

   Standardization agreements generally produce significant positive economic effects, for example by promoting economic interpenetration on the internal market and encouraging the development of new and improved products or markets and improved supply conditions. Standards thus generally increase competition and lower output and sales costs, benefiting economies as a whole. Standards may maintain and enhance product quality, safety, provide information and ensure interoperability and compatibility (thus increasing value for consumers).

   Standardization agreements frequently give rise to significant efficiency gains. For example,

Union-wide standards may facilitate market integration and allow undertakings to market their goods and services in all Member States, leading to increased consumer choice and decreasing prices. Standards which establish technical interoperability and compatibility often encourage competition on the merits between the technologies of different undertakings and help prevent lock-in to a particular supplier. Furthermore, standards may reduce transaction costs for sellers and buyers. Standards relating to, for instance, the quality, safety and environmental aspects of a product may also facilitate consumer choice and may lead to increased product quality. Standards also play an important role for innovation: they can reduce the time it takes to bring a new technology to the market and facilitate innovation, by allowing undertakings to build on top of agreed solutions.

4. Likewise, the Press Release announcing the withdrawal of the Department of Justice, U.S. Patent and Trademark Office and National Institute of Standards and Technology 2019 Standards-Essential Patents policy statement, stated that the three agencies had concluded that the withdrawal "best serves the interests of innovation and competition" and acknowledged that:

   Standards-developing organizations (SDOs) and the widespread and efficient licensing of SEPs on reasonable and non-discriminatory (RAND) or fair, reasonable and non-discriminatory (FRAND) terms (collectively F/RAND) help to promote technological innovation, further consumer choice, and enable industry competitiveness, including in emerging technologies and by new and small- to medium-sized market entrants.

5. The smooth functioning of a dynamic licensing market is critical to retaining incentives to participate in standards development and to contribute advanced, innovative technologies to standards. It creates a competitive element in standardization, ensuring the best technologies are contributed to and incorporated into global standards, from a wide variety of market participants. Well-functioning licensing markets also ensure a balance between the contributors of innovative technologies to standards as well as the users of them. Those who invest in intensive R&D and into developing standards can obtain royalties from the users of the standards, which they can then reinvest into developing future standards – thereby creating a virtuous circle of R&D, patenting, licensing and re-investment into R&D for new standardized technologies, e.g. 6G, while also enabling manufacturers to continue to introduce the best products for consumers. A fair and balanced framework for the licensing of SEPs is, therefore, critical for India's current objectives and long-term strategy to encourage IP-led technological innovation.

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