

Executive Summary

Context and Background

- Technology Business Incubators (TBIs) form one of the indispensable components of an entrepreneurial ecosystem for technology based start-ups in modern economies. The objective of TBIs is promoting technology transfer and diffusion of products, thereby developing local innovative firms. TBIs play a unique role, particularly with respect to promotion of innovation, technology commercialization and facilitating the emergence of technology based start-ups. Given this, their performance and contribution to national R&D efforts in the form of creating R&D personnel, R&D infrastructure and R&D outputs including patent grants and new products/services - at the TBI level as well as at the start-up level – can indicate the degree and direction of the contributions made by these TBIs to the national economy.
- This study is a preliminary and exploratory assessment of R&D contributions of TBIs in the Indian context comprising accelerators, incubators and co-working spaces located in three of the leading start-up hubs in India, namely, Bangalore, Chennai, and Hyderabad. All the TBIs in the public sector, and all the incubators, accelerators and co-working spaces in the private sector in all the three cities fell within the scope of the study. In addition, graduated as well as incubating start-ups from these TBIs were covered to ascertain the incubation process as well as incubation outcomes of these incubators.
- The primary data collection exercise comprised three stages. As part of stage I, an exhaustive database of TBIs operating in Bangalore, Chennai and Hyderabad was developed in April 2017. The database comprised 239 entities. To ensure quality of data, TBIs who were at least two years of age were considered for data collection. Post the application of the age criteria, the database of TBIs comprised 189 entities. The final and in-depth data collection exercise with the help of the semi-structured schedules was carried out from July 2017 till the end of December 2017. The project team could obtain complete responses from 65 of the TBIs. Further, the team was able to collect primary data from a total of 107 start-ups (65 incubating and 42 incubated). Thirty-one TBIs from a total of 48 incubators across the three locations (constituting to about 65% of the Incubators under the scope of our study) provided complete data for the Questionnaire. Nine accelerators from a total of 21 accelerators across the three locations (41% of the Accelerators that met the criteria for our study) provided inputs to our Questionnaire. Further, the project team was able to collect complete data from 25 co-working spaces out of a total of 44 co-working spaces, across the three locations (constituting about 57% of the total addressable population of the Co-working spaces).
- As regards to the primary data collected from start-ups, a total of 58 start-ups have provided complete data in Bangalore, across the three entities (incubators, accelerators and co-working spaces), with 31 among them being under incubation, and 27 that are alumni (graduates) from the entities that they earlier incubated from. From Chennai, primary data were collected from a total of 20 start-ups, of which 15 were under incubation and five start-ups had graduated from the entities that they were earlier incubated from. In Hyderabad, a total of 29 start-ups provided complete data for the study, of which 19 start-ups were under incubation and the remainder 10 were start-ups that had graduated.

Salient Findings

- The results of data analysis revealed that institute promoted TBIs were found out to be younger with more STEM qualified CEOs, and focused on early stage start-ups. Further analysis revealed that the objectives of early stage TBIs are non-revenue oriented and thus differed from stage agnostic TBIs, which are primarily revenue generation oriented, the former had CEOs with less work experience and are tech sector focused. Finally, tech sector focused TBIs are found to have better infrastructure but engaged in less promotional activities, and their CEOs had more work experience.

- The results for R&D input contribution evaluation indicated that the TBIs with CEOs having no previous experience but have external networks and provide need based mentoring for a larger number of incubatees, accounted for larger R&D investments. But only infrastructure and number of administrative personnel mattered for the employment of R&D personnel. From the collected data, it was revealed that overall, 20% of the TBIs, mostly located in Bangalore, incurred R&D expenditure for infrastructure up to Rs.10 lakh, another 35% of them, again majority located in Bangalore, incurred expenditure for infrastructure in the range of Rs.10 lakh to Rs.100 lakh, whereas the remaining 45% of them, spread more or less equally between the three hubs, incurred expenditure more than Rs.100 lakh up to Rs.2500 lakh. Among the ABCs, incubators accounted for a majority (nearly 80% of the TBIs) in the highest slab of >Rs.100 lakh to Rs.2500 lakh expenditure incurred for R&D infrastructure. The aggregate cumulative R&D expenditure incurred by the TBIs as of 2016/17 amounted to almost Rs.2050 million, the average expenditure being about Rs.31.5 million since inception.
- The 44 TBIs which employed at least one R&D personnel, together employed 150 persons, majority (almost 81%) of which are employed in the incubators, the highest being in Hyderabad, followed by Bangalore and then Chennai. Of all, co-working spaces accounted for the least share (about 5%) of the R&D personnel, in all the three hubs. Almost 50% of these 44 TBIs, largely comprising incubators followed by accelerators, employed at least one but not more than three personnel. About 12% of them, mostly incubators, employed in the range of four to six personnel and about 6% (all of them incubators) employed in the range of seven to 14 personnel. This further confirms that among the ABCs, incubators account for a larger share of TBIs having exclusive R&D personnel.
- The results of R&D output contribution of the TBIs showed that higher number of new products/services emerged from older TBIs, which have exclusive external networks and have a larger number of incubatees. But corporate sponsorship, infrastructure and higher successful exits influenced patent application submissions. Further, corporate sponsorship and successful exits mattered for total revenue generation as well.
- Overall, the 65 TBIs have produced 8110 new products/services from their inception up to 2016/17, with an average of 125 new products/services per TBI. Of these, more than half (about 52%) of the new products/services were produced by the mid-range TBIs (which produced new products in the range of 51-500), followed by the upper range (where just two TBIs accounted for 3050 (about 37%) of the new products/services), followed by the lower range of TBIs (about 11%). Between the ABCs, incubators accounted for a majority (59%) share of the new products/services generated, followed by co-working spaces (about 34%), and accelerators (about 7%). Among the three hubs, Hyderabad accounted for the highest share of 47%, followed by Bangalore (>45%) and then Chennai (<8%).
- While all of the TBIs have claimed to have produced new products/services through their start-ups, 25 (about 38%) of the TBIs (majority located in Bangalore) did not have any patent application submissions. Overall, the 65 TBIs claimed to have made 481 patent submissions. Of the total, about 46% submitted applications emerged from Bangalore, about 38% from Hyderabad followed by Chennai (remaining 16%). Among the ABCs, incubators of the three start-up hubs accounted for more than 71% of the total patent application submissions, followed by accelerators (about 25%), and co-working spaces (hardly 4%).
- The TBIs together generated a cumulative sales revenue of Rs.187985 lakh from the sales of new products/services through their incubated start-ups. Between the ABCs, accelerators accounted for the highest share of 59% of the total revenue, followed by incubators (37%) and co-working spaces (4%). Among the three hubs, Bangalore accounted for the highest share of 68% of the total revenue, followed by Hyderabad (29%) and Chennai (3%). Barring the four entities that together constitute 68.5% of the revenues generated and therefore can be considered as outliers (Microsoft and SAP Accelerators in Bangalore, IKP Knowledge Park and ALEAP in Hyderabad), the total revenues generated from the remaining 61 entities is Rs. 59,485 lakh, which indicates that on an average, each TBI has been able to make an average revenue contribution of about Rs.975 lakh since inception.

