



Telecom Regulatory Authority of India



Recommendations
on
Review of Television Audience Measurement and
Rating System in India

New Delhi, India

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Contents

Chapter	Topic	Page No.
Chapter 1	Introduction	1
Chapter 2	Issues in Television Audience Measurement and Ratings	5
Chapter 3	Summary of Recommendations	35

Tables

Table 1	Comparison of Watermarking and Audio Matching	21
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Annexures

Annexure I	International Experience	40
Annexure II	Report on the Hackathon to Find Out the Possible Solutions for Television Audience Measurement and Ratings in India, Conducted by TRAI at Bangalore	45
List of Acronyms		65

CHAPTER 1

INTRODUCTION

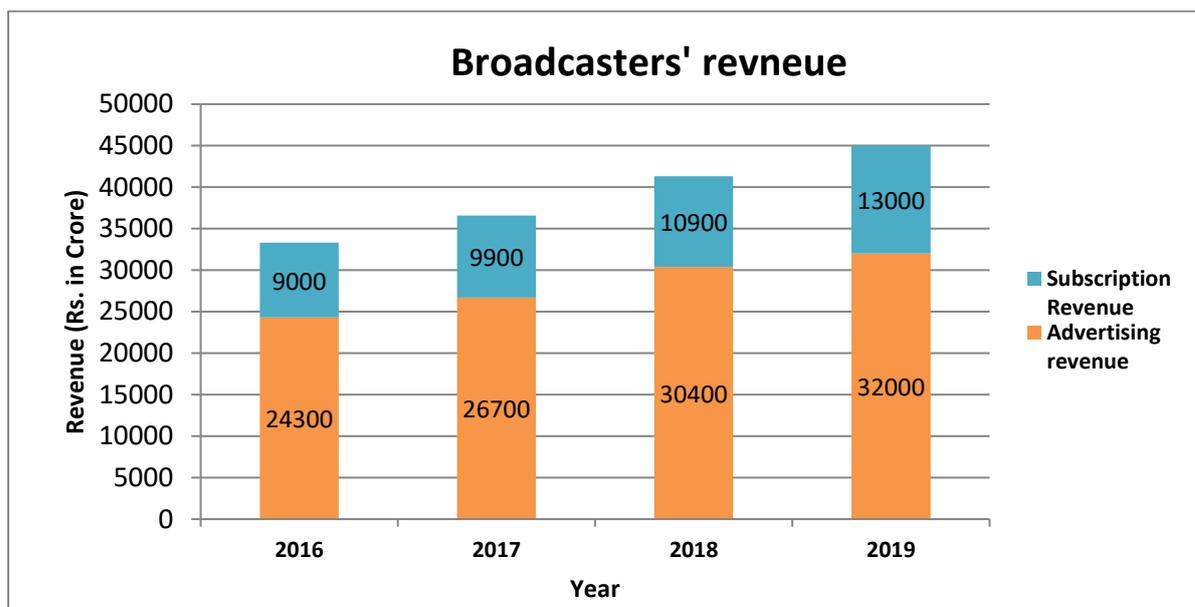
- 1.1 Audience measurement is a means of quantitatively assessing what is being viewed. Audience measurement is essential as a significant source of funds for broadcasting is advertising and program sponsorship. The popularity of a medium, a channel, or a program, as assessed by Audience measurement agencies, guides the advertisers and the advertising agencies in selecting the appropriate medium, the channel, and the time to reach a target audience. For sectors depending on advertisement revenue for survival and growth, Audience measurement is a critical activity. Broadcasting is one such sector, which is largely dependent on advertisement revenues. Audience measurement provides feedback to broadcasters on how their content is rated by the viewers, and helps them in resource allocation. Thus, a major impetus for audience measurement is advertising. It directly impacts the channel-wise direction of advertising expenditures. Such flows are guided by Audience measurement and the cost of reaching various audience segments, advertisement placements, and program schedules.
- 1.2 In India, ORG-MARG's INTAM (Indian National Television Audience Measurement) was established in 1994. INTAM's sample size was miniscule and restricted to major cities. While INTAM was in operation, a second rating agency TAM was formed in 1998. In 2001, INTAM and TAM were formally merged. In 2004 another rating agency, Audience Measurement and Analytics Ltd. (aMap), started operations in India. Its commercial operations, however, started in February 2007. Although, the operations of both these agencies was limited to a few large cities with population above one lakh; neither of the two agencies covered Jammu & Kashmir. Within big cities too, their panel size of households for Audience measurement was limited to about 7000 (TAM) and 6000 (aMAP) metered homes.

- 1.3 In 2008, Television rating services on a commercial basis were provided by TAM Media Research and Audience Measurement and Analytics Ltd. (aMap). Concerns were raised regarding the credibility of the rating system in India. MIB in 2008, sought TRAI's recommendations on various issues relating to the Television Audience Measurement (TAM)/ Television Rating Points (TRP) and the policy guidelines to be adopted for Rating Agencies.
- 1.4 Telecom Regulatory Authority of India (TRAI) gave its recommendations to Ministry of Information and Broadcasting (MIB) on 19th August 2008 covering various aspects including the need for the Government to regulate the system of television ratings. TRAI also recommended the approach of self-regulation through setting up an industry-led body, the Broadcast Audience Research Council (BARC).
- 1.5 TAM Media Research became the sole provider of Television Rating services on a commercial basis, as aMAP discontinued its services. Subsequently, MIB in 2012 sought recommendations of TRAI for laying down comprehensive guidelines/accreditation mechanism for Television Rating agencies in India to ensure transparency and accountability in the rating system.
- 1.6 TRAI gave its recommendations on "Guidelines/Accreditation Mechanism for Television Rating Agencies in India" to MIB on 13th September 2013. The Authority supported self-regulation of Television ratings through an industry-led body like BARC. TRAI recommended comprehensive guidelines for registration of Television Rating agencies. MIB accepted TRAI's recommendations, and notified Policy Guidelines for Television Rating Agencies in India on 10th January 2014. Under these guidelines, the industry-led body, BARC was accredited by MIB on 28th July 2015, to carry out the Television Ratings in India. TAM Media Research did not register itself with MIB and discontinued its operations.

1.7 BARC is an industry-led body represented by the Indian Broadcasting Foundation (IBF), the Indian Society of Advertisers (ISA) and the Advertising Agencies Association of India (AAAI). BARC India commenced its operations in 2015 and since then it is the sole provider of Television Rating services on a commercial basis.

1.8 In 2019, India's Television industry grew from INR 74,000 crore to INR 78,700 crore with 60% revenue generated through distribution and 40% from advertisement. As per the industry estimates broadcasters' revenue increased from INR 41,300 crore to INR 45,000 crore in 2019, of which the advertising revenue is approx. 70% and subscription revenue is approx. 30%.

Figure 1: Broadcasters' Revenue



Source: FICCI EY India's Media & Entertainment sector Reports- 2018, 2019, 2020

1.9 Out of the overall broadcasters' revenue of Rs. 45,000 crore in 2019, Rs.32,000 crore was collected from advertising revenues. This underlines the dependence of the industry on the flow of advertisement revenues, which, in turn, largely hinges upon the profile of their audience, and the popularity of their content, which is assessed through Television Audience Measures and Rating. This is why it is imperative that the process of TAM and TRP should be objective, fair,

neutral, and transparent. For the same reason, the process of TAM and TRP engages continued attention from the Sector Regulators, leading to periodical reviews and reforms. In India, TRAI has been suggesting measures to refine the system from time to time.

- 1.10 Television audience measurement is a technology-backed process; is ever evolving with the advancement in technologies deployed. Similar characteristics of bringing technology-induced changes in the creation, storage, transmission, and delivery of content over the medium, is shared by the broadcasting services. These rapid changes gave rise to new issues along with new avenues to explore and update, to improve the credibility of the TAM system. Certain concerns relating to the structure, neutrality, and reliability of the existing rating system have been raised by the stakeholders, which necessitated the review of the existing Television Audience Measurement and Ratings' system in India. Issues of panel expansion and panel tampering are also raised, which require immediate attention because of the harm it can cause to the integrity of the TAM and Television channel ratings.
- 1.11 In the above context, TRAI *suo-motu* issued a consultation paper on 3rd December 2018 seeking stakeholders' written comments and counter-comments on the issues raised in the consultation paper. All the comments and counter-comments are available on TRAI's website. Open House Discussion on the subject was held on 31st May 2019 at New Delhi and on 3rd July 2019 at Mumbai.
- 1.12 Based on the inputs received from stakeholders and internal analysis, the Authority has arrived at these recommendations on the key issues. Chapter 2 deals with various issues related to Television Audience Measurement and Ratings. Summary of all the recommendations is available in Chapter 3.

CHAPTER 2

ISSUES IN TELEVISION AUDIENCE MEASUREMENT AND RATINGS

2.1 At present, BARC India is the sole provider of Television rating services on a commercial basis. BARC, an industry-led body, is represented by the Indian Broadcasting Foundation (IBF), the Indian Society of Advertisers (ISA) and the Advertising Agencies Association of India (AAAI). BARC India commenced its operations in 2015 BARC is born out of the general consensus that an industry- led body would be, by far, the ideal option to meet the expectations of all stakeholders, and will provide TAM and TRPs in a fair, and impartial manner. However, some stakeholders continue to express their concerns of the present system on certain important aspects of BARC such as Structure, Governance, Operations, Transparency, Accountability, etc. These issues have been discussed in the consultation paper seeking the views of the stakeholders. The following paragraphs contain the stakeholders' views, detailed analysis and the findings of the Authority on each of the issues.

Governance, Equity and Structure

2.2 BARC India is promoted by the Indian Broadcasting Foundation (IBF), the Indian Society of Advertisers (ISA) and the Advertising Agencies Association of India (AAAI), based on a 60:20:20 formula (IBF 60%, ISA 20%, AAAI 20%). It was expected that a proper self-regulatory model having adequate representation from all concerned stakeholders would help in ensuring that no individual section of the industry has a majority control; thereby, influence on decisions, as the decisions would be made collectively. Despite being an industry-led body, some concerns have been raised by some stakeholders regarding the neutrality and credibility of the rating services provided by BARC India.

2.3 Therefore, in the consultation paper stakeholders were asked to provide comments whether BARC has been able to accomplish the purpose with transparency and without any bias for which it has been established and whether the present shareholding/ownership pattern of BARC ensures adequate representation of all stakeholders to maintain its neutrality and transparent Television ratings. Stakeholders were also asked to suggest measures to enhance the effectiveness of BARC to give Television ratings with transparency and without any bias.

2.4 In response, comments, in affirmative and negative, were received from stakeholders. Stakeholders who were satisfied with the rating service mechanism by BARC commented that:

- BARC India has successfully set up a transparent, accurate, representative and inclusive Television audience measurement system, which has been built upon a robust and future-ready technology backbone, and best-in-class systems and processes.
- BARC, being an industry-owned body, having no cross-holding and conflict of interests has been able to furnish better data sets.
- The strength of BARC is in its technology of unique coding in each audio file.

