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REAL-TIME GOVERNANCE SYSTEM IN FARMING: A CROSS-COUNTRY COMPARISON

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ABSTRACT

Governments globally are increasingly using analytical reports and dashboards to make vital agricultural data available before Government officials and farmers to take crop-related decisions. The Real-Time Governance System (RTGS) of the Government of Andhra Pradesh is one such implementation where inputs collected from different sources (including from the Union Government) are encapsulated into an easy-to-use interface for quicker and easier agriculture management in the state.

This descriptive research paper uses the non-participant observation method intending to understand the various features of the RTGS and core dashboard used in farming information dissemination to multiple stakeholders, including Government officials, farmers, agri-markets, financial intermediaries and various other stakeholders. Multiple farming variables are identified, and portals features are reviewed. These agri-variables are then compared with the US farming practices where ever possible. These insights can help policymakers in framing better regulations. The study finds that the RTGS information brings in useful information to the hands of the stakeholders for faster decision making. This study indicates that loan waiver programs are unique to India, while crop insurance and new farmer funds are on an advanced level in countries like the USA. Overall, RTGS is contributing a lot to farmers.

KEYWORDS: agriculture dashboard, farm analytics, crop insurance, Indian agriculture, farm loan waiver, US agriculture

JEL CLASSIFICATION: P32, Q12, Q13, Q18

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INTRODUCTION

Highly populous and consumption-driven India has a high reliance on Agriculture. The South Indian state of Andhra Pradesh (AP), with its reasonably decent water availability from the Godavari and Krishna rivers and adequate seasonal rainfall, makes it an agriculture-driven state. With a population of around 55 million people living in about 2000 villages, agriculture is the predominant occupation in the village communities. Multiple crops and crop rotation are prevalent, particularly in the water abundant coastal belt — commercial crops such as paddy, cotton, and *mirchi* are commonly grown in the region. Governments provide a vital information link for the farmers to get good crop yields and thereby sold at profitable prices.

Governments are now more open to sharing agri-information to their stakeholders. Further, agriculture intelligence has emerged as a new technology enabler for the farmer. (Ghadiyali, Lad, & Patel, 2011) The Real-Time Governance System (RTGS) of the Government of Andhra Pradesh brings in critical functions aligning then with different Government Departments. The core dashboards built for the Chief Minister's Office are now opened for the public view and their understanding and benefit it. (CM Office, 2019) This information availability is a great move and can help Government officers, the common public, and the research community. The system improves public services by reaching out to the farmer community and provides better governance.

COMPARISON WITH THE US FARMER

Several researchers in the past compared various dimensions of Indian agriculture with other countries. The data presented below give a cursory glimpse comparing a typical US and Indian farmer.

The average USA farmland is 178 hectares, while it is merely 1.06 hectares in India. The Indian hectarage levels have come down from 2.63 hectares, as seen in 1960-61. Also, only a 2 percent US population is into agriculture while in India, it is close to 60 percent. The US had 922 million acres under cultivation, while India has 349 million acres in active farming. India's export of agriculture products is to the tune of US$ 46 billion, while that of the US is at US$ 175 billion! Due to the average per person farm size is 2 acres, mechanization is also weak. Whereas in the USA, the average per person farm size is 400 acres, and hence the need to invest more towards rich farm mechanization.

I. LITERARY REVIEW

A. THEORY

Several studies dealt with the topic of the use of ICT in e-agriculture. (Yuvaraj, 2019). Increased use of Information technology in agriculture is visible over the years. (Kapur, 2018) A higher degree of focus is to enhance the productivity of farmers and farm output. The advantage of the right kind of information was proven to be very useful over the years. Several studies dealt with the cross-country comparison of Indian agriculture with other countries in various aspects. (Ali, Geng, Robins, Cooper, & Roberts, 2019)

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B. LITERATURE GAP

While substantial research work and literature on the Indian agriculture sector is available, this study fills the research gap on the analytical reporting and dashboards usage in Andhra Pradesh.

