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BETWEEN AASTHA AND ZEE: MYSTERY OF THE MISSING MARKET FOR A WEATHER CHANNEL

**SATISH Y. DEODHAR AND
CHAYASMITA DEKA¹**

Abstract

Until a few decades ago, Doordarshan was the only channel which would broadcast TV programmes in black-&-white and that too for a few hours. It was a pure public good then, offered free of cost by the government. Today, however, from Aastha to Zee there are hundreds of dedicated private channels competing to offer news, sports, entertainment, and spirituality for a price. And still, there is not a single channel which is dedicated to 24-hour weather forecast. This is a clear case of market failure of the free enterprise system. The missing market for an exclusive weather channel is the result of perceived marginal private benefit to millions of individual farmers and other stakeholders being much less than the marginal social benefit accruing to the nation as a whole. Every year unanticipated weather patterns cause huge economic losses to food and agriculture and other industries and cause a great number of fatalities too. If IMD gives quick alerts to pilots and airports, and some private forecasters plan to give medium to long-term forecast to cricketing and other events, the same can be done for millions of farmers and other stakeholders of the economy. Therefore, government and the corporate sector may offer a 24-hour TV channel for weather forecast in the form of public private partnership (PPP). The weather forecasting infrastructure and data may come from

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government institutions such as IMD, C-DAC, and ISRO; professional content delivery and services of weathermen who deliver the content may come from TV media firms; and the break-even revenue may come through CSR activities of the corporate sector.

Key Words: Agriculture, Agro-Climatic Zones, Food Safety and Quality, CSR, Externality, IMD, India, ISRO, Marginal Social Benefit, Marginal Private Benefit, Media firms, Public Good, Television, TV, Weather Channel

JEL Classification: D62, H4, L82, L86, Q54

1. Market for TV Channels

Pure Public Good

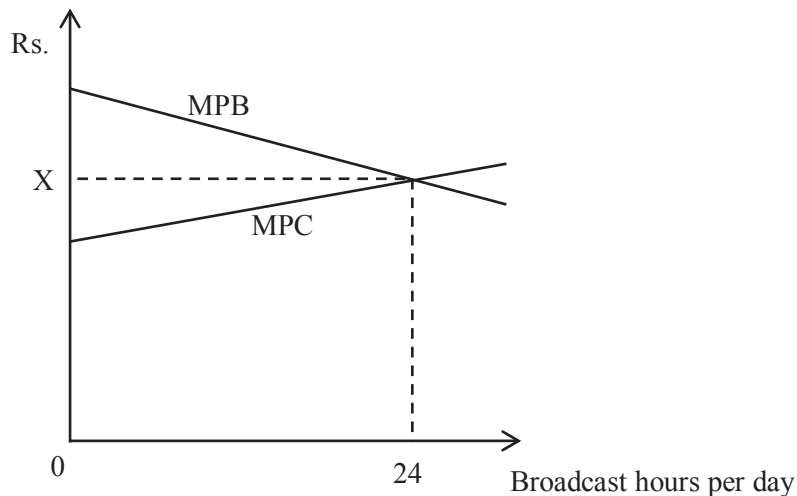
Quite a few of you would remember – More than a score years ago, television (TV) viewers in India had to be content with the monopoly of Doordarshan. Doordarshan was the one and only channel available for viewing on TV and it was owned by the state. Private firms would not have been able to offer this service to viewers then. There were two reasons for this. First, once viewers had access to TV sets and they were within the broadcast range, technology of that time made it practically impossible for private firms to charge a price for viewing the block the channel for non-paying free-riders. Second, unlike other goods that one buys from the market, if someone watched the channel on one's TV-set, it did not mean that the very same channel could not be watched at the same time by others from their respective TV-sets. Thus, Doordarshan was characterized by two features – non-excludability and non-rivalry in consumption. No private parties would have ventured into this business. It was a clear case of a market failure, where the service had to be offered for free by the government. As economists would call it, Doordarshan was a pure public good.

Competition in TV Media

Broadcasting technology has improved significantly since then. Today, the network of signal-carriage offered through satellites, towers, and cables remains a natural monopoly and telecom regulatory authority of India (TRAI) auctions the rights to signal-carriage to different media firms. Importantly, however, the newer technology is such that it allows media firms to offer content through multiple channels charging a price to viewers for each channel and excluding those who do not pay. Over the years the demand for television viewing has increased significantly and the technology-induced excludability feature has made it possible for media firms to make a profitable business in this market. Thus, the content provision service is no more a pure public good as Doordarshan used to be. In fact, these changes have introduced competition in the market for content provision and the broadcast space is inundated with channels. Free enterprise and competition has had its advantages – Viewers have a wide variety of channels to choose from, which broadcast myriad of combinations of news, sports, entertainment, and spirituality offered in various Indian languages and English. And, product differentiation among channels has meant that they are offered at different subscription prices.

