

ISALPI

IIMA-SFarmsIndia Agri Land Price Index

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Abstract

This white paper describes the nature, uses, method, limitations, and potential future works related to the IIMA-SFarmsIndia Agri Land Price Index (ISALPI) launched during the second quarter of 2022. It also provides a brief primer on popular indices. After several rounds of discussion, SFarmsIndia, a Hyderabad-based Agri Land (Online) marketplace, signed a memorandum of understanding (MoU) with the Indian Institute of Management Ahmedabad (IIMA) on 25 November 2021. The MoU laid out the blueprint for a collaborative research project on pricing of Agri Land parcels listed on the SFarmsIndia platform. SFarmsIndia agreed to share new land listing data with IIMA on a regular frequency. IIMA agreed to explore the idea of developing an Agri Land Price Index for India based on the SFarmsIndia data. The first batch of data included over 6,000 listings across several states of India starting the January of 2019. For a meaningful index, we selected data from the six states: Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Telangana, and Uttar Pradesh. These states offered a critical mass of listings adequate to be included in the index formation. Currently, the aggregate of these six states is posited as the National ISALPI. As more data is generated, ISALPI will be expanded for wider and more granular geographic coverage. The ISALPI index is based on a hedonic pricing model on a monthly frequency of land listing data and could be treated as a “Constant-Quality Agri land price Index for India.”

Background

“अल्लाह मेरे खेत की शादाब फ़िज़ाएँ; आती हों जन्नत के दरियों से हवाएँ”

[Thank god for the fresh breeze coming from my lands, as if they are blown straight from the windows of paradise. -Unknown]

Agriculture represents nearly 60% of the employed force in India, and land stays central to agricultural activities. In 2016, India was home to nearly 200 million hectares of cropped land with an average landholding of 1 hectare (2.5 acres approx.) per household¹. The National Sample Survey Organization (NSSO) Report² 587 suggests that nearly 80% of the agricultural households are self-employed, with most (70%) involved in crop production. Beyond production and employment, agriculture also contributes to capital formation. According to NABARD, agriculture contributed over 7% of gross capital formation (GCF)³ during 2019-2020. The gross value added (GVA) of agriculture is growing roughly at 3-4% per year.⁴ However, the pace of growth in agriculture is surpassed by the growth in the manufacturing and service sectors. Agriculture contributes less than 20% to the national GDP, despite claiming a majority of the national workforce.

Importance of Tracking Agri Land Prices

Agri Land has been an asset-class in flux. Although India contributes only 2.3% of the world's land area, it has 17% of the world's population (Patel, 2015). Nearly 4% of the world's cultivable land in India feeds a disproportionately large part of the world population. Yet, the representation of cultivable Agri Land in India has witnessed shrinkage -although marginal- in recent years⁵. Some of this shrinkage is attributed to factors such as loss of ground water and climate change⁶. Besides, the green revolution of India during the latter half of the twentieth century was blamed for the widespread use of chemical fertilizers and genetically modified crops (Prabhu, 2012) that led to depletion in soil-quality. In peri-urban and sub-urban areas, Agri Land is fast converting into real estate, as an unavoidable side effect of urbanization (Govindaprasad & Manikandan, 2016). However, according to Hinz et. al. (2020): “agricultural

¹ The landholding per household has almost halved in the last fifty years. In 1970-71, it was around 2.28 hectares.

² https://www.mospi.gov.in/documents/213904/301563/Report_587m1631267040957.pdf/

³ GCF is a measure of the net new fixed capital formation in an economy. GCF = Gross fixed capital formation + Δ Inventory + (Acquisition – Disposition) of valuables

⁴ Data sourced from

<https://nabard.org/auth/writereaddata/tender/2901194931Average%20Size%20of%20Land%20Holding.pdf>

GVA reflects the state of the supply side (producers) of an economy whereas GDP relates to the demand (consumer) side.