II. RESEARCH METHODOLOGY

Agriculture needs support and information flow from multiple disciplines, particularly from Governmental entities, and this should be passed on to farmers through the right channels. (Patel, 2016) The current paper tries to identify various areas and parameters to analyze the availability of that information from multiple Governmental channels. Simultaneously, this paper attempted to keep information from other countries into the same section to give an overview of those. Major infrastructure to help agriculture need to be coordinated by Government like power, water (apart from rain-fed), seed supply, fertilizers, pesticides, and, most importantly, creating a marketing environment to handle the outcome. Hence, the Government needs to handle this Governance smoothly, and most importantly, this info needs to be shared through respective bodies and simultaneously keep this information visible to all stakeholders and farmers. (Dasgupta, 2011/18)

A. RESEARCH OBJECTIVES

1. To study various forms of data available for Andhra Pradesh Farmers on Real-Time Governance System and other agriculture department websites.
2. To compare various farming options in India against countries like the USA and Brazil.
3. To identify potential gaps in Information systems available that can potentially benefit the Indian farmers.

B. RESEARCH METHOD

This study uses a qualitative descriptive research approach using the non-participant, indirect, and uncontrolled observation method to study the prevailing situation and to get a better understanding of the subject.

C. VARIABLES STUDIED

The table below is a summary of the various dimensions considered in the research in the context of agriculture in Andhra Pradesh. The practices used in India are then compared to that of the US whenever possible.

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Table 1:Various agri-variables studied

Land & Water	**Seeds & Fertilizers**	**Power supply**
1. Land Availability & Land Leasing mechanisms 2. Soil Tests / Soil Health & Compatibility Info 3. Land Conservation Programs 4. Water availability & Rain Forecast info 5. Ground Water availability 6. Weather Forecast	1. Seeds availability 2. Seeds Distribution Mechanisms 3. Fertilizers/Chemicals info	1. Power availability 2. Power Subsidy 3. Low Voltage Transformers
Crop Management	**Equipment**	**Marketing**
1. Crop care info 2. Crop Advisory (Dial for Farm help) 3. New Trends in Farming / Latest technologies	1. Farm Equipment (Tractors, Harvesting Machines) 2. Machines on subsidy	1. Minimum Support Prices 2. Subsidies - Fertilizers, Power 3. Marketing Support
Financial	**Storage & Standardization**	**Risk Management**
1. Farm Loans / Bank Loans 2. Funding Options for New Farmers 3. Loan Waivers 4. Grants / Subsidies 5. Crop Insurance	1. Storage Mechanisms like cold storages 2. Standards & Certifications	1. Risk Management 2. Emergency Management 3. Disaster Management

III. DISCUSSION

A. LAND & WATER

1. LAND AVAILABILITY & LEASING MECHANISMS

Andhra Pradesh enjoys reasonably fertile land with good water supply compared to other Indian states. (Pathak, 2010) However, there are thousands of hectares of land suffering without proper water supply. Most of those lands need to depend on seasonal rains, and it affects production to some extent. In the areas where water availability is good, leasing rates seem to be slightly higher. Lands are available for farmers to do Farming.

Farm availability for leasing data is not available on any government websites, and some private sites carry this information. Usually, at the village level, this information needs to be procured manually. Even in other countries, this information is available on private websites

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only. However, for entrepreneurs planning for agriculture, the US Agriculture department seems to be extending support in this area.

AP Government allows Lease deeds registration provision, and the rate of this registered lease deeds is very less in case of farmland leasing.

2. SOIL TESTS / SOIL HEALTH & SOIL COMPATIBILITY INFO

Soil health plays a vital role in identifying the suitability of land for different types of crops. (Magdoff, 2001) Soil samples after testing can provide info like available nutrients, pH, and organic matter details. It is also possible to find if the soil has more salt content or sodium contents. Soil health can be evaluated based on chemical health and potential imbalances. If this data is within suitable ranges, the land will be ideal for crops and also helps in deciding the required nutrients, especially phosphorus and potassium.

India has 4000 soil testing centers, with 980 of them located in Andhra Pradesh, as per farmer.gov.in. A detailed list of soil centers along with address details is openly available for farmers to access. Several Governmental websites provide soil compatibility information with pattern matching information between various land types and suitable crops, at both District and Mandal-level. (Dept of Agr, Cooperation & Farmers Welfare, 2019)

3. LAND CONSERVATION PROGRAMS

The U.S. Dept. of Agriculture (U.S. Department of Agriculture, 2019) spends more than 5$ billion per year towards farm conservation. These funds are used towards the improvement of lands and bringing new areas into cultivation, which helps to increase cultivation.