Conceptually, the monthly subscription price and the hours of daily broadcast on a channel are decided by the perceived marginal private benefit (MPB) to a representative viewer in accessing an additional hour of broadcast and the marginal private cost (MPC) to a media firm in delivering an additional hour of broadcast. As shown in Figure 1, the MPB line and MPC line intersect each other at the combination of Rs. X and 24-hour broadcast level. At any level of broadcast which is lower than 24-hours, MPB to a viewer is higher than Rs. X and MPC to a media firm is lower than Rs. X. Therefore, from the point of view of the viewer and the firm, a 24-hour channel offered at Rs. X as the subscription fee maximizes both viewer benefit and firm profit. Of course, to the extent that channels air advertisements, we assume that MPB and MPC include the advertisement related information benefit to the viewer and cost reduction to media firm, respectively.

Figure 1: Provision of a TV Channel where $MPB=MPC$



2. Externality: A Source of Market Failure

In the entertainment segment itself, there have been a plethora of 24-hour paid channels dedicated to movies, movie songs, light music and dance, comedy shows, reality TV shows, and a few others; however, until a few years ago, there was no 24-hour channel dedicated to Indian classical music and dance. Free market and competition had failed to serve this genre of entertainment. Why this might have happened? As we understood from description of Figure 1 above, a channel will get provided on TV on the basis of MPB to a viewer and MPC to media firm. In most cases, MPB also coincides with marginal social benefit (MSB). Therefore, free

market and competition results in delivery of a socially desirable channels and hours of broadcast at appropriate prices. However, as originally argued by A.C. Pigou [1], if there is divergence between the MSB and MPB, then socially desirable level of a good or service will not get provided in the market. This divergence between the social and the private benefit is defined as an “externality” in the economics literature.

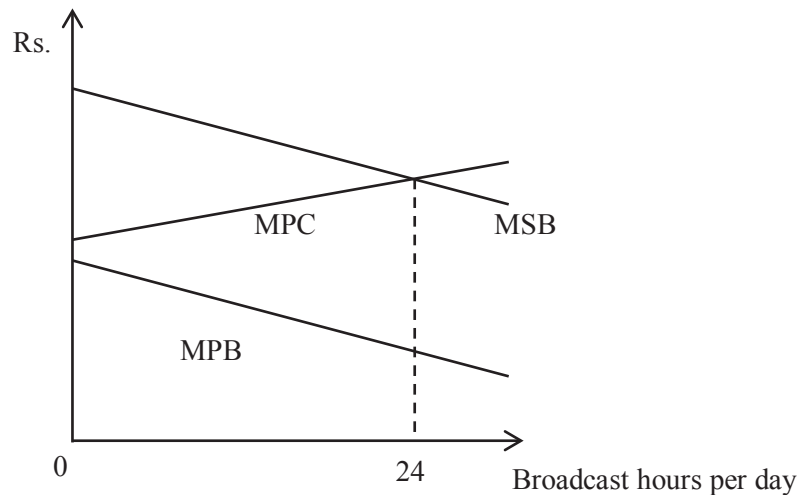
In the case of Indian classical music and dance, MPB of watching and learning from a channel dedicated to classical art forms would be limited to those who want to or have acquired a taste for classical music and dance. Their willingness to pay will be lower than MPC of offering such a channel, and, importantly, it will be much less than the MSB arising out of preserving and promoting Indian classical art forms. From the revenue point of view as well, there would be a limited numbers of potential subscribers to such a channel. Furthermore, channel will not attract revenue-generating advertisements since subscriber pool is very low. However, classical music and dance provides scientific foundation of and inspiration for the continued evolution of folk, light, and semi-classical art forms. It also represents the rich heritage of Indian tradition that has been preserved going back to many millennia. Therefore, though MSB of classical art forms is very high, left to free market and competition, MPB (& MPC) alone does not contribute to offering a dedicated 24-hour TV channel for Indian classical music and dance. The positive externality arising out of promotion of classical music and dance does not get internalized by free market².