⁵ <https://www.thehindubusinessline.com/economy/Cultivable-land-in-India-shrinking/article20113643.ece>

⁶ <https://www.scientificamerican.com/article/as-land-degrades-india-struggles-to-save-its-farms/>

lands [in India] are likely to expand, and existing farmlands need to be intensified.” Indeed, in some parts of India such as Varanasi, the agricultural land area increased by 40% between 1993 and 2013 (S. K. Patel et al., 2019). Nevertheless, the average land holding per household has been shrinking due to increase in population and division of landholding over the generations of a family.

The Need for Tracking Agri Land Prices

For agricultural households, the land possessed is a critical component of wealth. In financial terms, however, operating Agri land may not create adequate additional wealth. For example, the annual yield from crop farming is often as small as 1-2%. On the other hand, land, as a resource, gets scarcer with the increase in population. Thus, land price appreciation is the dominant way for landowners to track their wealth. As the majority of the Indian population is still agriculturally based, the question of tracking land prices over time is an important policy goal. Beyond a passive tracking of an Agri Land owner’s wealth locked in the land parcels, there are several other motivations for developing ISALPI, some of which are listed below:

1. Several states, such as Andhra Pradesh and Kerala, came up with policies to support organic farming. An increased awareness and government support policies towards the Environmental, Social and Corporate Governance (ESG) goals has led to increased enthusiasm for organic farming in India and has opened new doors for innovative Agri entrepreneurship. Thus, the interest in Agri land is expanding from agricultural households to a breed of new-age entrepreneurs in numerous allied areas: Agricultural engineering, crop protection technology, precision farming, food technology, supply chain management, green energy, and agricultural education, among others (Bhooshan & Sharma, 2021)⁷. With sustainable irrigation, it is possible to protect farm land (Lichtenberg, 2008). These entrepreneurs’ proposition to offer support/ partnership to Agri Landowners, necessitates transparent the valuation of land parcels.
2. Depletion of vegetation lends as much importance to Agri land as to real estate development. For example, In Varanasi, an 86% decrease in vegetation meant a 40% increase in Agri land, but a 350% increase in built-up area (S. K. Patel et al., 2019). Besides, in peri-urban areas agricultural land conversion (ALC) to urban land has led to several studies that call for Agri land protection. If Agri Land parcel prices shoot up too fast

⁷ This trend is espoused by world-class educational programs. For example, IIM Ahmedabad’s agribusiness program is globally ranked one, and two other Indian-based programs rank among the top 50.

compared to the benchmark index, it could be a signal for potential conversion into real estate. In some cases, the conversion may be financially prudent for the landowner. In other cases, such conversions may warrant policy interventions. In either case, the role of tracking price movements is a critical exercise.

3. Diminishing farm sizes pose a threat to the yield and profitability of Agri Landowners (Eastwood et. al., 2010). This points towards the need for building an economy of scale by aggregating multiple contiguous land parcels (“collective farming”⁸), potentially with the help of third parties. Conflicts may arise from uncertainty in valuation of various land parcels aggregated into one unit for cultivation purposes.
4. Farmers may need to buy or sell land parcels for various reasons. A thriving farmer may wish to acquire suitable land parcels at fair prices. In some circumstances, the landowner may wish to sell their land on their discretion. More transparency in Agri Land price movement offered by a price index will ease all such transactions. In other cases (e.g. regulatory taking for highway construction) wherein a landowner may have to trade their landholding for a “fair compensation”, a price index may help reduce litigation costs.

The Challenges with Creating a Land Price Index

There are centralized marketplaces for goods (e.g. Amazon), services (e.g. Fiverr), or assets (e.g. Bombay Stock Exchange). Some items being sold may be homogeneous, e.g. toothpaste tubes of a specific brand and batch, or securities (e.g. common stocks of a company). Yet, several goods (e.g. computers) or assets (e.g. homes, artworks, land parcels, etc.) of the same type sold within a market may be different from each other significantly.