In India, the Department of Land Resources, which works under the Ministry of Rural Development, funds the conservation programs. The Government of India supports 91.66 percent of the grant, and the rest comes from the respective state government. Integrated Wasteland Development Program (IWDP) is active in some states, including Andhra Pradesh, and is giving useful results in few districts.

4. WATER AVAILABILITY & RAIN DATA

Water-rich Andhra Pradesh gets stable river water from the Godavari and Krishna rivers. River-water integrations project is on the way, which will further boost irrigation water availability of the state. The coastal areas will have more streams compared to other regions that have limited water availability. RTGS and AP State Development Planning portals capture water level information based on river capacities and their current status and offer live and comprehensive data providing water availability District-wise and even at Mandal-level points.

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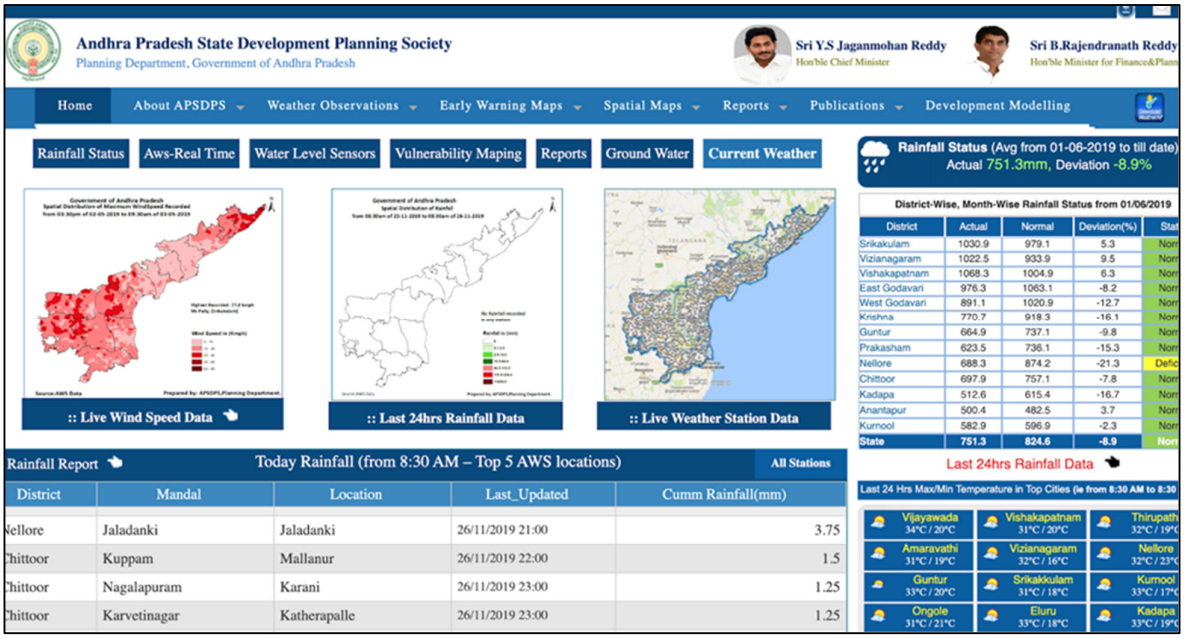
Figure 1:Real-Time Governance through dashboards



Source: Planning Department, AP Government (APSDPS, 2019)

Water and rains in Indian are usually at standard levels. India seems to have sufficient analytical tools to assess the water data, though, water channelizing is still in the process, as water wastage into oceans is happening.

5. GROUND WATER AVAILABILITY

The Governments assess groundwater availability and disseminated to farmers. Andhra Pradesh groundwater levels were at an average of 11.24 meters below ground level in November 2019.