The graphical presentation of the positive externality associated with classical art forms on TV channel is made in Figure 2 below. If left to free market, MPB and MPC never intersect, for MPC is always higher than the MPB. Therefore, free-market will not offer a dedicated channel for classical music and dance. This channel will be missing from the plethora of paid channels offering news, sports, entertainment, and spirituality on TV. However, Figure 2 also indicates that the MSB of such a channel can be very high. If one considers the MSB of watching such a channel in relation to MPC of offering such as channel, then there is a market for a 24-hour

² A standard example of externality is provided in terms of cost of pollution. When a firm produces steel, it generates and releases smoke in the environment. The social cost of steel production is very high as the smoke pollutes the environment. And still, the firm will produce too much steel than what is socially optimal, for the cost of environment pollution does not enter the profit and loss account of the firm. Therefore, this externality is internalized by government levying green (pollution) tax or deciding on limiting production of the firm. Ban on consumption of drugs and alcohol or high taxes on alcohol are some of the stylized policies aimed at internalizing the negative externalities associated with consumption of drugs and alcohol.

channel for classical art forms. The recognition of relatively higher MSB implies that the externality has to be internalized by either government providing such a channel, government subsidizing private media to offer such a channel, or offering such a channel through corporate social responsibility (CSR) funding.

Figure 2: Divergence in MPB and MSB for TV Channel



Today, while most TV channels are priced and have a huge subscriber pool, a new channel titled “Insync”, dedicated to Indian classical music and dance has been offered free of cost. This channel is offered free and exclusively on Tata Sky Channel No. 833. The channel was started by an Indore based visionary musician Ritesh Tagde, founder of Perfect Octave, a company that emerged from its earlier avatar, Sarasvati Sangeet Vidyalaya. The channel would not have had a large pool of subscribers compared to other channels. The channel, however, appeals to CSR initiatives of firms and seeks advertiser funded programming (AFP). Aditya Birla Group has been supporting the channel programmes as part of its CSR initiative. Presence of Insync channel is a recognition of the fact that unless the strong positive externality is internalized, free completion would lead to a missing market. By offering a free channel through CSR, private sector has turned Insync into a pure public good without government intervention! The case for a dedicated weather channel on TV seems very similar and perhaps much more urgent. There is a missing market for a 24-hour weather channel on Indian TV. I take up this aspect next.

3. Demand for Weather Channel

Today, from Aastha to Zee, not 26 but hundreds of channels are offered on the Indian TV round the clock. However, there is not a single channel dedicated to 24-hour weather forecasting. Somehow, free-market and competition has failed to contribute to starting such a channel among the run-of-the-mill paid channels. Therefore, the questions to ask are – Is there a case for sufficient benefit accruing due to a weather forecast channel, and, whether or not there exists an appropriate technology to offer a 24-hour weather channel on TV. As described below, one can think of three aspects of weather variations which point to the latent but huge demand for a dedicated weather channel.

Dynamic Weather Variation

India is one of the world's most disaster prone countries. Variability in her climatic conditions over time at a given place coupled with high degree of socio-economic vulnerability implies that losses due to extreme weather changes are very high in India. As per the Germanwatch report, in terms of impact of extreme weather, India's material losses to GDP in the year 2013 were valued at 15 billion PPP US Dollars; she had ranked 3rd on the criteria of overall Global Climate Risk Index, and worse, with a loss of 7437 persons she had ranked 1st on the criteria of disaster fatalities [2]. Importantly, in countries like India, not even 10 per cent of direct losses are insured. These losses show that there must be demand for weather forecast services which has not been met so far. Dynamic variation in weather patterns in the otherwise seasonally stable climate of a particular region does occur once in a while but it is highly unpredictable. For example, in an otherwise stable climate condition, there could be sudden cloud burst in Himachal Pradesh, flash floods in Kerala, cyclone in Eastern peninsular states, massive hailstorms in the parched Deccan plateau, tormenting rains in Western ghats, or loo (hot, dry, dusty, strong winds) sweeping northern plains. A detailed list of such weather related adverse impacts are documented by Indian Council of Agricultural Research (ICAR) in its Handbook of Agriculture [3]. Such dynamic variations in weather patterns for any given region imply that all stakeholders could alter their decisions depending upon early warning weather forecasts. National resources saved as a result of such adjustments would be in billions of rupees and thousands of lives.

Disaster management efforts have significantly improved in India in the recent past. Anticipatory relief operations in Orissa during cyclone Fani in May 2019 were exemplary.