2.5 On the other hand, stakeholders not satisfied with BARC's rating service contended that:

- BARC is not transparent in sharing the methodology and the representation of the panel home amongst the various platform types.
- The objectivity and neutrality are compromised with IBF holding a majority in BARC.
- No transparency over the original collected data, and the difference between the original and the final data released to the market.

- Low sample to universe ratio in many markets have led to erratic viewership behavior leading to misinterpretation of viewing behavior.
- Even after investing heavily on technology, BARC data is still delayed by a week and is not presented daily.

2.6 Some stakeholders also submitted that the sampling criteria that function on demographics do not factor the distribution landscape, which again leads to monumental aberrations in representation. The major bias of the sample towards Urban due to advertising implications has led to improper reporting of viewership by BARC. According to a few stakeholders, Television measurement system is being controlled by certain Television broadcasters, advertising agencies, pay-TV channel aggregators and large FMCG companies – all having a direct stake in the outcomes, and hence has a strong motive to manipulate the ratings to their advantage.

2.7 Regarding the shareholding pattern of BARC India, few stakeholders were not satisfied with the current structure. According to them, IBF controls day-to-day functioning and course of action of BARC India, and ISA and AAAI members are not involved with overall measurement system of TRP currency. The current system is closed and controlled by those who have a direct stake in the outcomes and have a potential of conflict of interest.

2.8 On the contrary, many of the comments (mostly from Broadcasters) were in favor of the existing shareholding pattern of BARC India. According to them, the broadcasters are responsible for the creation and nurturing of the Television viewing market with significant sustained efforts, and are also directly impacted by the Television ratings. They further suggested that it is important that IBF has a shareholding in BARC India, commensurate with its importance for the market and any change in shareholding pattern may have a significant

impact on the shareholder's ability to infuse proportionate funds into BARC.

2.9 Some stakeholders gave the following suggestions for enhancing the credibility and neutrality of Television rating services:

- It should have equal shareholding between all three stakeholders.
- Consultation with ISA and AAI may help ensure equal contribution in the functioning of BARC by all the three industry bodies, irrespective of the share of revenue contributed.
- Television audience measurement should be done by a neutral entity that has no relationship, direct or indirect, with television broadcasters, advertising agencies, and advertisers; otherwise, there will always be a strong motive to manipulate the ratings to their own advantages.
- A significant representation from the DPOs' footprints is required to keep the checks and balances in place to promote new technologies.

2.10 The Authority noted that BARC India is a not-for-profit company under Section 25 (now Section 8) of the Companies Act, with the prime objective of providing ratings to Television channels based on transparent, independent, and accurate measurement methodology. It seems that exemption provided to BARC under clauses 1.5, 1.6 and 1.7 of MIB's policy guidelines for rating agencies did not work the way it was expected. As IBF nominated representative of 6 major broadcasters as the non-executive directors controlling effectively all policies/rules of the BARC. BARC is not just involved in framing methodology, validation rules and audit mechanism of measurement, but also involved in the collection of data, processing of the data and publishing the rating. Hence, there is a need for structural reforms to mitigate the

potential risk of conflict of interest, improve credibility and bring transparency and reliability in the whole TRP measurement system.

- 2.11 The Authority further noted that IBF, AAI and ISA are declared as 60:20:20 shareholders of BARC in order to portray it as an industry body, but, in fact, 100% shares are held by IBF. Further, IBF holds 100% shareholding with a share capital of Rs. 15 lakhs. This implies that IBF has full control over BARC from making policies/Rules to collection of data, etc. This can naturally raise the question of credibility and neutrality of the measurement system.
- 2.12 As mentioned above, of the ten members on BARC's Board – six are broadcasters/large players. It seems that it is skewed in favor of broadcasters/large players. Though all directors on the Board are non-executive directors, but they are not independent as all of them have a potential conflict of interest in the rating system.
- 2.13 Ideally, an industry-led body such as BARC India should be involved in framing methodology for rating, audit mechanism and publishing the data, with completely independent agency(s) to perform the functions of measurement. However, as mentioned above, BARC is involved in end-to-end functions of the rating system and hence there is a need to change the composition of the Board, to ensure an independent functioning of BARC. BARC Board should have at least fifty percent independent members, which should include one member as a measurement technology expert, one statistician of national repute from among the top institution(s) of the country and two representatives from the Government/Regulator.
- 2.14 The technical committees of BARC India also has similar issues of disproportionate representation. There is hardly any representation for small broadcasters/regional channels. BARC is entrusted with an important commercial activity involving significant public interest.

Governing bodies of such entities usually have representation of external experts from the fields of economics, law, consumer protection, Government Agencies, etc. This kind of Board composition helps an organization in two ways. It is benefited from the expertise and experience such representatives bring in. Secondly, it enhances the overall credibility of the organization, reinforces the faith of the stakeholders in its decision-making process, and to a large extent addresses the concerns of the stakeholders regarding the lack of transparency, fairness, etc.

- 2.15 The Authority noted that Clause 1.5 of MIB's Policy guidelines for Television Rating Agencies in India states that "any member of the Board of Directors of the television rating company shall not be in the business of broadcasting/advertising/advertising agency." However, being an industry body, BARC is presently exempted from this clause.
- 2.16 In order to bring in more transparency and neutrality in the Television audience ratings' system in the country, it is important to minimize the scope of any potential conflict of interest. The French and the Israeli Agencies are notable of this approach. In the French model, conflict of interest is minimized by ensuring equal representation of various stakeholder groups without any one of them having a majority stake. The audience ratings research agency of Israel (IARB) is a joint body comprising of the regulatory body, the state broadcaster and the private broadcasters. The inclusion of the Government/regulator enables unbiased decision making and also takes care of the interests of the State broadcaster. In short, measures like having a more inclusive decision-making body, which denies a position of majority/undue influence to any stakeholder group, enjoys a representation of Government/regulatory bodies, etc. help in making the audience ratings measurement bodies more neutral, transparent and credible. The international experience on this issue is appended as **Annexure I**.

2.17 Apart from suggesting a more inclusive Board for the BARC, the Authority is also of the view that a broad-based Oversight Committee with experts from related fields should include representations from National Council of Applied Economic Research, IIT, IIM, media research expert and demography expert, nominee from the Ministry of Information & Broadcasting and TRAI.

2.18 **Accordingly, the Authority recommends that:**

- i. Structural reforms are required in the Governance structure of BARC to mitigate the potential risk of conflict of interest, improve credibility and bring transparency and instill confidence of all the stakeholders in the TRP measurement system.**
- ii. Composition of the Board of BARC India should be changed as part of the proposed structural reforms. The Board should have at least fifty percent independent members, which should include one member as a measurement technology expert, one statistician of national repute from among the top institution(s) of the country and two representatives from the Government/Regulator.**
- iii. Restructured Board of BARC India should provide for equal representation of the three constituent Industry Associations, namely; AAI, ISA and IBF and with equal voting rights irrespective of their proportion of equity holding. Tenure of the members of the Board shall be for two years.**
- iv. Active participation of representatives of the Advertisers and the advertising agency will bring more accuracy, transparency, credibility, and neutrality in the system, due to their inherent need of advertisers to reach viewers accurately.**

- v. The constituent Industry Associations shall be entitled to nominate their representatives to the board membership subject to the condition that a cooling period of 4 years shall be applicable between two consecutive tenures, for any such nominee member.**
- vi. Tenure of the Chairman of the Board should not be more than two years. Chairmanship of the Board shall be rotated among the constituent industry associations in every two years.**
- vii. Number of members in the technical committee should be increased to 5 with addition of two external technical experts.**
- viii. An Oversight Committee should be formed to guide BARC India in the areas of research, design and analysis, constantly improving the rating system. The Oversight Committee shall be broad based with representation from the National Council of Applied Economic Research, IIM, IIT, media research expert and demography expert, nominee from the Ministry of Information & Broadcasting, and TRAI. The Committee should also be responsible for nomination/appointment of independent members of the Board as well as to give policy direction to BARC India, if it is so required.**

Competition and Multiplicity

2.19 Currently, BARC is the only Agency providing the rating services in India. The monopolistic situation invariably raises concerns on account of the market behavior, quality of service, and cost inefficiencies. Entry of more players and the resultant increased competition might contain the ill effects of market dominance, and lead to a better quality of service and reduced costs. At the same time, setting up of credible and transparent rating services require substantial capital investments, which is to be ultimately borne by the

stakeholders. Therefore, the question regarding the need for multiple rating agencies or otherwise was included in the consultation paper.

2.20 The main issue posed to the stakeholders was whether there is a need to have competition in the Television rating services. In case competition is required, what initiatives are required to encourage effective competition in Television rating services through introduction of more players. Comments were received both for and against the idea of multiple players in TAM.

2.21 Stakeholders against the idea of multiple players in Television rating service submitted that:

- Data of different agencies will be based on the sample of different sample households, the output from different agencies can differ, which may lead to the possibility of conflict of data.
- If more Television rating agencies are allowed to compete then the sample size will reduce and might even get scattered demographically.
- Multiple agencies will lead to an increased cost of operations passed on to the broadcasters and ultimately to the end users/ consumers.
- Financial market having multiple rating agencies and Television market are inherently different; hence, the principles applicable for determining the ratings for financial products will not apply to the Television industry.

2.22 One stakeholder also submitted that, history has it in 2004 when the market could not support two-rating systems and one organization — aMap got wiped out. Philippines presents a typical example of confusion and ambiguity in the market due to the presence of more than one measurement agency.

2.23 On the contrary, quite a few stakeholders were in favor of competition and they contended that:

- Competition would bring in new technologies, new research methodologies, new methods in analysis, new and better ways to ensure better data quality.
- In a monopolistic arrangement, there is absolutely no driver for BARC to improve, invest, and upgrade the process with the changing demand of times.
- Competition will push BARC to introduce neutrality and fairness as manipulation in ratings will be easy to detect.

2.24 In addition, the following measures were suggested by stakeholders to make the Television rating services more accurate and widely acceptable:

- Expanding measurement from a ‘sample-based model’ to a ‘census-based model’ gradually through the use of secure and optimally priced technology would prove to be more effective in enhancing accuracy of the ratings. There should be two currencies, one based on people-meter and the other based on RPD. Having access to this big data is an incredibly useful and accurate measure of subscriber-viewing behavior.
- A third party should also conduct co-incidental studies to ensure that the show and channel reach is in line with BARC’s reporting. The outcomes of such studies should be shared with the stakeholders to ensure that they are involved in the steps taken to improve the currency constantly. The industry should periodically conduct studies to arrive at broad parameters such as Reach, profile of viewers of specific channel, etc., and compare the same with BARC findings.
- Increasing the sampling size and complete automation of the validating process and the introduction of RPD-embedded STB would certainly make the ratings more accurate and transparent.

- Hybrid STB, smartphones, and other connected devices along with Artificial Intelligence (AI), and data science could be used to evaluate popularity, and to analyze consumer behavior and pattern.