Consider some examples. No two homes are exactly alike: They may differ in orientation, location, and several other characteristics. Even within a brand and make, a buyer may customize her car to differentiate from other buyers. Two paintings by the same painter will not be the same even if the painter endeavours to replicate his work: It may differ in the quality of canvas (or paint), brush strokes, or in more abstract terms (e.g., the first one may have the “novelty/premier” status while others will not). Similarly, two land parcels can never be identical: They will differ in their geographic coordinates, access to amenities (e.g. roads, views, sunlight) even if they are sub-plotted from the same parcel. Pricing homogeneous assets (e.g. stocks, bonds), therefore, is a different type of exercise compared to pricing heterogeneous assets (e.g. land, artwork, homes, etc.). As the assets are not identical, one may easily argue

⁸ <https://krishnagiri.nic.in/scheme/collective-farming/>

that the price differential observed between two items is due to differences in the attributes between these assets, and not because the underlying supply-demand conditions for the asset class have fundamentally changed.

Applications of ISALPI

A price index reflects the systematic change over time in the price of the asset class. For example, the NIFTY50 recorded at the closing date of each month reflects how the prices in the biggest 50 stocks listed on the National Stock Index have evolved over time.

On the other hand, by developing the price index of a heterogeneous asset class (e.g., land), we are primarily interested in observing how the market forces related to supply and demand affect the price of a fundamental asset class common across all the items in a sample. Rather than a specific list of assets such as in a stock index, the asset class may be relatively abstract such as “paintings by modern artists”, “agricultural land parcels in Telangana”. Through abstraction, our interest is focused on an overarching asset class rather than the price movement in a single asset, or a set of them.

Existing landowners may use the index to assess how the valuation of their holdings have evolved over time. Sellers and buyers could use this information to assess the historical risk and return and predict these metrics for the future to prudently decide on their buying/selling decision. Fund managers and producers could use this information to broadly benchmark their own performance⁹. Uncertainty in price movements increase the cost of financing or insuring the underlying assets. The transparency offered by the land price index may not only reduce the underwriting costs to financial institutions, the financial market products (insurance, mortgage, etc.) the availability and cost of financial products will improve for the landholders.

Researchers could use this information to study how economic events and factors are associated with price movements in a specific asset class. Policymakers (e.g., the Central bank) may use it to modulate their policies. Benchmarking land price movements in rural or semi-urban areas to a standard land price index will signal the potential conversion of agricultural land into real estate. The index is useful for governments in reducing litigation cost by offering fair price to land owners when acquiring them for public use (e.g. highway). The index also interests policymakers, local governments, environmentalists, entrepreneurs, investors, and financiers.

⁹ However, we recommend avoiding using this index for performance appraisal of such managers. See the FAQ section for more details.

A Short Primer on Indices

As stocks (and other such assets) are homogeneous, creating their indices is a relatively simpler task: It involves calculating a weighted average of the items included in the index data. Such an index movement reflects the change in supply and demand factors for such stocks that led the prices to go up or down over time. Creating such an index by aggregating the transactions of heterogeneous assets is a challenge. Simpler methods are prone to some serious errors, as described below:

Average Price Index:

Method: Prices of land parcels (per acre) sold in a quarter are averaged. The average serves as the index for that quarter.

Advantage: Simple to calculate. All one needs is to aggregate the sale information of land parcels and calculate the average price per acre. The averages could assign equal weight to all the observations in a quarter (equally-weighted), or assign a higher weight to pricier assets (value-weighted).

Disadvantage: The change from one quarter to the next may be driven by differences in the attributes of the land parcels rather than the fundamental shifts in the demand and supply factors of the underlying asset class (i.e. Agri Land). For example, in one quarter, only large parcels near the airport were sold. The next quarter was dominated by small-sized parcels far from the airport. The fall in price across these two quarters may not necessarily reflect a fall in the net demand for Agri Land parcels. The issue of size may be addressed by reporting the average price per acre. Still, the dominant role of other asset attributes in price differences can mislead the inferences. The price differences could have been due to the difference in proximity to the airport, irrigation facility, type of produce, etc. These differences may be random but correlated with land prices. In other words, the observed changes to the index may be “confounded” by factors other than the supply-or demand-related factors of the land parcels included in the data.