However, such disaster management presupposes pro-active anticipation of adverse weather conditions not just by government but by all stakeholders. It is not just about Orissa that billions of rupees could have been saved for the people and the country. Similar situations arise in other parts of the country at irregular intervals. For example, if the city of Mumbai knows with 70 per cent chance that it will be hit with stormy rains in the ensuing 48 hours; stakeholders can adjust their activities in all walks of life and save themselves, city administration, and the country a whole lot of inconvenience, financial loss, and fatalities. Same would be true in other cities, towns, and importantly for farming communities in rural areas across the country. For example, with extreme changes in weather, crop yields are lowered significantly and agricultural produce becomes more vulnerable to spoilage. In a developing country like India, such spoiled produce ends up in the food chain raising food safety concerns.

Micro Weather Variation

Similarly, it is not just about extreme weather conditions that people are concerned about. Forecast is equally important for knowing unusual weather patterns which may not necessarily be in the nature of extreme natural disasters. For example, if there is a good likelihood of an unseasonal light rain, high humidity or mild frost; a groundnut farmer is more likely to advance harvesting prior to such weather change; else the farmer runs the risk of having higher levels of fungi in the groundnut pods. High levels of fungi, in turn, contribute to high levels of aflatoxins in the groundnut inside the pods. Higher levels of aflatoxin in groundnut is a health hazard, for the aflatoxins finds their way in the food chain through processed groundnuts, animal feed, *chikkis* and peanut-butter purchased by consumers. If the groundnut, animal feed, and/or peanut-butter are being exported, exporters may face non-tariff barrier due to stringent permissible limits on aflatoxin by the importing countries. This has happened to quite a few Indian firms who export peanut-butter.

Similar instances can be given for other crops in terms of quality, safety, and wastage of produce. It is not just groundnuts but crops such as wheat and maize are also affected by aflatoxins due to sudden hot and humid conditions. Sudden warmer conditions are also congenial for increase in fly and insect population. Risk of diarrheal diseases increase when such flies and insects carry bacteria from animals and faeces and land on meals. According to World Health Organization (WHO), food contaminated with bacteria, viruses, parasites, toxins,

or chemicals causes 420 thousand people to die every year and more than 0.6 billion people fall ill. One estimate suggests that about \$95 billion are lost due to low productivity caused by unsafe food in low- and middle-income economies [4]. Farmers are an extremely intelligent group of people. What they need is timely information. In the absence of early-warning weather information, they are unable to readjust their farming activities. Thus, forecasts about unseasonal micro weather variations can save losses across the agricultural value chain. Also, a medium to long term forecast of drought or late monsoons can help farmers plan delayed sowing and other farm activities or even advance their plans for installing drip irrigation on their fields. In fact, ability of real-time adjustments in plans by various stakeholders in anticipation of adverse weather conditions may lower insurance premiums due to lower expected losses.

Spatial Weather Variation

India is a country of continental proportions and geographical diversity. If there are deserts regions ranging from Kutch, Rajputana, to Ladakh; there are tropical rain forests along the Malabar coast, Konkan, and the parts of North-East. If there are alluvial riverine plains ranging from Punjab, Bihar, to Bengal; there are tropical hilly areas like Sahyadris, Aravalis, and Vindhyas. Similarly, if there are vast dry-lands of the Deccan, there are snow-clad mountainous terrains in Himalayas and the Shivaliks. These differences mean that there is spatial variation in weather conditions across the country at any given point in time. They reflect weather variations in terms of temperature, humidity, fog, rainfall, wind-movement, exposure to sun, and a few more parameters. Therefore, accurate weather prediction is important for traders and tourists, businessmen and bureaucrats, rail-passengers and road-transporters, postal servicemen and pilgrims, and many more; who travel throughout the length and breadth of the country. All these itinerant stakeholders can alter their travel plans if they anticipate destination weather conditions well ahead of time. National resources saved as a result of such adjustments would be in billions of rupees per year.

Private Benefit Vs Social Benefit

Clearly, there must be a latent demand for a 24-hour TV channel on weather forecasting. The potential for such demand is also supported by the fact that as early as in 2007, more than 50 per cent of Indian households had personal or community based access to TV [5]. Today this access is substantially higher. However, the latent demand and access to TV does not get translated into existence of a 24-hour weather channel. This happens because the expected private benefit

perceived by each stakeholder for the isolated cases of adverse impact is too small to demand and pay for a 24-hour weather channel. However, with the network of economic activities and the value-chain linkages across primary, secondary, and tertiary sectors within the country and the rest of the world; the integrated social benefit to a stakeholder of a dedicated 24-hour weather channel would be much higher than the narrowly viewed private benefit perceived by the stakeholder individually. This is a stylized case of MSB being much higher than MPB. There is positive externality in offering the service of a weather forecasting channel on TV. The 24-hour weather channel can be considered as a merit good, where if market is left to itself, free competition would fail to internalize the positive externality.