2.25 The Authority analyzed the comments supporting and opposing the idea of multiple players in TAM. One very important aspect of TAM is that there are various functions/stages in the whole measurement process. It is also a possibility that while a single agency continues to publish the ratings, multiple agencies could be involved in other tasks like processing/collection of the data using various methods/technologies. The ratings finally published by the Publishing Agency based on amalgamation of data collected/processed by various other agencies may produce more credible results, compared with the results produced by a single agency handling the entire process by itself.

2.26 In this context, it is relevant to note that the rating agencies: BARC India and TAM India have formed a joint venture called Meterology Data Pvt Ltd (MDL) to set up a meter management company. In MDL, BARC India have management control with a 51 per cent stake, while TAM India – which includes Nielsen and Kantar –has a 49 per cent stake. As a part of this system, all TAM India meters which were in use have been re-deployed in panel homes selected by BARC India's sample design. MDL's role is to run and manage the meter operations and supplying raw data to BARC India. Television Viewership data is being disseminated through BMW (BARC India Media Workstation). MDL is managing the panel households and is also responsible for future Television panel expansions.

2.27 The majority stake in MDL enables BARC to exercise control over its data collection operations. The present scenario of a single entity holding control over the policy formulation, methodology, data collection, data processing and publication in India, does not leave

much scope for a new player to enter into the field of measurement of Television rating or for collecting the data.

2.28 The Authority is also of the view that in the era of big data and Artificial Intelligence, introduction of competition in rating services would bring in new and innovative methodology. It is quite possible that we can expand measurement from a 'sample-based model' to a 'census-based model' by allowing multiple players in data collection. This will gradually enhance accuracy of the ratings as well.

2.29 The Authority is also of the view that competition in rating service would bring new and innovative methodology and better data quality, and thus, limiting the state of monopoly.

2.30 **Accordingly, the Authority recommends that:**

- i. To create credible and accurate collection of data, multiple data collection agencies need to be encouraged. Competition and multiple agencies for data collection and processing would bring in new technologies, new research methodologies, new methods in analysis, new and better ways to ensure better data quality.**
- ii. BARC should be at an arm's length from its own subsidiary, Meterology Data Pvt Ltd., which is the sole data collecting agency for BARC, as of now; so that the entire process of measurement is carried out independently to ensure inherent checks in data inconsistency, i.e., there should be a clear demarcation of the roles between the data collection agency and the data processing/publishing agency.**
- iii. Efforts may be made to withhold the identity of the channel's name, and number, while collecting and processing the data from the field to bring more transparency in the complete process.**

- iv. **BARC should also separate its functions in two units (a) one unit should be responsible for prescribing methodology of ratings/validation of data, publishing the data and audit mechanism and (b) the other unit for processing the data, watermarking or any other such technical work including management of data collection agencies.**
- v. **Once multiple agencies come forward for rating, BARC should limit its role to publishing the ratings, and framing methodology and audit mechanism for the rating agencies, so that the number of agencies can develop multiple rating system leveraging new technologies.**

Sample Size and the Use of New Technologies

2.31 Panel size represents the number of homes, drawn from samples collected during the establishment survey, where the audience measurement device is placed. It should be the representative of age, socio-economic class, gender, working status, delivery platforms and geographical coverage (both urban and rural markets).

2.32 The policy guidelines for Television rating agencies has the following provisions regarding panel size:

“5.3.5 A minimum panel size of 20,000 to be implemented within 6 months of the guidelines coming into force. Thereafter, the panel size shall be increased by 10,000 every year until it reaches the figure of 50,000. The panel of homes has to remain representative of all television households in the country.”

2.33 However, the present sample is limited to 44,000 only. Accordingly, stakeholders were asked to suggest measures to improve the sample size. In response to the issue related to Television rating based on

limited panel homes being termed as representative, opinion was divided. Stakeholders who were in favor commented that:

- Scientifically designed small sample would yield more accurate and representative results than the one which is larger in size, but lower in sample design quality.
- With an increase in samples beyond a certain threshold, the incremental gains in precision of data begins to drop off.
- Samples provide surprisingly accurate results at an overall level. One can easily calculate the margin of error for an estimate based on the sample size, which proves the robustness of smaller samples in providing accurate population estimates at a national level.

2.34 Many stakeholders hold a contrary view and they contended that:

- Small sample size poses real difficulty in prediction/establishment of true measurement data whereas larger panel size would certainly improve robustness and give more weightage/value to measurement rating.
- Smaller panel size results in limited data for analysis.
- Expecting a panel of 30,000 to represent a market with 200 million Television homes across 22 languages and 5000 plus combinations of channel offtake — is unrealistic.

2.35 Stakeholders who were in favor of increasing the panel size suggested the following measures:

- Use of multiple technologies such as people-meter, Reverse path Data (RPD), channel video players, software measuring the consumption of OTT, and data modelling should help increase the overall sample size without commensurate increase in the costs.
- Having apps on mobile phones capable of wider reach and data extraction.
- IRMAI (Image Recognition via Machine Learning/AI) with fair

representation of census having equal dispersion across the distribution landscape. The rating data, which is a decent representation of the content affinity, needs to be married to a daily supplementary ground census-based data. There will be no commercial challenges as long as there is one primary agency and one supplementary agency — both operating independently to validate each other.

2.36 With regards to panel size both in rural and urban India to give a true representation of audience, the following responses were received by various stakeholders:

- A sample size of 75,000 to 100,000 people-meter homes should be reasonable. However, this sample needs to be supplemented with RPD.
- The total sample size of panel households needs to be increased to 0.1% of the total Television households.
- There cannot be a defined number/panel size that can be held to be adequately representing the entire Television viewing audience.

2.37 Presently, BARC, through establishment surveys and a study gathers the details of households and individuals. This study is used with census data for preparing a universal estimate for Television audience characteristics such as geography, demography, age, social-economic status, etc. This set-up involves huge amount of installation and maintenance cost to the industry. Thus, panel expansion becomes a huge barrier to the industry in terms of cost.

2.38 Smaller panel size results in limited data for analysis and therefore is not truly a representative, but a larger panel size would certainly improve the robustness and give more weightage/value to measurement ratings. Achieving a higher panel size more rapidly requires newer technologies to be adopted.

- 2.39 Technology changes occur at a very rapid pace. Hence, the rating system should match or account for the pace of technical advancement. The present people-meter technology is being used since a long time. However, there have been numerous technological changes especially in the data collection method, big data analysis and Artificial Intelligence. These new technologies should be leveraged for Television rating system as well.
- 2.40 In May 2017, some Television channels watermarked (WM) by BARC India switched off their Audio Watermarking as a bargaining tool to emphasize their agenda. During this period BARC India could not release the ratings of channels whose Audio Watermarking was intentionally switched off from the Broadcaster's end. As a result, BARC India considered an alternate solution, which was based on Audio-Matching and tied up with an Israeli measurement firm Media Research Labs (MRL). MRL provides Audio-Matching based measurement software systems, which runs on fixed as well as mobile devices. This technology was deployed with BARC's second generation BAR-O-Meters and tested successfully in parallel with existing Audio Watermarking solution. BARC has a roll-out plan that integrates the Software Development Kit (SDK) in next generation BAR-O-Meters, which would enable it to work simultaneously on both Audio Water Mark and Audio Matching detection.
- 2.41 The next generation BARC India BAR-O-Meters with universal SDK (audio matching and watermarking) will first attempt to identify the Television channel being viewed using the Audio Water Mark decoder. In case that is not available, the audio sample will be used to recognize the content/channel using Audio Matching system. At the backend, Audio Repository Files are generated 24x7 for all channels for mapping and measurement with the MRL technique. The sample events generated from these meters are then matched with the repository audio to arrive upon accuracy. This is a classic example of deployment of Big Data and AI, and to achieve the large-scale data. BARC is

processing this on Cloud platform which ensures accuracy and future scaling too.

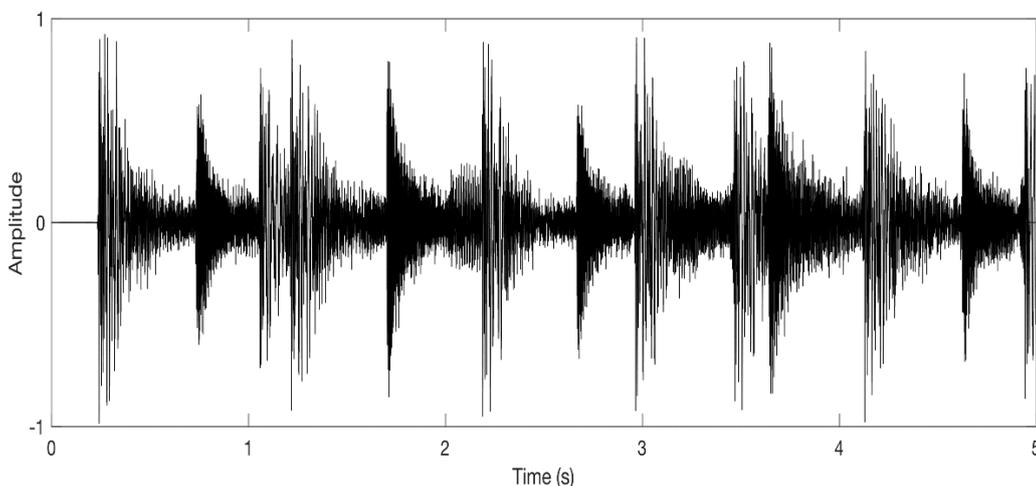
2.42 Multiple scenarios were tried by BARC in an attempt to understand the merits of each. Table 1 provides a fair comparison of the use cases of the two technologies:

Table 1: Comparison of Watermarking and Audio Matching

	Watermarking	Audio Matching
Broadcaster Investment	✓	✗
Third Party Involvement	✓	✓
Ease of Scaling	✓	✗
Fast Processing	✓	✗
Low Capacity Requirement	✓	✗
Business Resilience	✓	✓
Opportunity	✓	✓

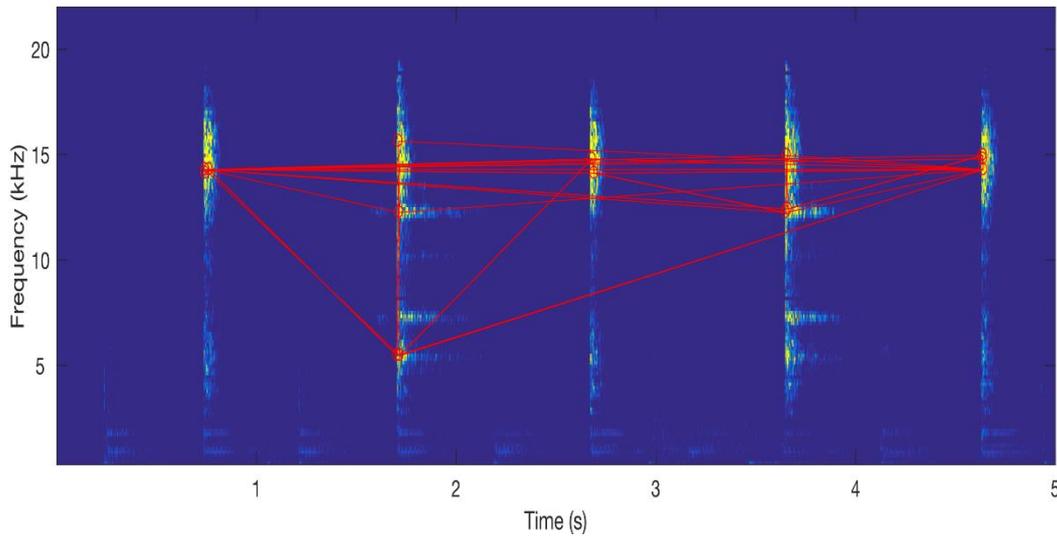
2.43 Audio fingerprints are based on features in a *spectrogram*. A spectrogram is an approximate decomposition of the signal over time and frequency. It is created by taking a short window of time of the signal, and then performing a Fourier transform that decomposes the window over its frequencies. By repeatedly performing this calculation for subsequent windows of time, BARC finds the frequency composition of the audio as time progresses.