Another major problem with such an index relates to outliers. For example, a small number of large land parcels close to an airport sold at extremely high (or low) prices may skew the index unfairly towards themselves.

Median Price Index:

Method: Prices of land parcels sold in a quarter are sorted in ascending/descending order. The price in the middle (i.e. the median) serves as the index.

Advantage: It is simple to calculate. All one needs is to aggregate the sale information of land parcels and calculate the median, per acre price of land. Calculating the median addresses the problem of outliers.

Disadvantage: The land parcel on which the median is based may not be representative of all parcels sold in the quarter. The problem of “confounds” persists.

Hedonic Index:

Method: A critical mass of heterogeneous assets sold over time are sampled. Each time period (e.g. month) - for which an index is desired- should be well represented in the data. A pricing model is developed that allocates asset price to (1) its own (hedonic) characteristics and (2) a “drift” allocated to the time. The hedonic part (1) of the model controls for variation in prices due to heterogeneity in characteristics across the assets. The residual variation is attributed to time (month) as a “constant-quality” drift in the pureplay asset class.

Advantage: One of the most efficient methods to exploit data from markets with less frequent trading.

Disadvantage: Specification of the hedonic pricing model may not be perfect. The method also assumes that the model is stable over time, however, the market’s preference for hedonic characteristics may change over time (although gradually).

The following table (Table 1) provides a survey of various land price indices developed in different parts of the world:

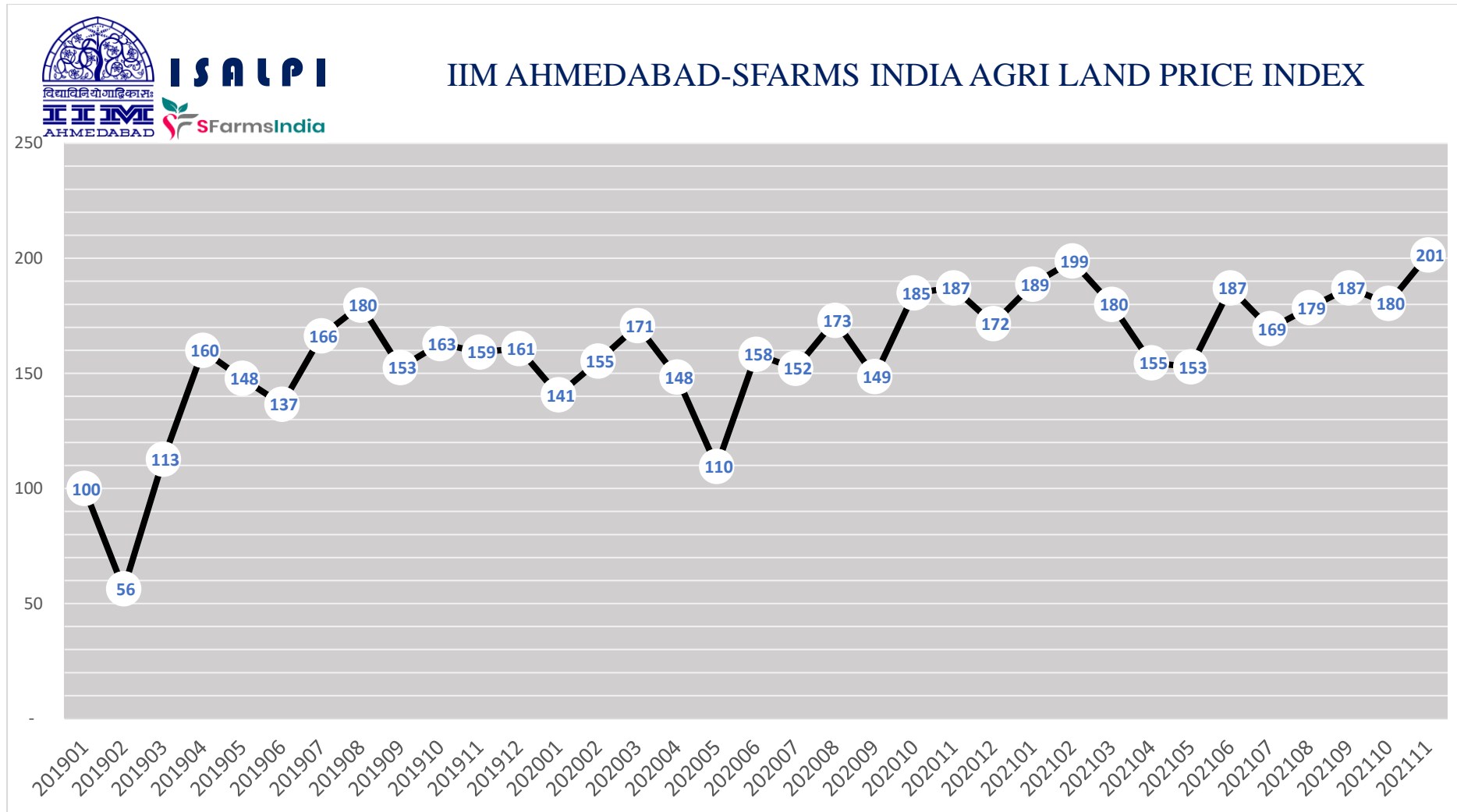
Table 1. Land Price Indices in Different Parts of The World