As depicted in Figure 2, MPB and MPC would be such that a market for 24-hour weather channel remains missing from hundreds of channels that clutter the TV set. However, if one considers the MSB in relation to the MPC, then there is a strong case for 24-hour weather channel on TV. In the earlier section, the divergence between MSB and MPB for a channel on classical art forms was based on the perceived or intangible higher social benefit which could not have been measured in rupee terms. In the case of weather channel; however, the MSB can be measured in the form of saving integrated economic losses to affected stakeholders in the value chain as also the attendant fatalities. This only highlights the urgency of having a 24-hour weather channel on TV. Of course, one may understand the demand for weather forecasting services; however, a pertinent question to ask would be – Why provide weather forecast through a 24-hour TV channel? Aren't there other sources of dissemination of weather forecast? I turn to this issue next as I discuss the supply side of weather forecast service.

4. Existing Supply of Weather Forecast

Newspapers and TV News

The traditional way of providing weather information has been through the newspapers. Some readers would recall that decades ago newspapers would report previous day's maximum and minimum temperature in the leftmost column of the front page. This was no forecast. This was akin to driving a car by watching in the rear-view mirror! That practice still continues now but in somewhat improvised form, where newspapers like Times of India give forecast of maximum and minimum temperature for the day, if not for the previous day. This kind of information is

hardly useful to most stakeholders except that it creates occasional buzz among the people at work with spurious discussions on that day's temperature and 'climate change'.

TV news channels do not offer anything better. A few minutes spent on weather information give a brief overview of temperatures at various cities in India. A simplistic animation image of a truck with the logo of the sponsoring firm moves around the map of India giving maximum and minimum temperatures at different cities for the day gone by. Perhaps the TRPs (television rating points) for a channel increase only when they repeatedly show the devastation caused by an extreme weather condition in one part of the country or the other. But then, this is no weather forecasting. DD Kisan and Krishi Darshan programmes on government TV channel do provide information on various developments in agriculture, but again, they hardly focus on dissemination of early-warning weather forecast.

IMD and C-DAC Websites

India Meteorological Department (IMD) of Ministry of Earth Sciences has up-to-date information on its website and provides forecasts of various durations [6]. INSAT 3D and IMD radars show real time lightning images and 5 day forecasts in their All India Weather Warning Bulletin posted on the website. Similarly, extended forecasts and outlook for next two weeks are also provided. However, most citizens do not know that they can access such information from IMD website. Government offices are not expert in marketing their services! Moreover, even if one visits the website, one finds that information is not user friendly. One finds computer graphs, detailed bulletins in small font in English, and some visuals of India's map with many icons and colour-mappings which require understanding of the associated technical terms, legends, icons and colours. Even if one were a smart citizen who can navigate effectively on the website, he/she will feel inadequate to search for exact hot-link to get forecast for a particular town for a particular period. Clearly, the website is not user-friendly even if one were to know that such website exists. Similarly, Agromet, the Agricultural Meteorological Division's website has similar features of inaccessibility and some of its hot-links takes one back to IMD site itself.

Centre for Development of Advanced Computing (C-DAC), the research and development arm of the Ministry of Electronics and Information Technology also offers a Website titled Anuman which gives weather forecast [7]. It provides hour to hour weather forecast over 50,000

locations using a weather model generated using its PARAM Supercomputer. Three-day forecast on rain, humidity, and temperature are also offered. C-DAC also uses Weather Research and Forecast (WRF) model of National Centre of Atmospheric Research (NCAR), USA [8]. This model is used to give high-resolution weather simulations as a decision support for various user stakeholders. In fact, Anuman is now also available on mobile. However, Anuman too faces similar challenges in terms of its accessibility and use by citizens. A stakeholder is not given a pro-active early warning but he/she has to constantly look up Anuman to see if any adverse conditions are emerging. Engagement of farmers with the Kisan Call Centres established by Ministry of Agriculture is very similar. It is the farmer who has to call to know the weather. This approach is extremely inefficient. To give a simile, if one wants to get up early in the morning at 5 am, one does not disturb one's sleep by constantly checking for time every hour. One goes to bed peacefully with the confidence that the alarm will go-off at the opportune time. Something similar must happen to weather forecast, where a pro-active early-warning gets issued to relevant stakeholders in different regions.