Figure 2: Spectrogram of an Audio signal



2.44 The algorithm used in audio fingerprinting identifies the strongest peaks in the spectrogram, and to store the relative signatures of these peaks. The algorithm is shown in Figure 3.

Figure 3: Algorithm Used in Audio Fingerprinting



2.45 Red circles indicate the strongest peaks and the red lines connect the peaks that are close to each other. The result is a “spider web” over the spectrogram. The web is much sparser than the original spectrogram, and hence, can be stored more efficiently. Furthermore, the web is robust to distortions like white noise, since that will have a relatively small impact on the strongest peaks. The web therefore acts like an audio fingerprint.

2.46 Once the fingerprints are extracted, the next challenge is to identify the content to which the fingerprint belongs. This process is often called audio matching. The reference database is acquired by extracting fingerprints from the reference content. The reference content may be pre-existing (e.g. a film) or could be a live feed (e.g. a Television channel). The app extracts the fingerprint from the audio and uploads it to the server that maintains the reference database. The server performs the audio matching, and the result is passed back to the app.

- 2.47 TRAI organized a Hackathon to find out the possible solutions for Television Audience Measurement and Rating in India. Several solutions were proposed by the participants. Most of them focused on the collection of data from households via mobile applications or by a combination of hardware -software. A Report on the Hackathon is appended as **Annexure II**.
- 2.48 The Authority observed that BARC India is also trying to introduce new technologies such as Audio matching, which will reduce dependency on the broadcasters, and will also be cost effective. BARC India could also take up some of the suggestions received from the Hackathon on a pilot basis.
- 2.49 The whole rating system is data centric from collection of data to processing the data to publishing the ratings for the use of stakeholders. As rating becomes currency for the advertisers for their expenditure, security of data is utmost important in the whole system. Irrespective of the technology used, sample size or agency responsible for rating the system, security of data should not be compromised at any stage. In the whole value chain, even a single insecure data leakage point may affect credibility of the whole rating system. Therefore, the Authority is of the view that whatever be the technology adopted by the Agencies in the measurement, it must follow the best data security practices, and should meet the highest level of security audit requirement to give confidence to all stakeholders.
- 2.50 After analyzing all the comments received on the issues, the Authority is of the view that Rating agencies should explore new technologies which can increase the sample size in a cost-effective manner, build confidence in the rating published by the agency. Scientifically designed bigger sample size could yield more accurate and representative results, as almost all quantitative research techniques use sample-based measurement. During the discussions BARC informed that they are

trying to use audio matching technology, which is more cost effective for large sample size.

2.51 **Accordingly, the Authority recommends that:**

- i. The rating agency should be mandated to increase the sample size from the existing 44,000 to 60,000 by the end of 2020, and 1,00,000 by the end of 2022 using the existing technology.**
- ii. BARC shall immediately conduct a study in collaboration with the Indian Statistical Institute or any other institute of repute, to estimate the appropriate sample size, and to get the correct representation of the viewership including regional and niche channels. Sample size once increased; it will make the data tampering an arduous exercise. On the basis of the study conducted, BARC should reach the target of reaching the sample size in a time-bound manner.**
- iii. There should be some financial disincentives prescribed as penal provisions including the cancellation of registration, if the specified target is not met by BARC.**

Return Path Data (RPD) Technology

2.52 In the consultation paper stakeholders were asked to suggest method/technology that would help to rapidly increase the panel size for Television audience measurement in India. In response the following comments from the stakeholders were received:

- There is an urgent need to either supplement a system with RPD (Return Path Data) or have an independent RPD-based currency, which can ensure that the system will be able to provide robust estimates for smaller channels as well as reduce the influence of tampered households on overall ratings.

- RPD is a cost-effective solution for a market and will reduce the fear factor of households while installing separate meters and will make every STB into a barometer.

2.53 Involvement of DPOs in collecting the viewership data electronically for better TRP rating was also one of the issues raised in the consultation paper. Several stakeholders supported this and gave the following justifications:

- Subscriber data is already available with them; hence, it would make the process time efficient and easier.
- Collection of viewership data electronically after masking user information may be mandated. This can protect individual privacy, while at the same time build robustness of RPD, and reduce sample error of the current survey.
- Many DPOs are now moving to the deployment of Hybrid STBs, and are making provisions for IPTV that has inherent RPD.

2.54 There were counter views with the following justifications:

- DPOs are running either directly or indirectly in their own locality specific Television channels, so this method may result in manipulation and tampering of the Television ratings data by the DPOs.
- Might lead to encourage unethical practice(s), and a source of illegal revenue.

2.55 The Authority noted that the Return Path Data (RPD) enabled set-top boxes are a low-cost alternative to drastically enhance the sample size. As it collects viewership data from a large set of panel homes, transfers electronically to the servers from these homes, making it a more viable and cheaper collection method. This requires manufacturing of hybrid STBs, capable of transferring viewership data through establishing a

path/connection from STB to the remote servers of the Television audience measurement agency.

2.56 Return Path Data (RPD) will facilitate large sample size in a very cost-effective manner, which will reduce the chances of data manipulation. But, installation of devices in such panel homes involves keeping the individual's information anonymous so that the individual's privacy is not compromised. Further, transfer of viewership data electronically from panel to the servers must only happen with the consent of the individuals. If the individual denies sharing of the viewing data, then the opinion should be respected, and no data should be obtained from that individual's home.

2.57 DPOs can be mandated to provide a near full census-based data. This will entail some modification of the software at the DPOs end. BARC India is already piloting with one MSO, DEN Networks, for measuring Television viewership ratings using Return Path Data (RPD). Canada is an example where its Government has mandated sharing of RPD from operators to the Joint Industry Committee for viewership measurement.

2.58 In the view of above, the Authority is of the view that by increasing the sample size, error in the viewership data could be reduced. And this can be achieved by adopting new technology (RPD) and with the help of DPOs.

2.59 **Accordingly, the Authority recommends that:**

- i. MIB should amend the DTH License and MSO registration so as to mandate STBs capable of transferring viewership data and adoption of RPD technology. This transfer of data can be done by establishing a return path/connection from STB to the remote servers of the Audience Measurement agency.**

- ii. Anonymized viewership data should be transferred electronically to the Audience Measurement agency for statistical analysis and Television Rating purpose. No data from any STB should be transferred to Rating agency without explicit consent from the subscribers.**

- iii. DPOs should be allowed to mutually negotiate the terms and conditions for sharing the data with Measurement Rating agency within the overall framework prescribed by TRAI from time to time. Such framework shall be prescribed by TRAI, once these recommendations are accepted by MIB.**

Panel Tampering

2.60 Panel Tampering/Infiltration remains a legacy issue for Television audience measurement in India. In panel tampering, incentives are provided to people in the panel homes for watching a particular channel that would affect ratings. Panel infiltration has a significant impact when the panel size is smaller. Increase in panel size, reduces the impact of infiltration of panel homes on ratings.

2.61 In order to reduce the impact of manipulation of panel home data/panel tampering on overall Television ratings, several suggestions were received from stakeholders:

- Panel manipulation should be recognized as a serious, unethical offence, and any person/company indulging in such manipulation should be punished by levying hefty fines, suspension of licenses, etc.

- Separate report should be put together on such compliance and this report should be published to the industry stakeholders. The panel homes that have been visited by the third party then can be removed from the panel, and this could be treated as a part of the

yearly panel churn that is desired.

- With more TAM agency getting involved and stipulating operating guidelines to be adhered by all would ensure enough checks.
- Household panels should be replaced from time to time.
- 100% automation from data capturing till the final delivery will ensure zero infiltration, which is not practical as long as an external physical device is installed at panel homes. The only option is to use the rating data married to the ground data on a daily/weekly basis.
- Information like details of households must not be disclosed, and it must also be ensured that no person should be able to tamper with the data and manipulate the final ratings.

2.62 Panel tampering affects the rating to some extent and is one of the unresolved issues in TAM rating. In order to make the TAM rating more accurate and widely acceptable this issue needs to be addressed at a minimal cost. This could be done by changing the panel homes more frequently, and in case some panel homes are found to be involved in such activities they should be removed from the panel.

2.63 Presently, panel size is limited to only 44000 households. Moreover, households that may be involved in panel tampering could be very limited. Therefore, the suggestion for penal provisions for panel tampering may not serve any fruitful purpose. Instead, use of new technologies for Television audience measurement like RPD should be encouraged, which will enable a much larger panel size. From this large panel, households whose viewership data is used for the purpose of generating ratings can be selected randomly based on a computerized algorithm. This may help in mitigating the problems of panel tampering.

Veracity of Data and Processes

- 2.64 During the consultation process some of the stakeholders also raised the issue of no transparency over the original collected data, and the difference between the original, and the final data released to the market; and further, there is no well-defined period for which BARC India has to maintain the data. Similarly, reports on the actions taken on the metered data by BARC India is not maintained. Some stakeholders also strongly argued that in many cases BARC India manually intervenes and removes some data in the name of outliers and this action significantly affects the ratings of niche channels as respondent/panel homes for these channels are very few.
- 2.65 The Authority examined the submission of the stakeholders and analyzed this issue in detail. As noted earlier the main function of BARC India is data centric; and therefore, archiving data and action taken on these data will bring further transparency in the system, which is the ultimate purpose of creating an industry body for Television rating measurement.
- 2.66 In view of the above, the Authority is of the view that there should be a well-defined period for which data is to be archived, which will also be useful if any dispute arises in the long run. The Authority is also of the view that manual intervention should be avoided as much as possible, as any kind of manual intervention with whatever good intention is done brings subjectivity in the whole rating system, and questions the credibility of the Television measurement system. Further, outlier policy must be based on the market survey conducted from time to time. As far as possible, outlier policy may be implemented without any manual intervention. This will bring confidence of various stakeholders in BARC ratings. The Authority is also concerned with effective grievance redressal mechanism so that the stakeholders have options to raise their concerns, which can be addressed transparently. This can be done

by instituting effective grievance redressal mechanism having well designated nodal officers to address the grievance in a time-bound manner. Provision of Appellate Authority may also be made to ensure justice is done with utmost satisfaction to stakeholders.