Country	Name	Publisher	Frequency	Granularity	Method	Data	Start Date	Last Update
China	Wharton/Tsinghua Chinese Residential Land Price Indexes (CRLPI)	Wharton, Upenn	Quarter	National, Regional, and City	Hedonic	Government records	2004	2017
Germany	Germany Land Price Index	Statistisches Bundesamt	Quarter	National, Types of land use	Average	Transactions	2010	
Hungary	FHB Agricultural Land Price Index	FHB Banking Group	Quarter	Regional	Hedonic	Transactions data from the Stamp Duty Office	1998	
India	Land Price Index	National Housing Bank	TBA	Cities	TBA (Laspeyer's weighted average likely)	Market price, registered price, financing institutions	TBA	
Japan	Urban Land Price Index	Japan Real Estate Institute	Semiannual	City	Average appraisal price	Ministry of Land, Infrastructure, Transport, and Tourism	1936	
Kenya	The Hass Property Index	Hass Consult Ltd.	Quarter	Suburbs	Mixed adjusted methodology	Advertised prices	2006	
Luxembourg	Hedonic urban land price index	Land Use Policy (Journal)	Annual	National	Spatial Hedonic	Transactions	2010	2014
Singapore	Land Price Index	Journal of Housing research	Quarter	national	Hedonic	Transactions	1990	2005
Sri Lanka	Land Valuation Indicator	Central Bank of Sri Lanka	Semiannual	Columbo divisions	Average	Government valuation	2009	
Taiwan	Urban Land Price Index	Dept. of Land Administration	Semiannual	Metro	Hierarchical Linear Modeling	Ministry of Interiors	2013	
Thailand	Land price index in Thailand	Bank of Thailand	Monthly	National	Hedonic	Mortgage appraisal	2011	