Forecast for Airlines and Cricketing Events

It must be noted that airports and pilots need latest updates on weather forecast. Too much is at stake if civil aviation industry (as also air force) ignores weather updates. Low and behold, IMD does offer meteorological services for civil aviation. Significant Meteorological (SIGMET) information is transmitted by IMD from its meteorological watch offices, flight information centres, and area control centres to aircrafts in flight. At the aerodromes, prior briefing is available and depending on the weather situation, meteorological officer may insist that the pilot in command of a flight be present personally for briefing [9]. Thus, weather forecast in real time is provided where there is an obvious expression of societal requirement. In fact, as we write, private Indian weather service providers such as Skymet Weather Services, Express Weather and Weather Risk Management were toying with the idea of helping major private event organizers to skirt potential disruptions by scheduling events at a particular location and time based on weather forecast. Skymet Weather Services, in particular, was working on a pilot project for a major cricket league [10]. These initiatives show that whenever MSB gets adequately revealed in the market through MPB, weather forecasting services get offered. As described earlier, that has not been the case with millions of farmers and other stakeholders spread across the country. Importantly, however, if airline pilots can be provided with quick alerts and cricket organizers

can be provided with medium to long-term forecast, the same can and must be done to millions of farmers and other stakeholders in the economy.

5. A Free Dedicated TV Channel for Weather Forecast

Area Delineation and Weather Data Sources

Fortunately, efforts have already been made to delineate major agro-climatic regions of India. The regions are delineated on the basis of climate, natural vegetation, soil, and other physiographics. During the 7th Five Year Plan, 15 such agro-climatic regions were identified. These 15 regions were further sub-divided into 127 Agro-climatic Zones (see Figure 3) through the National Agricultural Research Project (NARP) initiated by ICAR. The delineation of zonal boundaries is in terms of districts, talukas and tehsils, or even their further sub-divisions. Similarly, there are 263 Agromet observatories of IMD across India which collect weather data on a daily basis.