2.67 **Accordingly, the Authority recommends that:**

- i. BARC should keep all relevant data such as original data (meter-level data) arising out of the household panel, the data deleted/ignored/not considered for ratings and the resultant processed data for TRP rating at least for one year in the same format and pattern as in the final ratings, declared to the subscribers including Broadcasters, advertising agencies, and advertisers.**
- ii. BARC should review/frame its outlier policy based on scientific study and market survey conducted from time to time. BARC should automate data processing in such a manner that no manual intervention is required before the final TRP rating is released. Any type of manual intervention in the meter-level /raw data arising out of household panel must be avoided. Manual intervention, if any, in abnormal circumstances should be reported and informed to the auditors also.**
- iii. Adequate framework for grievance redressal may be made having nodal officers and Appellate body so that the grievance(s) of stakeholders can be effectively addressed in a time-bound manner. BARC should also develop a portal wherein any stakeholder can raise the grievance(s) with regards to ratings published by the agency.**

Disclosure and Audits

2.68 Audits are required to make the process more transparent and credible. Accuracy of the ratings and procedures adopted can be ensured

through self-discipline in the adoption of procedures and independent audit. Rating agencies should be subjected to independent audit of the methodology adopted by them for determining the sample and also of the procedures followed by them for arriving at the final results.

2.69 Presently, MIB guidelines for rating agencies stipulate the following disclosure and reporting requirements:

Disclosure

The following information shall be disclosed by the rating agency on its website:

- Detailed rating methodology, coverage, possible source of conflict of interest in clear terms including possible sources of errors.
- Quality control procedures, rate card, ownership pattern of rating agency.
- Quarterly/Annual audit reports, complaint redressal statistics, Comments/viewpoints of the users of the rating data.

Reporting Requirement

The rating agency shall annually report to the Ministry of Information and Broadcasting on the following aspects:

- Equity structure, shareholding pattern, Details of key executives and Board of Directors.
- Details of coverage of rating services, Subscription and revenue details.
- Any other information and reports as may be asked for by MIB or TRAI, from time to time.

2.70 In the consultation paper stakeholders were asked to provide their comments on the adequacy of requirements for disclosure and reporting by the rating agency.

2.71 In response, some stakeholders were satisfied with the current disclosure and reporting requirement prescribed in the present guidelines. However, some of them have given suggestions for further improvement. Main comments/suggestions received are compiled below:

- Present disclosure guidelines and reporting requirement brings in good governance and transparency in the way BARC operates.
- Rating agencies must follow the regulatory requirements of the supervisory body and of an international quality standard, and must subject themselves to an audit by a third party to ensure the survey to be scientific, regulated, objective, and fair.
- There should be a periodic audit of modifications made to the original data via outlier detection, omission of a few records and its justification, etc., by the third party using the same rules that BARC applies to the data at the time of processing it. The actions taken on the data during the validation process should be archived in the server with the name/ID of the person who modifies the original meter data.
- BARC should also provide state-wise sample size in its reports.
- Disclosures regarding any corporate actions undertaken by the Ratings Agency or any of its member associations/agencies to ensure a smooth and transparent functioning.

2.72 Some stakeholders are not satisfied by the present disclosure and reporting requirements submitted that:

- There is no transparency over the original collected data and the difference between the original and the final data released to the market.
- Additional levels of reporting are needed such as Digital Addressable System (DAS) phase-wise, definition-wise SD/HD,

platform-wise, more samples at each population strata, NCCS detailed cuts.

- It would also be good to have standard reporting breaks by each state.

2.73 The Authority also noted the activities of Media Rating Council (MRC), an industry-funded organization to review and accredit audience rating services in the U.S. (**refer Annexure I**), which includes:

- Establishment and administration of Minimum Standards for rating operations.
- Accreditation of rating services on the basis of information submitted by such services.
- Auditing, through independent Certified Public Accounting (CPA) firms, of the activities of the rating services.

2.74 The Authority noted that MRC is a specialized independent body that has garnered the industry's respect and MRC's accreditation is the most sought-after seal of approval for rating agencies in the U.S. In the U.S., audience rating agencies are subject to severe internal audits, and independent external audits through MRC. The Audience rating agencies are also required to get their systems, processes, and methodologies validated by MRC.

2.75 The most important attributes of any rating system are its credibility and acceptance by the stakeholders. The Authority is of the view that transparency plays a very important role in creating confidence among the stakeholders and making system credible and therefore the system which is mainly based on trust should meet highest level of the transparency requirement. Audit and disclosure are two very important tools to improve transparency. Proper disclosure norms and reporting requirement will improve standards of governance and operations of BARC.

2.76 Accordingly, the Authority is of the view that mandatory annual audits of the rating agency executing the audience-measurement activity by independent bodies such as consulting firms to validate the methodology, sample, transparency, and grievance redressal will also be useful in India. The audit should include:

- Adherence with well-defined TRP rating methodology and highlighting the deviations, if any.
- Verification of actual sample size and its deployment as per the statistical projections to give desired accuracy while publishing TRP ratings.
- Publish an audit manual.
- Functioning of grievance redressal framework and deviations if any from the defined policy.
- Need to prescribe internal audit process and submit periodic findings to BARC board.

2.77 **Accordingly, the Authority recommends that:**

- i. BARC should get annual audit conducted by an independent agency to ensure conformance with TRP rating methodology, sample size, and grievance redressal methodology and publish the audit report on their website after the Board's approval within three months, after the end of the financial year. An audit manual should be made to ensure accuracy of the process adopted for ratings, household-panel selection, functioning, and data collection for overall rating systems.**
- ii. An internal audit committee may be constituted headed by a member of AAI or ISA to audit processes, sample size, rating methodology and effective redressal of grievances in a time-bound manner. Quarterly report of internal audit committee must be approved by the Board of BARC within 30 days from the end of quarter and shall be placed on the website of BARC.**

CHAPTER 3

SUMMARY OF RECOMMENDATIONS

- 3.1 Structural reforms are required in BARC to mitigate the potential risk of conflict of interest, improve credibility, and bring transparency, and instill confidence of all stakeholders in the TRP measurement system.**
- 3.2 The composition of BARC India should be changed as part of the proposed structural reforms. The Board should have at least fifty percent independent members, which should include one member as a measurement technology expert, one statistician of national repute from among the top institution(s) of the country and two representatives from the Government/Regulator.**
- 3.3 Restructured Board of BARC India should provide for equal representation of the three constituent Industry Associations, namely; AAI, ISA and IBF and with equal voting rights irrespective of their proportion of equity holding. Tenure of the members of the board shall be for two years.**
- 3.4 Active participation of representatives of the Advertisers and the advertising agency will bring more accuracy, transparency, credibility, and neutrality in the system, due to their inherent need of advertisers to reach viewers accurately.**
- 3.5 The constituent Industry Associations shall be entitled to nominate their representatives to the board membership subject to the condition that a cooling period of 4 years shall be applicable between two consecutive tenures, for any such nominee member.**
- 3.6 Tenure of the Chairman of the Board should not be more than**

two years. Chairmanship of the Board shall be rotated among the constituent industry associations in every two years.

- 3.7 Number of members in the technical committee should be increased to 5 with addition of two external technical experts.**
- 3.8 An Oversight Committee should be formed to guide BARC India in the areas of research, design and analysis, constantly improving the rating system. The Oversight Committee shall be broad based with representation from the National Council of Applied Economic Research, IIM, IIT, media research expert and demography expert, nominee from the Ministry of Information & Broadcasting, and TRAI. The Committee should also be responsible for nomination/appointment of independent members of the Board as well as to give policy direction to BARC India, if it is so required.**
- 3.9 To create credible and accurate collection of data, multiple data collection agencies need to be encouraged. Competition and multiple agencies for data collection and processing would bring in new technologies, new research methodologies, new methods in analysis, new and better ways to ensure better data quality.**
- 3.10 BARC should be at an arm's length from its own subsidiary, Meterology Data Pvt Ltd., which is the sole data collecting agency for BARC, as of now; so that the entire process of measurement is carried out independently to ensure inherent checks in data inconsistency, i.e., there should be a clear demarcation of the roles between the data collection agency and the data processing/publishing agency.**
- 3.11 Efforts may be made to withhold the identity of the channel's name, and number, while collecting and processing the data from the field to bring more transparency in the complete process.**

- 3.12 BARC should also separate its functions in two units (a) one unit should be responsible for prescribing methodology of ratings/validation of data, publishing the data and audit mechanism and (b) the other unit for processing the data, watermarking or any other such technical work including management of data collection agencies.**
- 3.13 Once multiple agencies come forward for rating, BARC should limit its role to publishing the ratings, and framing methodology and audit mechanism for the rating agencies, so that the number of agencies can develop multiple rating system leveraging new technologies.**
- 3.14 The rating agency should be mandated to increase the sample size from the existing 44,000 to 60,000 by the end of 2020, and 1,00,000 by the end of 2022 using the existing technology.**
- 3.15 BARC shall immediately conduct a study in collaboration with the Indian Statistical Institute or any other institute of repute, to estimate the appropriate sample size, and to get the correct representation of the viewership including regional and niche channels. Sample size once increased; it will make the data tampering an arduous exercise. On the basis of the study conducted, BARC should reach the target of reaching the sample size in a time-bound manner.**
- 3.16 There should be some financial disincentives prescribed as penal provisions including the cancellation of registration, if the specified target is not met by BARC.**
- 3.17 MIB should amend the DTH License and MSO registration so as to mandate STBs capable of transferring viewership data and adoption of RPD technology. This transfer of data can be done by establishing a return path/connection from STB to the**

remote servers of the Audience Measurement agency.

- 3.18 Anonymized viewership data should be transferred electronically to the Audience Measurement agency for statistical analysis and Television Rating purpose. No data from any STB should be transferred to Rating agency without explicit consent from the subscribers.**
- 3.19 DPOs should be allowed to mutually negotiate the terms and conditions for sharing the data with Measurement Rating agency within the overall framework prescribed by TRAI from time to time. Such framework shall be prescribed by TRAI once these recommendations are accepted by MIB.**
- 3.20 BARC should keep all relevant data such as original data (meter-level data) arising out of the household panel, the data deleted/ignored/not considered for ratings and the resultant processed data for TRP rating at least for one year in the same format and pattern as in the final ratings, declared to the subscribers including Broadcasters, advertising agencies, and advertisers.**
- 3.21 BARC should review/frame its outlier policy based on scientific study and market survey conducted from time to time. BARC should automate data processing in such a manner that no manual intervention is required before the final TRP rating is released. Any type of manual intervention in the meter-level /raw data arising out of household panel must be avoided. Manual intervention, if any, in abnormal circumstances should be reported and informed to the auditors also.**
- 3.22 Adequate framework for grievance redressal may be made having nodal officers and Appellate body so that the grievance(s) of stakeholders can be effectively addressed in a time-bound manner. BARC should also develop a portal wherein any**

stakeholder can raise the grievance(s) with regards to ratings published by the agency.