UK	RICS/Royal University Rural Land Market Survey	Agri. Land	RICS/RAU	Semiannual	Regional	Weighted average	RICS RAU Transactions survey	2013	
UK	Property Market Report		Valuation Office Agency (VOA)	Annual	Cities	Average	Valuation	2003	
UK	Residual Land Value Index		IPF	Quarter	Market	Econometric Imputation	Multiple sources	1995	2016
USA	Newmark-Slade Front Urban Land Price Index	Wasatch Land Price	Newmark Grubb ACRES	Annual	Las Vegas Counties	Hedonic	Transactions	2007	
USA	Land Share Index		American Enterprise Institute	Quarter	Metro areas	Econometric Imputation	Indices	1960	2018
USA	US Farmland Price Trends		AcreTrader	Annual	Metro	Average	USDA land valuation	1997	
USA	National Transaction-based Land Price Index		Journal of Real Estate Finance & Economics	Quarter	National	Hedonic	CoStar transactions	1991	2009
USA	Composite Land Price Index		Journal of Urban Economics	Semiannual	Metro	Hedonic	CoStar transactions	1995	2011

Source: Prashant Das, PhD

Figure 1. IIMA-SFarmsIndia Argi Land Price Index | Release 1 | 31 May 2022



Source: Author

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Figure 1 depicts the Agri Land Price index developed using three different methods: 1. Average price (dashed line), 2. Median price (dotted line) and 3. Hedonic price (solid line). The index values are depicted on the Y-axis on the left. 2019 January is standardized at the index value¹⁰ of 100.

As the Mean (average) and Median price indexes rose sharply during the analysis period [not shown in the graphic], it may lead to an erroneous conclusion about the price change. The Hedonic index (ISALPI) shows a relatively modest price appreciation. As described earlier, the Mean index is highly volatile and offers noisy information about the price movements. Later months are dominated by the listing of land parcels that are expensive due to their attributes (e.g. proximity to the nearest airport). Several of the listings throughout the time period are outliers in that they have specific characteristics that make them more expensive. The median index takes care of the outliers to some extent but is still relatively volatile (spiky) due to the effects of differing land parcel characteristics over time. From January 2019 through November 2021 (in 35 months), the ISALPI increased from 100 to nearly 200. This implies roughly over 25% annual price appreciation on average.

As the SFarmsIndia data collection starts during these months, the first few months of data may still be noisy although they quickly “season” in 6 months’ time. The average monthly price appreciation is 2-3% although it varies in a wide range. During the early phases of the Covid-19 crisis (i.e., late 2019 and early 2020), the prices fell by roughly 1.6% per month. It was followed by a period of recovery until March 2021, when the average monthly appreciation stood at around 4%. The prices started falling drastically (2.5% per month on average) during the second peak. Between July and November 2019, the prices rose at an average monthly rate of 2.6%.

¹⁰ Note that this graphic, although complete is presented here for illustrative purposes. The latest (and updated) index value can be seen on the Index website: <https://www.iima.ac.in/web/areas-and-centres/research-centres/misra-centre-for-financial-markets-and-economy/isalpi-releases>

District Ranks

Hedonic Pricing method also allows us to compare the relative priciness of the districts included in our sample. Table 2 provides the ranks of the Agri Land priciness across districts. Note that these rankings are based on the data of the districts from the six states included in our analysis. As the rankings compare assets of similar quality across the districts, they may be different from rankings developed based on average prices. The rankings assume that the relative priciness across these districts was constant during the analysis period.

Table 2. Rank of District in Terms of the Priciness of Agri Land Parcels | Q1 2022 Release

Aligarh	Uttar Pradesh	Most Expensive
Bengaluru Rural	Karnataka	Most Expensive
Davangere	Karnataka	Most Expensive
East Godavari	Andhra Pradesh	Most Expensive
Gautam Buddha Nagar	Uttar Pradesh	Most Expensive
Ghaziabad	Uttar Pradesh	Most Expensive
Jagtial	Telangana	Most Expensive
Jangaon	Telangana	Most Expensive
Karimnagar	Telangana	Most Expensive
Khammam	Telangana	Most Expensive
Kodagu	Karnataka	Most Expensive
Krishna	Andhra Pradesh	Most Expensive
Mahbubnagar	Telangana	Most Expensive
Mathura	Uttar Pradesh	Most Expensive
Nagpur	Maharashtra	Least Expensive
Nellore	Andhra Pradesh	Least Expensive
Ratnagiri	Maharashtra	Least Expensive
Saharanpur	Uttar Pradesh	Least Expensive
Thanjavur	Tamilnadu	Least Expensive
Theni	Tamilnadu	Least Expensive
Thoothukudi	Tamilnadu	Least Expensive
Tiruchirappalli	Tamilnadu	Least Expensive
Tirunelveli	Tamilnadu	Least Expensive
Tiruppur	Tamilnadu	Least Expensive
Tiruvannamalai	Tamilnadu	Least Expensive
Tumakuru	Karnataka	Least Expensive
Vijayapura	Karnataka	Least Expensive
Viluppuram	Tamilnadu	Least Expensive
Virudhunagar	Tamilnadu	Least Expensive
Wardha	Maharashtra	Least Expensive