Figure 2: Groundwater levels – District-wise Month wise in AP (Meters below ground level)

S.No.	District	Nov-18 27/11/2018 11:00 HRS	May-19	Sep-19	Oct-19	Nov-19 27/11/2019 11:00 HRS	Rise (+) / Fall (-) from current water level				Rainfall (in mm) 01/06/2019 to tillnow		
							Nov-18	May-19	Sep-19	Oct-19	Actual	Normal	Deviation in %
1	SRIKAKULAM	5.45	6.57	3.55	2.44	3.55	1.90	3.02	0.00	-1.11	1030.90	979.10	5.30
2	VIZIANAGARAM	6.36	8.28	4.91	3.09	3.88	2.48	4.40	1.03	-0.79	1022.50	933.90	9.50
3	VISAKHAPATNAM	9.00	10.24	6.45	5.29	5.81	3.19	4.43	0.64	-0.52	1068.30	1005.10	6.30
4	EAST GODAVARI	9.37	10.44	7.16	6.31	6.93	2.44	3.51	0.23	-0.62	976.30	1063.20	-8.20
5	WEST GODAVARI	17.14	21.02	18.07	16.44	17.31	-0.17	3.71	0.76	-0.87	891.10	1021.00	-12.70
6	KRISHNA	10.45	12.05	9.14	8.28	8.95	1.50	3.10	0.19	-0.67	770.70	918.40	-16.10
7	GUNTUR	9.07	11.37	7.15	5.76	6.14	2.93	5.23	1.01	-0.38	664.90	737.40	-9.80
8	PRAKASAM	20.62	22.79	17.90	14.33	14.39	6.23	8.40	3.51	-0.06	623.50	736.40	-15.30
9	NELLORE	10.63	12.68	12.33	9.89	9.08	1.55	3.60	3.25	0.81	688.30	876.10	-21.40
10	COASTAL ANDHRA REGION	10.90	12.83	9.63	7.98	8.45	2.45	4.38	1.18	-0.47	859.60	919.00	-6.50
11	CHITTOOR	21.03	28.35	26.60	23.98	23.61	-2.58	4.74	2.99	0.37	698.30	758.50	-7.90
12	KADAPA	21.80	27.97	25.94	20.80	20.76	1.04	7.21	5.18	0.04	512.60	616.00	-16.80
13	ANANTHAPUR	21.51	25.96	24.92	19.44	19.75	1.76	6.21	5.17	-0.31	500.50	482.80	3.70
14	KURNOOL	9.92	12.74	9.29	6.74	7.20	2.72	5.54	2.09	-0.46	582.80	596.90	-2.40
15	RAYALASEEMA REGION	18.57	23.75	21.69	17.74	17.83	0.74	5.92	3.86	-0.09	573.60	613.60	-6.50
16	ANDHRA PRADESH	13.26	16.19	13.34	10.98	11.34	1.92	4.85	2.00	-0.36	751.30	825.00	-8.90

Source: AP RTGS

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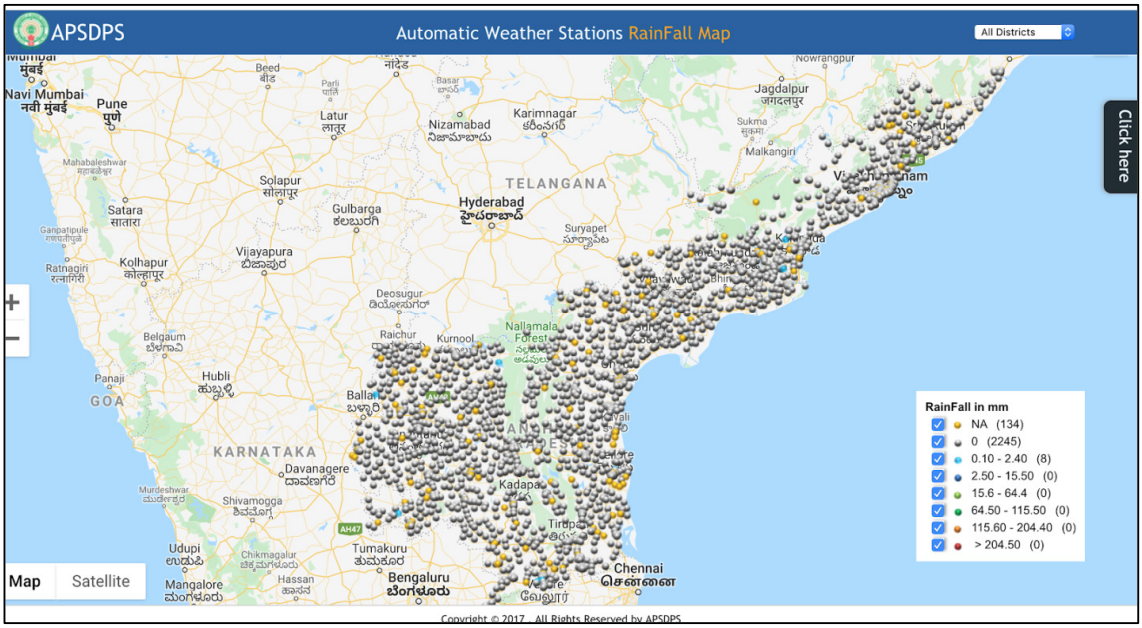
6. WEATHER FORECAST