3.23 BARC should get annual audit conducted by an independent agency to ensure conformance with TRP rating methodology, sample size, and grievance redressal methodology and publish the audit report on their website after the Board's approval within three months, after the end of the financial year. An audit manual should be made to ensure accuracy of the process adopted for ratings, household-panel selection, functioning, and data collection for overall rating systems.

3.24 An internal audit committee may be constituted headed by a member of AAI or ISA to audit processes, sample size, rating methodology and effective redressal of grievances in a time-bound manner. Quarterly report of internal audit committee must be approved by the Board of BARC within 30 days from the end of quarter and shall be placed on the website of BARC.

International Experience

France

4.1 Measurement of television audiences in France is conducted by an independent company, Médiamétrie, which consists of representatives of radio, Television, advertisers, advertising agencies and media brokers without any of them having a majority holding to take a decision alone. The stakeholding in organization is as follows: 35% Broadcasters, Radio 27%, Advertising Agencies 35%, Others 3%.

(<http://www.mediametrie.com/>)

USA

4.2 Media Rating Council (MRC) is an industry-funded organization to review and accredit audience rating services in the U.S. Currently, MRC has approximately 95 Board members representing Television and Radio Broadcasting, Cable, Print, the Internet and Advertising Agency organizations as well as Advertisers and Trade Associations. Organizations such as Nielsen or Arbitron that provide media ratings are not allowed to be the members.

Israel

4.3 The audience measurement in Israel is done by the Israel Audience Research Board (IARB). In the Israeli audience measurement system, the equity investment is dissociated from the voting rights, and by making the regulatory authority a shareholder of the newly formed joint industry committee.

Structure of IARB's Committee

4.4 Members of the committee include: the Second Authority for Television

and Radio, the Broadcasting Authority, the Association of Advertising Companies, the Israel Marketing Association, Keshet Broadcasting Ltd., Reshet Noga Ltd., Channel 10, Israel Educational Television, Channel 9, Music Channel 24, Channel 20.

- 4.5 The committee is managed by a CEO, who is chosen by a tender procedure and is not a member of any of the bodies. The CEO works through a professional team headed by a scientific advisor, Prof. Zvi Gilula of the Hebrew University and the University of Chicago who supervises the professional activities of the committee since its establishment.
- 4.6 The Board of Directors of the Committee, the Plenum, is composed of representatives of all its member bodies, as well as a representative of the Israeli Marketing Association, which sits as an observer. The committee convenes every month and its meetings are chaired by the chairman of the committee, a position that is filled (unpaid) by one of the members of the committee in rotation.
- 4.7 In addition to the plenum of the committee, the committee also operates through two subcommittees: (a) The Research Committee and (b) The Finance Committee.

<http://www.midrug-tv.org.il>

- 4.8 Since its inception, the committee has been operating for non-profit purposes and is funded mainly by its members' funds. IARB does not carry out the ratings study directly, it outsources the job to independent private agencies (currently outsourced to Kantar Media).

OzTAM, Australia

- 4.9 In Australia, OzTAM — the official source of television audience measurement (TAM) — has launched a project called “audience measurement diversification”, and is looking to engage a global measurement company to provide platform-agnostic views of the shows.

OzTAM Technology Solution

- 4.10 OzTAM provides broadcasters with a software development kit (SDK) and tools to integrate with OzTAM's system. This includes code developed by OzTAM.
- 4.11 The code attaches a broadcaster provided unique media identifier (ID) to every piece of live or on-demand content within a participating broadcaster's video player library. This means OzTAM can correctly attribute every minute of this content played on individual connected devices, whatever those devices are (e.g. smart TV, smartphone, tablet, desktop/laptop, games console) across platform or operating systems. OzTAM captures overall video play on connected devices, but it does not know who is watching on those devices.
- 4.12 Demographic estimates will be introduced to the VPM Reports, once OzTAM feels the data has been sufficiently tested and verified, and participating broadcasters are on board.

(Source: <http://www.oztam.com.au/vpmabout.aspx>)

BARB, U.K.

- 4.13 The BARB in the U.K. is conducting extensive trials for non-linear content viewership measurement.
- 4.14 BARB uses the same panel homes for online content viewership measurement than it uses for linear Television, where demographic viewing profiles are captured. Every time a home joins the panel, a software meter is also installed on their personal computers, mobiles and tablet devices.
- 4.15 BARB collects census data for online Television viewing and has been publishing the U.K.'s only fully-audited, joint industry measure of online viewing since September 2015.

Technology Deployed by BARB:

- Software meters are installed on all devices (computers/laptops/smart phones/tablets).
- Software code that's embedded in participating platforms Television player apps used by viewers:
 - Over 30 different platforms have implemented this software, and have been audited by ABC to ensure that the data meets BARB's standards.

4.16 BARB has appointed Kantar Media to implement this project and seems quite confident of its progress.

Return Path Data (RPD) Set-Top Boxes:

4.17 Broadcasting Audience Research Board (**BARB**) in the U.K. is close to integrating information from Return Path Data (**RPD**) for their integrated ratings project 'Dovetail' for audience rating measurement. Set-top box data offers similar benefits to the online Television viewing census data that BARB is collecting. RPD set-top boxes are a low-cost alternative to drastically enhance sample size and encourage competition. BARB has conducted successful pilot projects with data from Sky homes.

(Source: <http://www.barb.co.uk/project-dovetail/>)

SG-TAM, Singapore

4.18 The Singapore Television Audience Measurement (SG-TAM) is the official source of Television audience measurement in Singapore. Commissioned by IMDA, GfK operates and manages the integrated Television audience measurement system. It provides the viewership of Television content, such as Free-To-Air TV and pay-TV channels, shown across traditional and digital platforms.

The Technology Deployed by SG-TAM

4.19 For television audience measurement, a people meter is connected to panel households' television sets. Each household member is assigned

a designated button on a remote control to register their presence when they are watching Television programs. Similarly, when the particular member discontinues watching, she/he is expected to press the respective button to record the same.

4.20 For digital measurement, a software metering application is installed on PCs, laptops, tablets, and smartphones. The software works passively to collect media and the internet usage behavior. SG TAM has been delivering digital measurement ratings since 2016.

**Report on the Hackathon to Find Out the Possible Solutions for
Television Audience Measurement and Ratings in India, Conducted by
TRAI at Bangalore**

1. There are 197 million Television owning homes in India, amounting to 886 million individuals that make up the Television viewing universe. Of this, approximately 600 million people watch Television every day. This medium offers a very wide and cost-effective reach across the length and breadth of the country.
2. There are approximate 900 licensed Satellite Television channels in the country, of which viewership of approximately 600 channels is being measured and reported weekly by the existing system, which is managed and operated by BARC India (Broadcast Audience Research Council).
3. Accurate, credible and representative measurement of Television viewing is critical to the growth and sustainability of the Television broadcast sector. Accurate viewership data is an important tool for the broadcasters as a good rating appreciates further quality content generation. Viewership data of Television channels indicates what people want to watch, not only at an aggregate level, but also reflects the choices of different gender, age group, socio-economic status, geography and language.
4. Viewership data also forms the currency basis for advertising. It also tells the marketers and advertisers where to place advertisements for most effective dissemination of their messaging. The significance of viewership data can be gauged from the fact that Rs. 30,500 crores of industry money is spent annually on Television Platform (FICCI/EY Report 2019).

5. BARC India — a joint industry body, set up as per the Ministry of Information and Broadcasting Guidelines — is the agency that currently undertakes Television viewership measurement. BARC uses Audio Watermarking technology in combination with a “BAROMETER” installed in selected households to identify which channel is being viewed in that home. Additionally, the viewers in those selected households are given a special remote which helps to identify who among the members of that household is watching Television for a particular duration of time and which Television channel, as well as the particular program he/she is watching. These data are captured by the BAROMETER in the selected households and relayed back to the data processing system.
6. Like all Television markets across the globe, viewership measurement in India is also carried out on a representative sample basis survey. BARC India installs its BAROMETERS in a small panel of Television homes (currently at 44,000 and to be scaled up to 50,000). These homes are carefully selected on the basis of an annual establishment survey, so that their viewership records can form an accurate representation of the Television viewing in the country and can be extrapolated/weighted accordingly. With a small panel size of 44,000, it becomes really difficult to predict/establish true measurement data, especially, for a country of about 1.3 billion people along with diversity.
7. Achieving a higher panel size more rapidly requires newer technologies to be adopted. One method for increasing panel size could be to collect viewership data from a large set of panel homes, transferring viewership data electronically to the servers from these homes, hence, making it a more viable and cheaper option for the industry.
8. This set-up involves human intervention and a huge amount of installation and maintenance cost to the industry. Thus, panel expansion becomes a huge barrier to the industry in terms of cost.

9. Based on the experience of operation of the Television audience measurement system over the last 5 years (BARC India started reporting data since 2015), TRAI has initiated a consultation process on “Review of Television Audience Measurement and Ratings in India” to understand how the current measurement system can be further improved in the context of constant evolution of the sector and technological advancements.
10. During the consultation process on “Review of Television Audience Measurement and Ratings in India” stakeholders highlighted the need to explore the technological solutions for Television Audience Measurement without manual intervention. Accordingly, the Authority decided to conduct a Hackathon to find out the possible solutions for Television Audience Measurement and Ratings in India.
11. This Hackathon has been aimed at exploring the various technological options and finding the optimal solutions to capture the Television viewership data without/with least human interventions and transferring it to a server over a secure network, without compromising the privacy and secrecy of viewers.
12. The task of conducting Hackathon was given to M/s HackerEarth Technologies Private Limited, which is an expert agency in this field.
13. Hackathon on the subject was organized in two phases (Online phase & Offline phase). Online phase of Hackathon commenced on 2nd September 2019 and concluded on 29th September 2019. Ideas from 75 participants were received in the online phase of Hackathon. A committee consisting of the following officers evaluated the ideas submitted by the participants in the online phase of Hackathon:
 - Shri Sunil K. Gupta, Pr. Advisor (B&CS)
 - Shri Sunil Bajpai, Pr. Advisor (IT)
 - Shri Arvind Kumar, Advisor (B&CS)

14. After evaluating the ideas submitted by the participants in the online phase of Hackathon, the committee shortlisted ideas from 32 participants for Offline Hackathon.
15. The offline phase of Hackathon was conducted on 12th and 13th October 2019 at Bengaluru. During the offline phase only 15 teams participated **(Appendix A)**. Out of 15, only 14 teams presented their ideas. A brief of solutions presented by these 14 teams have been given in **Appendix B**.
16. A committee consisting of the following officers evaluated the final solutions developed by the participants during the Offline Hackathon:
 - Shri Sunil K. Gupta, Secretary, TRAI
 - Shri U.K. Srivastava, Pr. Advisor (NSL), TRAI
 - Shri Arvind Kumar, Advisor (IT), TRAI
 - Shri Nikhil Kumar, iSPIRT
17. The jury after assessing the solutions declared the following teams as winner, 1st runner up and 2nd runner up:
 - **Winner** : SRM college of Engineering, Chennai
 - **First runner up** : Red hot technologies, Kolkata
 - **Second runner up** : Guru Govind Singh College of Engineering, Nanded
18. A prize money of Rs. 1 lakh was given to the winner. The 1st runner up was given a prize money of Rs. 50,000, whereas the 2nd runner up was given a prize money of Rs. 10,000. All the remaining 11 teams, who presented their solutions at the Hackathon, were each given a consolation prize money of Rs. 5000.