- A gender based assessment of TBIs in our sample revealed that overall 13 out of 65 (20%) of the TBIs across the three cities had female CEOs. In Bangalore, 3 out of 11 incubators, 1 out of 7 accelerators and none among the co-working spaces had women leaders managing the TBIs. In Chennai, 3 out of 8 incubators had women leaders. In Hyderabad, 4 out of 10 incubators, 1 out of 2 accelerators and 1 out of 7 co-working spaces had women leadership.
- In terms of R&D contributions, the TBIs with women leadership contributed to about 13290 lakh INR of R&D expenditure in equipment (65% of total R&D expenditure) and was responsible for generation of 138 patents (29% of the total patent applications submitted), 3295 new products & services (41% of the total new products and services), and contributed to 43,705 lakh INR (23% of the total sales) in sales revenue from new products/services.
- The Private / Corporate sector has been the dominant player when it comes to R&D investments and R&D outputs in the TBIs. The private sector accounted for R&D expenditure of INR 17991 lakh (88% of the total R&D investment). In terms of R&D outputs, the corporate and private sector claimed to create 6214 new products and services at their TBIs (77% of the total new P&S), 243 patent applications (51% of the total) and sales revenue of INR 161570 lakh (85% of total revenue).
- Finally, when the R&D inputs along with new products/services and patent applications were analyzed statistically to examine their influence on total revenue, it was found that only new products/services and patent applications together influenced total revenue generation of the TBIs. Overall, it may be appropriate to conclude that there is scope and potential for an increasing R&D contribution to emerge from the TBIs through their incubated start-ups, in the future.
- Based on the analysis of the 65 TBIs across the three cities, an extrapolation at the national level assuming presence of 500 TBIs (190+ incubators and accelerators, 300 co-working spaces), and assuming that the same trends hold true across the country indicates that the total R&D expenditure from TBIs at national level can be about Rs. 1600 crores since inception, providing employment to about 1000 R&D personnel. Further, the revenue contribution from all the TBIs in the country can be estimated to be about Rs. 4875 crores since inception, an aggregate of 62,500 new products/services across all TBIs since inception and about 3500 to 6000 patents submitted by the TBIs at an aggregated level since inception.
- Primary data from one each incubating start-up located in each of the 65 TBIs, and one each graduated/exited start-up from the 42 TBIs which have experienced graduation and successful exit of start-ups since their establishment was analyzed. The results showed that both start-up specific characteristics such as educational qualification of CEO, age of the start-up and TBI specific characteristics such as TBI infrastructure and its external networks access positively influenced the R&D contributions of both incubating and incubated start-ups in the three hubs of India.
- In summary, it can be opined that R&D investment expenditure is common among the TBIs but not exclusive R&D personnel. Similarly, they do generate new products/services thereby enabling generation of revenue, but do not go for patent application submissions. The graduation of start-ups is an important determinant of revenue generation of TBIs. The strength of TBIs as well as resourcefulness of start-ups importantly determine the R&D contributions of start-ups. Overall, the R&D contributions that emerge from the TBIs as well as from the incubated start-ups are still at a moderate level.
- This research work has made three important research contributions to literature. Firstly, it has unraveled the structure and composition of TBIs along with their key characteristics in the context of Bangalore, Chennai and Hyderabad. Particularly, it has differentiated the TBIs in terms of sponsorship, stage focus and sector focus, and thereby provided an understanding of the typology of TBIs with respect to three leading start-up hubs of India.
- Secondly, it has examined the role and performance of TBIs in terms of applications received, admission made, occupancy of incubatees, and graduation of start-ups and thereby revealed the pre-incubation, incubation and post-incubation phases of start-up formation in the context of three start-up

hubs. As a result, it has thrown light on the extent of physical infrastructure and human expertise employed, apart from the prevalence of external networks, in these TBIs and its adequacy/inadequacy.

- Thirdly, it has analyzed the determinants of R&D contributions in terms of inputs (of capital and employment) as well as outputs (in terms of new products/services, patent applications and revenue generated) at the TBI level as well as at the incubating/incubated start-up level.
- The study has thus clearly revealed/answered that the TBIs and tech start-ups contribute to the national R&D efforts emphasizing the need to institutionalize measuring of the national efforts through systematic mechanism for an improved understanding of their structure and orientation in terms of R&D and innovation leading to suitable policy action.