Weather forecasting, for a climate-sensitive country like India, is a critical function to be carried out by the Government as it shares essential data to farmers to plan and to take sufficient care for their crops. (Kumara & Parikh, 2001) This weather forecasts on the data collected from various points, and it shares current atmosphere details along with rain forecast.

Andhra Pradesh Government entered into a collaboration with the Indian Space Research Organisation (ISRO) to provide comprehensive meteorological services like weather forecasting, extreme conditions data. (ISRO, 2017) RTGS-AWARE advanced modeling used this data for weather forecasting. All kinds of severe weather events information and its forecast, along with advisories and communication, are sent immediately by RTGS. Subsequently, this data shared with Mandal and village level administrations, farmers, and media.

Serious advancements made in the areas of meteorology and weather forecasting globally, as well as in India, are helping the farmers (Aggarwal & Chowdhary, 2018). Weather forecast data provided by AP Government appears to be resourceful, adequate, and practically relevant.

Figure 3: Spatial weather map with automatic data capture from weather stations



Source: APSDPS

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B. SEEDS & DISTRIBUTION DATA

1. SEEDS & FERTILIZERS

Quality Seeds are a critical component of agriculture Farming. To organize quality seeds, certified and quality assessment agencies have been made available to farmers. This initiative is helping farmers to increase their productivity by using quality seeds. To enhance the cultivated area, seeds availability in adequate quantity and quality is an essential support for farmers.

2. SEEDS DISTRIBUTION MECHANISMS

Quality seeds are necessary for farmers to get decent produce, and unfortunately, this is scarce in India. Seeds distribution and distributor channel data are essential for farmers to reach out to those places and get quality seeds. (Suresh & Robert, 2002) The Andhra Pradesh Government's e-seed portal provides distributor details and their seed availability across the state. (Aadhaar-enabled Seed Distribution Center, 2019) Apart from government-organized seed distributors, independent seed developers and distributors are active in the country.

3. FERTILIZERS AND PESTICIDES INFO

Indian farming products are often criticized for higher concentrations of harmful chemicals because of the increased inorganic fertilizer practices (largely chemicals-driven nitrogen, phosphorus, and potassium), as against to organic fertilizers (such as cow dung, leaves, and parts of plants, inorganic fertilizers). Farmers need to know the exact combination to be used based on soil and crop, failing which the excessive usage can damage soil health and the plant. Governments regulate harmful products and other products by evaluating them from time to time because some pesticides are highly poisonous and toxic.

Through apagrisnet.gov.in, the AP government is providing these support functions and data to farmers. It consists of e-seeds, e-Panta, and many other relevant data to help. Indian agri-produce contains higher-than-normal chemical content because of increased use of chemicals to grow plants while some countries prohibited these practices. The U.S. uses technology in farming by using GPS, GIS, and remote sensing technologies and satellites for agriculture at a far higher level than in India. The application of natural sources would significantly reduce chemical content.

C. POWER

1. POWER AVAILABILITY

Farm productivity and availability of unit power are linearly associated. (Surendra, R S, & S P, 2014) The solar-powered micro-irrigation system has come to the rescue of smallholders of drylands. (Kumar, Reddy, Adake, & Rao, 2015). Indian farmer now has a power supply from multiple sources.

The availability of nine hours of power is essential for farmers to use electrical equipment such as running water motors to handle water requirements and other farming equipment. Power Demand in Andhra Pradesh is around 168.0 MW per day, and the Government of AP addresses these needs to avoid any supply gap. For AP farmers, the Government has promised the availability of 9 hours of power per day to take care of Farming requirements.

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2. POWER SUBSIDY

Not just power availability, but the cost of power for the Indian farmer is at a low price. Electricity is available at a subsidized rate of Rs. 1.5 per unit (USD 0.02). The Indian subsidized power rates are relatively small compared to most other countries across the globe.