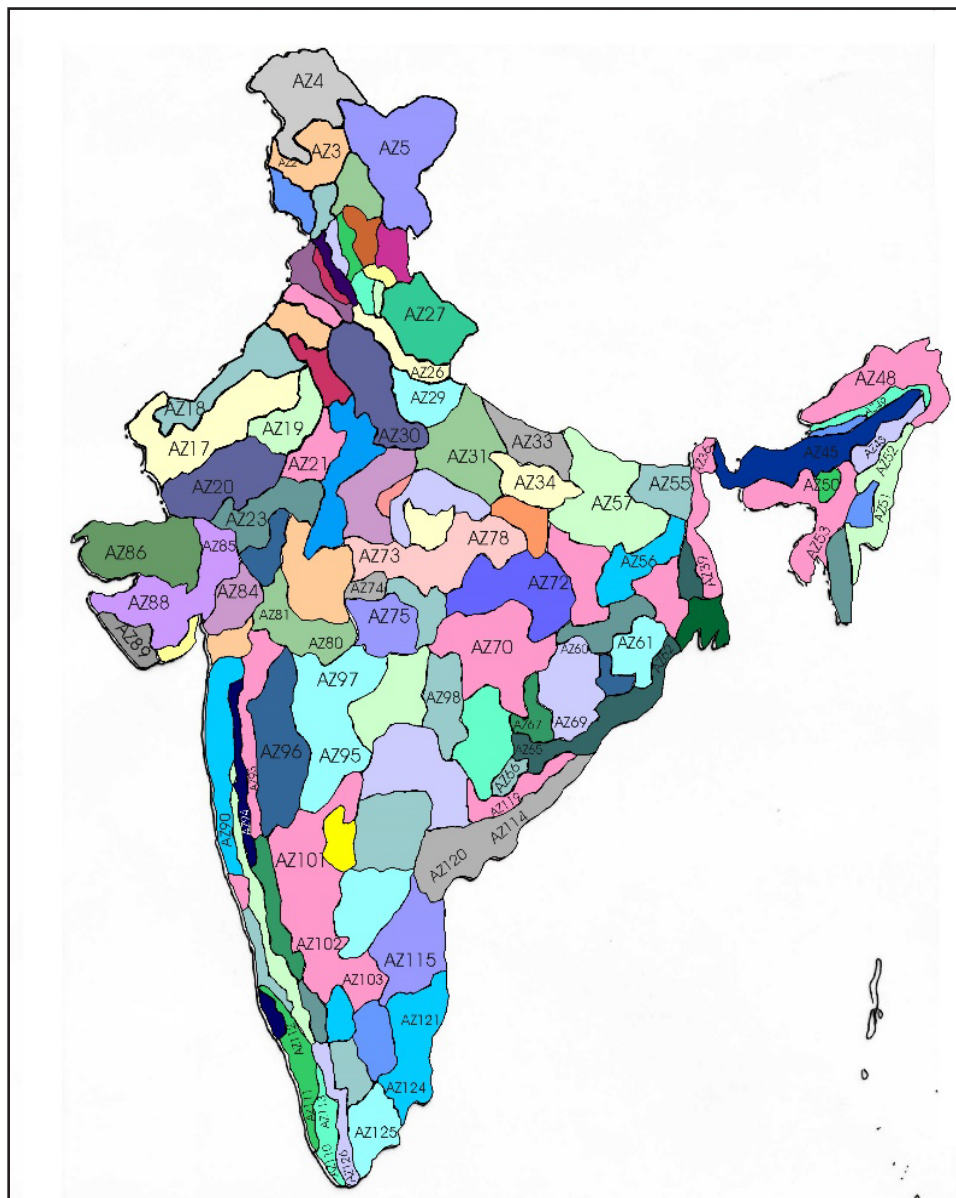
As mentioned in the previous section, IMD and C-DAC have a robust on-ground data collection infrastructure and forecasting models. Of course, one cannot forget the role played by Indian Space Research Organization (ISRO) in collection of data for such institutions. For example, ISRO satellite Oceansat-2, among other things, provides data for forecasting of sea state, sea surface wind vector, coastal climate and weather. Similarly, INSAT series of satellites have been providing data for understanding cloud motion, cloud top temperature, vapour content, and facilitates rainfall estimation and cyclone tracking. Moreover, ISRO has also designed and developed ground-based observation systems such as, Automatic Weather Station (AWS), Agrometeorological Tower, Doppler Weather Radar (DWR) as well as Vertical Atmospheric Observations System. These ground-based systems augment the space based observations of ISRO [11]. Therefore, an integrated approach to weather forecasting can be adopted, where IMD, CDAC, ISRO and NARP come together to develop hourly, 6-hourly, 3-day, 5-day as well as the medium and long-term forecasts for all 127 agro-climatic zones of India.

TV Content and Delivery

Importantly, coordinated efforts of IMD, CDAC, and NARP should be translated into real-time user-friendly computer generated moving graphics which can be broadcast on TV on a dedicated TV channel on an on-going basis. The key to the successful content delivery would be to show

moving graphics of the forecasts that are made at the national, state, district and taluka level. The moving graphics could capture prospective movements of winds, humidity, precipitation, temperatures and other parameters using viewer-friendly visuals and legends superimposed on intended maps. Zoom-in and zoom-out features could be incorporated between macro and micro level forecasts. Importantly, well trained professional weather-news

Figure 3: NARP Agro-Climatic Zones in India



Source: <http://www.imdagrimet.gov.in/node/290>

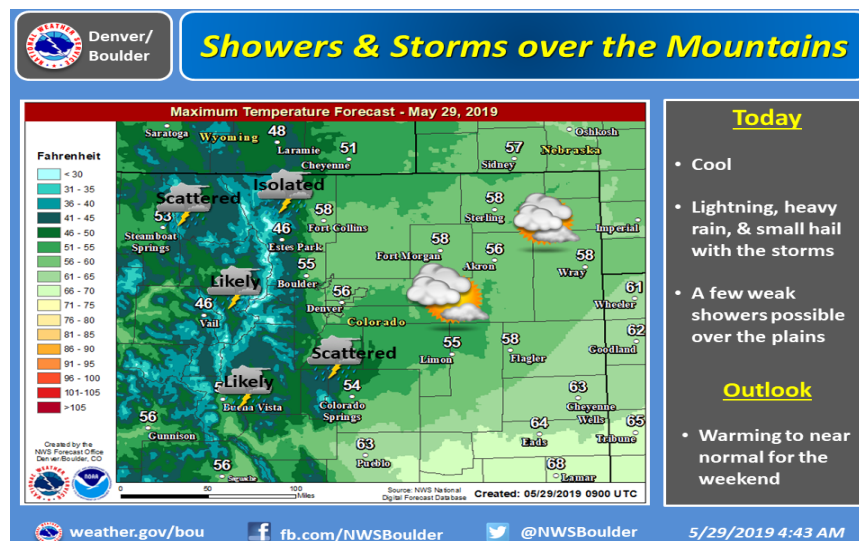
anchors should be employed to convey the forecasts while the moving graphics of the forecast get displayed. Representative snapshots of a typical macro and micro level weather broadcast on US TV are shown below in Figures 4 and 5, respectively. This approach would serve the stakeholders much better than populating IMD and C-DAC websites with statistical numbers, technical jargon, and scientific graphs.