Appendix A**Details of Teams Participated in the Offline Phase of Hackathon**

S. No.	Team	Name of Institution/Organization	Team leader
1	Kiamio	My Box Technologies, Bangalore	Balaji
2	Stuxnet	Lovely Princely University, Jalandhar	Soumyajit Dutta
3	Nerve	Gudlalleru Engineering college, Vijaywada	Nitin Bharadwaj
4	Invisible	Red hot technologies, Kolkatta	Ashhadul Islam
5	Code Gamblers	Government college of Engineering, Aurangabad	Aakash Tripathi
6	Mansa Studio	SRM college of Engineering, Chennai	Nitish Kumar
7	The Famous Five	PES University, Bangalore	Ritesh Manchikanti
8	Traid and Tested	Vellore Institute of Technology, Vellore	Rahul Sinha
9	Supravo Ghosh	Aacharya Institute of Technology, Bangalore	Supravo Ghosh
10	Ramasamy M	WIPRO, Bangalore	Ramasamy
11	Hungry Booleans	Shree Krishna College of Engineering, Coimbatore	Bhavik Kumar
12	Kepler	Model Engineering College, Kochi	Adithya
13	Dhanraj Pawar	Nitte Minakshi Institute of Technology, Bangalore	Dhanraj
14	Codeplay	Guru Govind Singh College of Engineering, Nanded	Yogiraj
15	8 fists of code	Ramarao Aditya College, Mumbai	Navjot Singh Rajput

1. Mansa Studio, (SRM college of Engineering, Chennai)

- (i) The solution is based on a mobile application which replicates the features of a universal remote. Many phones come equipped with an IR blaster. For other phones it is very simple and cost-efficient (approx. Rs. 40) to integrate an IR blaster.

- (ii) To extract Hex code of the service provider remote buttons, we used TSOP1738 which is an IR receiver along with Arduino UNO. To convert the given Hex code to pattern of On/Off bits in micro-seconds we used adafruit library of the same. This pattern of micro-seconds is then fed to the android app that we created for each set of buttons.

(iii) **Working**

- Every new user is required to register on the app and provide personal and demographic details.
- One account can have multiple profiles and one can choose from the many profiles registered from the app similar to Netflix.
- Remote Interface is created for each profile of the user.
- Once a channel number is entered at a particular time, this channel number of the respective provider, along with the timestamp is sent to a server.
- The channel number streaming is displayed on the app.
- The channel number pressed is also displayed.
- A list of Favorite channels is displayed under Favorites.
- Once the user decides to change the channel and enters a different number or navigates away from this channel, the current timestamp is again sent to the server as the end time.
- The server using the start time and end time and the channel number of the provider figure out what program was viewed by the respective profile and for what duration of time.

- The application extracts the data from the user that is sent to the server, which will maintain a database of the channel viewed and the time duration by the user in “Real Time”.
- Viewers can also be given an option to indicate the rating for the show, which they are watching or some kind of feedback related to the show after that program ends.

(iv) For those viewers who don't want to use the app and finds a hardware remote more feasible to use, the hardware remote with Bluetooth feature is used which has the same functionality as the android app.

2. Invisible (Red hot technologies, Kolkata)

(i) The solution is Hardware based wherein the Television remote is modified to contain a fingerprint sensor and a GSM/GPRS module to send data. The sensor will be on the back cover of the remote, similar to mobile phones where fingerprint sensors are at the back of the phone.

(ii) Working

Step 1: When the remote is delivered to the household (HH), the members will also be asked to authenticate and register through an app. Thus, every member's demographic details along with fingerprint will be stored in a secure server database. The fingerprint will be stored in the server database in the form of a hashed value.

Step 2: Whenever a viewer wants to change a channel, he or she has to touch the fingerprint sensor on the remote to unlock it and change the channel. While the channel gets changed, the GSM module in the remote will send the information of the channel number pressed and the fingerprint details (unique hash value of fingerprint) to the datastore. The database, which already contains the specifics

corresponding to each fingerprint (collected during step 1) will be able to map fingerprint id to the viewer details as and when required. All information will then be encrypted and sent through GSM/GPRS module.

- (iii) Using the fingerprint lock technique, we will be subconsciously triggering the viewer to give his or her biometric detail every time they change a channel.
- (iv) As the registration will be done remotely, it is hoped that the product can be scaled to a bigger audience in India. The cost of maintenance is expected to reduce, and the accuracy of the data gathered will be ensured because of the finger-lock system.

3. Codeplay (Guru Govind Singh College of Engineering, Nanded)

- (i) The solution centers around an ecosystem containing a data accumulation module and a supplementary android application.
- (ii) Data Accumulation Module (DAM) consists of Single-board microcontroller (Arduino/Raspberry Pi), Bluetooth Module and Infrared (IR) sensor
- (iii) The microcontroller system is interfaced with the help of phone's Bluetooth connection.
- (iv) The data accumulation is done by the microcontroller system, and it is relayed to the central server using the application.
- (v) While deploying, a profile is created for a household in the Android Application of a viewer's smartphone.
- (vi) This profile creation assigns a unique house-id to the household.
- (vii) Profile-creation takes care of all demography-related data (Age, Gender, Location, socio-economic profile, etc.) and assign viewer-ID to each viewer.
- (viii) This data is reflected in central server database, while profile creation can easily be modified using the App.

- (ix) Based on the Television service provider and specific model for TV/STB, IR layout for remote control unit (RCU) is fetched from the central database. Then specific actions, for different viewers in the HH are assigned to the Data-Accumulation Module (DAM) and the RCU.

Working

- (i) Once the keypress is detected and acknowledged (blinking LEDs) by the DAM, it will trigger an action, resulting in creation of entry corresponding to start-time of session containing the:
- Viewer ID
 - Channel Number and
 - Current Timestamp.
- (ii) The timestamp will be generated by DAM using RTC (Real-Time Clock).
- (iii) The action will be repeated for each channel, resulting in another entry for End Time of session, until the Power-off button is pressed, or another user's presence is triggered. The data is stored for retrieval using EEPROM or SD card (Optional).
- (iv) The time will be synchronized twice a day during transmission of data to server, using Bluetooth based NTP-calibrated smartphone's time, for redundancy.
- (v) For transmission, first, the App will connect to the DAM, at specified time (twice a day) using Bluetooth and get the required file. This file will then be encrypted and transmitted to the server, using the internet connection available on the smartphone.

4. Traid and Tested (Vellore Institute of Technology, Vellore)

- (i) The solution is based on the smart TV app which can be installed on the user's TV to monitor the viewership data and send it on real-time to the TRAI server with secure internet protocol.

- (ii) This app has profiles for different users with their information to collect individual viewership data, i.e., age, sex and social and geographic features.
- (iii) A remote's IR blaster can easily be tuned to multiple frequencies and thus a remote can be designed, which can access both STB as well as Television inputs. We will use this remote to input the LCN or channel number to the Television.
- (iv) This captured channel number is then compared to the database of the Television channels and their corresponding shows. This will give us the information about the show and all the advertisements that are being featured in this duration. The time duration along with the starting and ending time of the viewership can be calculated through this.
- (v) Comparing the date and time with channel information shall give us the data about which show is being watched and for what duration
- (vi) Data will be sent to the central server of BARC using Firebase which is an open-source software for data transfer over secured and encrypted network.

5. The Famous Five (PES University, Bangalore)

- (i) The solution consists:
 - a. A universal remote that captures and stores the data while in use.
 - b. A micro-controller to store the data locally in a memory chip and then push it to a server over a secured network.
 - c. An application to complete user details.
 - d. Node MCU with inbuilt Wi-Fi — For collection of data and pushing data.
 - e. Bluetooth Module — to connect the hand-held device with mobile application and configuration of Wi-Fi to the microcontroller.
 - f. FingerPrint Module: Used to identify user.

Working

- (i) Using Bluetooth, the Wi-Fi credentials are fed to the module through the support of the mobile application.
- (ii) The user is supposed to identify self-using Fingerprint Sensor on the hand-held device.
- (iii) Upon detection of new fingerprint, the fingerprint data is stored under a unique ID for whom the profile is completed through the mobile application.
- (iv) The module is configured to collect details of every activity performed by the users.
- (v) These details are matched with the details of the DTH and a data entry is recorded along with a timestamp corresponding to an activity.
- (vi) The data entries of each activity, thus, recorded are stored in the memory of the remote in encrypted format. This data is uploaded to a database on a regular basis.
- (vii) The data is decrypted, processed and uploaded to the required server from the database.
 - Configuration, being a one-time process, the remote is not expected to be connected with the mobile application all the time.
 - Support for reconfiguration in Wi-Fi networks and DTH providers is present.

6. 8 fists of code (Ramarao Aditya College, Mumbai)

- (i) The solution is based on mobile application which has the capability to control the Television channels and maintain Television show database using IR blaster smartphones.
- (ii) It records the activities and maps them with corresponding users and develops a database.
- (iii) Each user is required to log in and enter details such as name, gender, age, income, location.

- (iv) Whenever the user wants to watch Television, he will choose who's watching.
- (v) The set-top box starts Television at a default channel (for example channel number 001), Also the user has a fixed number of channels depending on his/her subscription plan. This information of channels and their unique channel numbers will be provided to the app.
- (vi) The app has functionalities of Channel+ and Channel-.
- (vii) The app maintains a pointer to the channel number it is on currently, starting from default channel and traversing through the list accordingly. Every channel switch will be timestamped.
- (viii) To maintain the knowledge of the users who are watching, there is a tab from where the user can select the family members who are watching.
- (ix) The user uses the Television using the smart phone, and the channel number is mapped with the channel schedule for that day to retrieve what show and which user is watching. This is recorded in Database.

7. Supravo Ghosh (Aacharya Institute of Technology, Bangalore)

- (i) The solution reaches all the audience of the television in a nationwide spectrum. It includes three parts:

a) Modified Remote Control

- The remote control has been modified with a touchpad, having a biometric sensor at the middle of it, along with a small ESP32 microcontroller to process the data. Hence, each time a user uses the remote to change the channel or the volume, he has to keep his finger at the middle of the touchpad and then slide sideways or upwards depending on his need.
- If he changes any channel, the onboard microcontroller gets activated and uploads the user details along with the channel which is being watched by the user, leaving out the channels which are not watched for more than 5 sec.