3. LOW VOLTAGE TRANSFORMERS

Transformer supply and power distribution is an expensive process to help the Farming community. There are three types of transformers used for agriculture purposes, and those are Auto Transformers, High Voltage Transformers, and Power Supply Transformers. These will vary based on power consumption and demand in respective areas.

AP Government provides this data through the RTGS and other portals so that farmers can understand the availability of power and schedule their work accordingly. There are online features that monitor the status of street lights and transformers across the state.

D. CROP MANAGEMENT

1. CROP CARE INFORMATION

Crop care is an essential part of taking care of crops. As most of the farmers are not entirely aware of this function, the Government's e-Agriculture portal provides support is vital to share knowledge and information at the right times. (AP Agrisnet, 2019)

2. CROP ADVISORY SERVICES (DIAL FOR FARM HELP)

Kisan call centers are a major initiative taken up by the Indian Government by introducing a toll-free number 1800-180-1551 so that farmers can call any time from all kinds of communication networks. AP government has enhanced it by adding the same service in the regional language. These call centers work on all seven days of the week and are accessible to farmers. The local language is beneficial for farmers to take the necessary help.

3. NEW TRENDS IN FARMING/SMART FARMING

Smart farming uses the latest technologies and best agriculture practices together and connecting with information systems to get better outputs and to use raw materials to the best. Considered as the key to sustainable agriculture (Walter, Finger, Huber, & Buchmann, 2017), Smart farming has endless applications using farm technology. The boost in startup culture in India fostered the start of 545 agri-tech startups as of who act as farm technology enablers. (Tracxn, 2019)

New trends keep regularly evolving for any sector, and agriculture is also one of the areas where new patterns and processes keep changing. It could be new machinery or methods or about the way they plant or manage their crops. Precision agriculture technology is getting popular with high computing power tractors and automated machines, which can run even in AutoPilot mode. These can increase the yield and helps farmers to improve their efficiency. Precision application of water and fertilizers to match for the exact requirement will help in reducing costs and safeguarding plants.

Some of the latest trends in Farming:

- Autonomous and Robotic Labour

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- Driverless Tractors (Auto Pilot)
- Automated Seeding and Planting
- Automatic Watering and Irrigation
- Weeding and Crop Maintenance
- Harvesting from Field, Tree, and Vine
- Reducing Labor, Increasing Yield and Efficiency
- Drones for Imaging, Planting, Crop Spraying, and Precision farming
- Real-Time Monitoring and Analysis
- The Connected Farm: Sensors and the IoT

New generation tractors are highly technical and can track every inch of land depending on soil type, required chemical application, and seed placements. Farm management software analyzes data and generates personalized recommendations. This precision agriculture approach is catching up in countries like the USA and Brazil (Agriculture Department of Brazil, 2019). Whereas in India, we are in a long way to look at these options. Due to less land per farmer, automation is not going up at a faster pace. In addition to that, costs to manage these new technologies and economic viability are also other reasons for not being used aggressively.

AP Government is trying to share this information on their portals. However, it requires more push compared to other countries.

E. EQUIPMENT

1. FARM EQUIPMENT (TRACTORS, HARVESTING MACHINES)

Various types of farm equipment are available for agriculture, such as cutters and shredders, harvesting equipment, planting equipment, sprayers and applications, tractors. AP Government is offering some subsidies for small tractors to be used within agriculture. Information about these subsidies and utilization data is made available on the RTGS portals.

However, the latest technology-based equipment needs to be encouraged by the Government and bring them to usage for better productivity.

F. MARKETING FARM PRODUCES

Reforms (such as a change in marketing patterns), policies (such as liberalization and globalization), and programs (such as a change in cropping patterns) in agricultural marketing over the years improved the agriculture marketing systems by protecting farmers from organized groups. (Bhat, 2009) Social networks and market access are amongst the top factors affecting farm productivity. (Tisorn, 2015). Development of agricultural marketing alongside improving marketing systems, strengthening of marketing infrastructure, improving investment and funding sources, and trying to involve the private sector is necessary. (Rahul & Sanica, 2014)

Andhra Pradesh is the first state to implement the electronic National Agriculture Market (eNAM, 2019) that allows farmers to sell their products through an online interface. Apart from