Figure 4: A Macro Weather Forecast using Moving Computer Graphics



Source: Internet images

Figure 5: A Micro Forecast at Local Level using Moving Computer Graphics



Source: Internet images

A half-an-hour module could include the general macro weather forecast at the global and national level for 5 minutes, state specific forecasts for 5 minutes, and taluka-level forecast for another 5 minutes. About 10 minutes could be spent on agricultural issues, farming practices, and general news. Finally, about 5 minutes could be reserved for advertisements or infomercials of the sponsors. While the duration of sub-modules can be calibrated to suit topical local needs, the full half-an-hour module can be broadcast sequentially in Hindi, English, and the state language. Moreover, this package of 3-language 1.5-hour weather forecast can be replicated throughout the day with real-time updates of the weather across the country. As mentioned in the earlier sections, India being a country of continental proportions and vast geographic diversity, crucial weather changes would always affect one part of the country or the other. Therefore, as the adverse weather conditions get developed in a particular region, district, or taluka; flash news can be broadcast at the local level through the weather channel. Importantly, a marquee could run on other channels in the specific local area requesting viewers to check the weather channel. Children, parents, grandparents, friends, relatives, or even acquaintances, on reading the marquee while watching their popular TV shows would certainly alert others regarding the impending weather disturbance. In fact, viewers may just develop a habit of viewing weather channel while surfing through their popular shows and channels. Alerts through SMS and social media could also be sent to registered users requesting them to visit the weather channel. Such pro-active, real-time weather service reaching out to communities would be extremely helpful to all stakeholders in general and farmer community in particular³.

A Broad Business Model

As described earlier, 24-hour weather channel is characterized by positive externality in terms of substantive social benefit which free market fails to internalize. Therefore, the aim would be to offer a weather channel free of cost to TV viewers. One possibility is that the channel is offered

³ The Weather Channel (TWC), a US firm based in Atlanta, Georgia does offer a dedicated weather forecast channel. It complements it with documentaries and entertainment programming related to weather. As of September 2018, the Weather Channel was received by approximately 79.128 million US households that subscribe to a pay television service. This number compares very well with CNBC and FOX News having viewership of about 87 million households. Its sister network Weatherscan offers 24-hour automated local forecasts and former parent company, a part of IBM, offers mobile apps and online website for weather forecast [12].

on the lines of Doordarshan as a government sponsored public good. However, one may be apprehensive about government's efficiency in coordinating various stakeholder institutions and matching the professionalism of the private sector in the content delivery mechanism. This would include showcasing timely and user-friendly moving graphics of the forecast and its anchoring by professional weathermen. The other possibility is that the channel can be offered free of cost by private sector alone through its CSR initiative as has been the case with Insync channel for the Indian classical music and dance. However, it may not have best access to weather forecast infrastructure and data which the government institutions such as IMD, C-DAC, and ISRO have.

The third option and a more viable one would be to offer the free weather channel in a public-private partnership (PPP) framework. Of course, the core weather forecast infrastructure and data would come from the government owned organizations such as IMD, C-DAC, and ISRO. Broadcast of professional services of the weathermen and the moving graphic imagery of the forecast on the TV channel could best come from private media agencies. The break-even revenue could partly come from government, or better still, through CSR initiatives of private sector sponsors. Since agriculture is substantially impacted by weather, co-sponsors could include successful agribusiness firms which specialize in production of agricultural inputs such as seeds, fertilizers, pesticides, tractors as also the ones which specialize in FMCG food products. They could very well advertise their products and services which will be beneficial to farmers in getting latest information on farm products and practices. Of course, the sponsors need not necessarily be the firms involved in agricultural sector.

Development of such a free weather channel would be a watershed contribution in terms of provision of a merit good through a PPP framework and turning weather channel into a pure public good. With easy and universal access to TV among the masses, such a channel will save billions of rupees in economic costs and thousands of fatalities.

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