- There is a small SIM800L GSM sim module for data uploading purposes, or via available Wi-Fi.

b) App Based Remote Control

- The remote app has been developed which will be connected to the ESP32 using Wi-Fi as all the phones are Wi-Fi compatible and the data will be transferred to microcontroller.
- The whole family will be registered using fingerprint or a unique single digit local code using which they can log in and the user session will be carried on.
- The user will be directed to the controller page where the user can access his favorites, channel details, usage statistics and can also transfer the access to any other family member.
- If the user is deviating from his/her favorites and accessing other members favorites or another channel then there will be a pop-up arising confirming the identity, and the user has to select the identity whoever he/she is to access the channel content, which will be done in a single tap.
- Each of the user data during his/her session will be stored and updated in a particular node under his/her generated id.

c) People with Smart TV's having Camera

- Many Smart TV's now-a-days come with an in-built camera, or provision to attach a USB camera.
- We will be using facial recognition algorithms to recognition the user who is watching the Television. It can recognize an individual user or a group of individual if more than one individual is sitting in front of the Television.
- Only the names of the individual would be sent to the database, thus taking care of privacy issues, along with the watch time and the channel's viewed, tapping the information from the

remote to the TV via a microprocessor. The processor will be enabled with Wi-Fi to send the information gathered to an online database, for further processing.

8. Code Gamblers (Government College of Engineering, Aurangabad)

- (i) The objective of the mobile application is to collect the data from houses about the popularity of the Television programs by recording the audio and recognizing the channel which is viewed.
- (ii) The mobile application involves collection of Television viewership data through recording the audio and matching to the existing databases to recognize which channel is viewed and for what duration.
- (iii) The users can subscribe channels through the app so that we can get a clear idea of what the users are willing to watch.
- (iv) We can take survey of the audiences through the app to get a clear account of the preferences of the viewers.

9. Dhanraj Pawar (Nitte Minakshi Institute of Technology, Bangalore)

TRP DATA EXTRACTION IN SMART TV USING IMAGE PROCESSING.

- (i) The solution includes more work from Smart TV such as geolocation access enabled to categorize user data under rural or urban, which includes the location of the user and screenshot capture mode which is available in android (Smart TV) for capturing screenshots whenever channel is changed by the user.
- (ii) As the user turns on the Television it captures an image and the image processing starts and finds that it's the starting channel on Television. So, next time whenever the user changes channel it once again captures image using screenshot-capture technology of Smart TV and does optical character recognition through the help of Tesseract OCR.

- (iii) After the text has been extracted by the help of Tesseract OCR, it is put into a text file and is stored locally on the system. These stored details will contain the channel name and the time at which it was switched to.
- (iv) The text file is then accessed by a java application which computes the amount of time that the user has watched that channel by subtracting the time at which the next channel was switched to by the time the current channel is switched to. After computing this information, the daily schedule of each channel is accessed. This information is stored in a database locally. From the daily schedule, the program that is running at the time the user is watching is found out. This information is then stored in another text file.
- (v) The stored text file is securely sent to a remote server through php post file transfer.
- (vi) As the application uses only software, it can be easily implemented in a large scale with less cost.
- (vii) Convolution neural network (CNN) can be used instead of optical character recognition since using CNN gives us more accuracy and efficient.
- (viii) Instead of using different applications for the various tasks, we can implement everything (taking the screenshot, extracting the information from the image, analyzing the extracted information) in a single application.

10. Kiamio (My Box Technologies, Bangalore)

- (i) The solution involves integration of Audience Measurement Software (AMS) with existing STBs using USD dongles.

- (ii) The solution captures most important data including Service Name, Service ID, Network ID along with the duration. In addition, it can also capture the viewership of advertisement.
- (iii) It collects channel zap data (channel watch time, channel name, event name) and advertisement viewed by user and sends it back to AMS server using SSL/CURL.1.
- (iv) Don't consider if the channel watch time is less than 10 seconds.
- (v) Form it as JSON data and send it back to the AMS server which is running on AWS.
- (vi) AMS server will receive AMS data and do some analytics.
- (vii) Using the analytics we will show Pie chart, Bar chart and TRB calculation. Please refer to our document for more information.

Client Side API flow:

- When the Set-Top Box (STB) gets boots, it initiates the AMS Engine.
- Inside the AMS Engine, we start the normal Wi-Fi stack, which connects the STB to the corresponding Access Point (AP). Once the Network is enabled, STB will try to establish the connection with AMS server and it will get the configuration file for the corresponding STB.
- Based on the MSO (Multiple System Operator) configuration, we will initiate corresponding event in AMS engine in STB. For this instance, if the MSO wants to capture channel zap event, we will start capturing the event from the user, while they press the corresponding channel zap keys in Remote (Program Plus and Program Minus). Hence, Hacker_Rank_Channel Zap will get invoked. Hacker_Rank_ChannelZap Api will capture the corresponding data including the following parameters:
 1. Service Name
 2. Service ID
 3. Transponder ID (Frequency ID)
 4. On Network ID (ONID)
 5. Start Time (Includes Date, Month, Hour, Minutes, Seconds)
 6. Event Name (Electronic Program Guide EPG)

Server Side API Flow:

- In AWS, we will host AMS server. In the User Interface part, one can select the configurations. Based on the configuration selected in Server, client will send Data to the corresponding configuration. Sample configurations are listed below:

HTTP 200 OK

Allow: GET, HEAD, OPTIONS

Content-Type: application/json

Vary: Accept

```
[ {"AutoscanEvent": 0,  
  "PlaybacktimeEvent": 0,  
  "RecordEvent": 0,  
  "StandbyEvent": 0,  
  "MenuappearanceEvent": 1,  
  "ChannelChangeEvent": 1,  
  "ADviewEvent": 1,  
  "ADexpandviewEvent": 0,  
  "NVODlinearEvent": 0,  
  "NVODIPEvent": 0,  
  } ]
```

- As per the above configuration, we can conclude that client will capture “channelChangeEvent” and “MenuappearanceEvent” from STB side and it will send JSON data in SSL.
- Also in the Server side we will analyze the data and store it in separate table in the Database. We will show Pie chart, bar chart based on the data analytics done in the client data.

11. Kepler (Model Engineering College, Kochi)

- (i) The solution uses a smart remote which enhances two-way communication between Television set and the remote.
- (ii) The current remote is equipped with an IR blaster thus enabling signal transmission in only one direction.

- (iii) Smart remote is equipped with sensor to enable two-way communication between Television and remote. The solution thus involves transmission of the channel bandwidth frequency to the remote which is then passed on to data servers.
- (iv) Along with channel frequency, the time of viewing when a channel is changed is recorded in the remote and is also transmitted to the servers.
- (v) Television remote is equipped with fingerprint sensor and with modern technologies, it is possible to predict the age and sex of the user in a near to accuracy. Thus, by giving an age band for a particular channel and comparing it with the fingerprint predicted data, it would thus be possible to map out the age group of the viewers of a particular channel or program.
- (vi) The solution also aims to analyze the spending pattern of a particular Television connection from the data obtained from the remote. This data can be used to construct a survey of spending of a family on Television connection and channels on a national or regional level.
- (vii) Transfer of channel information through Google APIs.
- (viii) Based on Google Cloud Platform.
- (ix) Collected data transferred to Google sheets simulating cloud.

12. Hungry Booleans (Shree Krishna College of Engineering, Coimbatore)

- (i) The Screen recorder app/software can be built for the Smart TV's and for other Televisions also if possible.
- (ii) The purpose of screen recorder is to record the screen once the Television is switched on to capture the logo of the channel that is being watched.
- (iii) The captured data is processed using image processing to find the details of the channel.
- (iv) Every channel has its own logo displayed in the screen.

- (v) We can capture the logo using image processing. Then we will find the channel that is being watched.
- (vi) For every change of logo, we record the time so that we are able to identify how long is a particular channel watched.
- (vii) Back-end connection is done using Firebase.
- (viii) The captured data has been processed and the processed information will be sent to the backend (Firebase) using IoT (Internet of Things).
- (ix) The data sync will happen every day in order to reduce storage capacity and increase the speed of data transferring.
- (x) At the firebase, the data collected can be stored and can be sent to the required protocol/Server.

13. Nerve (Gudlavalleru Engineering college, Vijayawada)

- (i) A solution is pairing STB and mobile application with Smart card number.
- (ii) After installation of STB, a customer will have to download Mobile app from the respective mobile platform store and register himself/herself to the application by entering, "Smart card number (CDSN NO)", "Customer ID", "Proof of Identity", and other basic information.
- (iii) After registration, the mobile app will be linked to the STB and communication between App and STB will be established.
- (iv) An Application Interface for every STB, an app Interface, is developed which is compatible with every set-top-box interface. Its purpose is to just collect data and transmit it to the server or to the Mobile.
- (v) The app interface which is developed for STB starts collecting all the data like, what program/channel/is being viewed, start time, end time, and duration of viewing, and send it to the mobile app server as communication is established between them, combined with user basic data.

14. Ramasamy M (WIPRO, Bangalore)

- (i) The solution is based on Android and IOS App
- (ii) Mobile apps take Gmail accounts for login and takes the age, gender, socio-economic profile, Geo location Inside the apps
- (iii) Collects data on what program/advertisement/other content is being viewed
- (iv) Start time, end time, duration of viewing (including up to intervals of 5 secs

Authorisation screen

- User registers through fingerprint
- It validates the device fingerprint if it exists or not
- Both matches will proceed the next screen
- Any user can register after downloading from play store
- For Android: Fingerprint is used
- For IOS: Face ID is used

Wi-Fi device collection

- Nearby Wi-Fi device address is captured
- It validates the device's Wi-Fi address if it exists or not
- Both matches will proceed the next screen
- Each selection analytics will be captured in the firebase console

Channel Selection

- When Channel selection increases or decreases in screen, Each Selection analytics will be captured in the firebase console
- It will send along with the channel name and start time
- Next selection will override the previous selection time and end time

List of Acronyms

Sl. No.	Acronyms	Description
1.	AAAI	Advertising Agencies Association of India
2.	BARB	Broadcasters' Audience Research Board
3.	BARC	Broadcast Audience Research Council
4.	CPA	Certified Public Accounting
5.	DTH	Direct to Home
6.	FICCI	Federation of Indian Chambers of Commerce and Industry
7.	IBF	Indian Broadcast Foundation
8.	ISA	Indian Society of Advertisers
9.	MIB	Ministry of Information and Broadcasting
10.	MRC	Media Rating Council
11.	STB	Set-Top Box
12.	TAM	Television Audience Measurement
13.	TRAI	Telecom Regulatory Authority of India
14.	TRP	Television Rating Points