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the direct online platform, the state has 22 Agricultural Produce & Livestock Market Committees (APMC) and 17 "*mandis"* doing online trading using the eNAM interface. AP has also declared the 22 warehouses running under Central Warehousing Corporation (CWC) to be official marketplaces. The farmer burden and costs in transporting the produce to the market yard will thereby come down. (Sambasiva Rao, 2019)

1. MINIMUM SUPPORT PRICES

A ten percent per annum growth in Minimum Support Prices (MSP) across crops was visible, though there are variations across crops and regions. (Rajiv, 2014) The MSP is a key influencer of the cropping patters. The average Indian farmer receives only 15% of the price paid for his produce by the consumer, while the average US farmer gets 70 to 75%. Like in several other states, the AP Government is offering crops-based MSP every year, expressing its willingness to pay to farmers to safeguard their efforts and interests. This data, along with crop-wise minimum support prices were mentioned on portals so that farmers can plan accordingly.

2. MARKETING SUPPORT

Several organizations and institutions in India provide direct or indirect assistance in agricultural marketing. (Haveripeth, 2014) Apart from the state portals (such as APagrieXchange), there are e-Choupal, mandi, yards, and online platforms through which various agencies provide agri-marketing support.

The APEDA's APAgrieXchange (APEDA, 2019) is offering excellent support for farmers producing flowers, fruits, vegetables, and cereals with an opportunity to provide export data. It gives provision for farmers/ traders to see data across countries and export and import data. It also offers to buy leads and sell leads to interested parties. It offers much-required market intelligence.

ITC introduced an e-Choupal model in support of the Government to handle various agricultural challenges. It includes supply chain management features to help farmers produce, finance, manage, and sell their produce.

G. FINANCIAL SUPPORT

1. FARM LOANS / BANK LOANS

Farm Loans is the primary source of funding for farmers in villages to handle their farming needs, to procure farming equipment, and for irrigation. (Agrawal, 1987) Agriculture funding has been declared as priority lending for banks (RBI, 2018) by the Indian Government and monitors the same. Farmers aggressively use farm loan credit because of the attractively lower interest at which it is offered compared to commercial loans and loans from local finance companies.

Some targeted funds are exclusively kept aside in the US to support native American tribes and youth agricultural projects through loans.

When the indebtedness goes beyond a threshold, it leads to distress and forces farmers to commit suicides. Suicide is a crime in India, and as such, is being investigated by state police while the National Crime Records Bureau (NCRB) compiles statistics. Recent research

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suggests that farmer suicides have come down over the period 2001 to 2018. Andra Pradesh has a farmer suicide rate of little over six suicides every 1,00,000 population. (Padmanabhan & Dantewadia, 2020)

2. FUNDING OPTIONS FOR NEW FARMERS

Funding options for new farmers, who start farming without owning any land does not have provision to avail funding in India. However, the US offers different types of funding options to encourage new generation farmers. FSA's "Beginning Farmer" initiative helps and guarantees loans for new farmers.

However, for existing farmers, a funding scheme called Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) was launched in 2009, which initially catered to small and marginal farmers but later also catered to large farmers. Farmers have to apply for the scheme with their Aadhar card. The responsibility of identification and verification of farmers is on the shoulders of the state governments. The Andhra Pradesh segment of the program is linked to the RTGS and thereby is amongst the top states which verified its farmer-beneficiaries. (PMKISANAP, 2020) The farmer payment success rate is high for Andhra Pradesh. When some states could not join the program for lack of farmer information systems or because of delays in identifying eligible beneficiaries, Andra Pradesh being able to achieve this feat is commendable. (Tiwari R. , 2020)

3. LOAN WAIVERS

Farm loan waivers is a concept unique to India with almost no such implementation in any other developed/ developing country. The first nation-wide loan waiver was offered in 1990 by the Government of India, costing the exchequer around Rs. 10,000 crores. Several state governments subsequently came up with loan waiver plans, but unfortunately, they turned out to be stressing banks and carried negative economic implications. (Vijaya Kittu & Satya Prakash, 2019)

4. GRANTS / SUBSIDIES AND CROP INSURANCE

The central and state governments offer various agriculture and equipment subsidies, and grants (such as local grants) in India. (Kaur, 2013) In India, these subsidies reach close to eighty percent of farmers. The Input-based farmer support model is still in vogue, and bodies like the Confederation of Indian Industry (CII) are suggesting replacing the agri-subsidiary system with a direct cash transfer system in a phased manner. (Business Line, 2020)

USA's Federal Government also spends more than $20 billion per year on farm subsidies. Around thirty-nine percent of 2.1 million farmers in the USA avail these subsidies. Though there is a conflicting argument about grants that do not help farmers to be innovative and effects GDP, these subsidies are still growing every year.