Source: Prashant Das, PhD

Medchal (Telangana), Mandya (Karnataka), and Gautam Budh Nagar (UP) are the most expensive Agri Land districts. Madurai (Tamilnadu), Tiruchirappalli (Tamilnadu), and Wardha (Maharashtra) are among the most affordable. Note that the rankings are skewed towards the land parcels that were listed for sale. Such parcels may exhibit systematically different price patterns compared to those that were not listed.

About IIMA (www.iima.ac.in)

The Indian Institute of Management Ahmedabad (IIMA) has been consistently ranked as the premier management school in the country by several national agencies. IIMA programmes are also ranked highly in several international rankings. In 2008, IIMA became the first management school in the country to be awarded EQUIS (European Quality Improvement System) accreditation by the EFMD (European Foundation for Management Development).

Led by space scientist Dr. Vikram Sarabhai and an eminent industrialist and philanthropist Shri Kasturbhai Lalbhai, and proactively supported by the then Chief Minister of Gujarat, Dr. Jivraj Mehta, a group of enlightened individuals set up IIMA in 1961. This group ably wove together a coalition of five actors - the governments at the centre and the state, local industrialists, the Ford Foundation, and the Harvard Business School, to establish the foundations of the Institute.

IIMA was set up as an institution that would be managed by a Society, the IIMA Society, created under the Societies Act. The Institute was to be run by a Board of Governors, constituted by the IIMA Society; the Board would have representation from all the relevant constituencies to reflect the multifarious needs of a developing nation. IIMA was therefore conceived as a Board-managed institution, free from the exclusive control of any one constituency. Thus, operational freedom is an integral part of the DNA of IIMA.

About SFarmsIndia and Its Data (www.sfarmsindia.com)

SFarmsIndia is an Agri-land discovery platform, that connects prospective buyers and sellers. It is one of the very few platforms in India focusing exclusively on agricultural land listings. With more than 25,000 registered buyers and sellers, the platform currently offers more than 7000 land listings. SFarmsIndia has been successful in eliminating middlemen, bringing in price transparency, and expanding the prospect set for the rural sellers. With more than 15%

month-on-month growth in listings, SFarmsIndia is expanding to more geographies (states) and new product offerings (APCs & Food Park Lands, Small Farms, etc).

SFarmsIndia follows a streamlined data collection process with standardised data elements. As soon as a prospective seller submits a listing, our customer service executive contacts the seller and verifies the submitted information. The fields collected include but are not limited to the area (in acres), price per acre, location (latitude & longitude), state, district, pincode, seller/buyer identity information, etc. Unlike other peer platforms, SFarmsIndia doesn't entertain listings from middlemen, which is aimed at preserving price transparency. SFarmsIndia also has a network of freelancers in each district who source genuine listings from rural areas onto the platform. Hence, the ask prices listed on the platform are close to the final transaction prices although SFarmsIndia doesn't currently track the transaction bids. SFarmsIndia has a strong focus on data warehousing and mining aimed at bringing cutting-edge real-estate domain-specific AI capabilities to the market. The collaboration with IIMA to develop an Agri-land price index (ISALPI) is an important step in this regard.

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