The US farmers choose to participate in either ARC or PLC apart from enrolling in the crop insurance program, which has the same general function of keeping farm incomes high. So, farmers can double dip from at least two subsidy programs should their crop revenues come up short.

Agriculture Risk Coverage (ARC): If per acre revenue is less than average per acre revenue of the country (a benchmark for these subsidies), this program pays a grant to the farmer. This

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subsidy program is applicable for 20 different crops, such as wheat and corn. ARC subsidies were paid as much as $3.7 billion in 2017.

Price Loss Coverage (PLC): The basis for this program is in a comparison between the National average price of a crop and crop's reference price fixed by the congress. A payout is made in the event the nation's price fall drops below reference price (usually set high). As much as US$ 3.2 billion is paid towards this in 2017 alone.

The administration of crop insurance for the Indian farmers is through the PM Fasal Bima Yojana (PMFBY) program. Though already implemented, the scheme received some hiccups and is undergoing revision owing to both insurers and state governments opting out of it. Crop damage claims in Andhra Pradesh and few other states for the crop year 2018-19 are more than the premium that is collected, making the implementing private insurers back off. Andhra Pradesh and few other states existed from the program after asking for a change in the premium paying structure and making the crop insurance optional for loanee farmers. (Mishra, 2020) Having exited the program, Andhra Pradesh now has its state-government administered crop insurance program. The event prompted the center to set up a seven-member Group of Minister (GoM) to review the program. (Tiwari R. , 2019)

H. STORAGE & STANDARDISATION

Several methods of farm storage are in use in India. (Vimal, 2002) The Andhra Pradesh Government aggressively gives subsidy (as much as 25 percent) for cold storage development. Several cold storages were constructed in the state, thereby helping farmers to store their agri-produce. Around 200 cold storage facilities were set up in the state under the private sector by using the subsidies provided by the Government, says APEDA report.

Both the central government and state governments, through their various bodies, issue certifications for food-grade produce to increase exports. These standardizations and certifications help farmers to take care of the quality of the final harvest.

In the US, marketing loans were given to farmers during harvesting time so that they may store their crops and sell at a later price mimicking an almost price-guarantee program. The program had spent around US$ 160 million per year till 2016 before being dropped in 2017.

While farm loans are available at the cultivation stage in India, no such farm credit availability is available at harvest time. Amidst lack of proper storage facilities, farmers most often tend to sell their harvests at lower rates.

I. RISK MANAGEMENT

Agriculture is undoubtedly a risky business (Huirne & Meuwissen, 2000) that gets exposed to unexpected weather conditions, unexpected market variations, unexpected problems to plants. The NIFA of the US Department of Agriculture provides discusses and disseminates information on agricultural systems for agricultural enterprises. (NIFA, 2019)

1. Emergency Management

Massive damage to farms occurs because of unexpected weather conditions such as floods, cyclones, or thunder. Hence, it is essential to know about these scenarios in advance to take some precautions to reduce loss. (Hess, Richter, & Stoppa, 2002) Being a coastal state, Andhra Pradesh gets exposed to such natural calamities frequently.

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Subsidies/loan waivers offer required financial support for these emergencies in India and Andhra Pradesh. Usually, in the USA, the emergency loan program is used to help farmers to rebuild and to help them recover from losses. Either Secretary of Agriculture declared a natural disaster or president declared an emergency as per Stafford act, and in such situations, these loans are available. In India, the Central Government has a body to review and announce such conditions. The RTGS has a sound information system to showcase information about such scenarios.

2. Disaster Management (Floods or other calamities)

Disaster preparedness is the most crucial part of dealing with natural calamities. (Dekens, 2007) Real-time communication and proper exchange of data among different government departments are vital to handle the situation. RTGS has a special section to provide information for such incidents. These systems have come to the rescue and reduced the damage to human and property loss during recent cyclones. Farmers were able to get information three days in advance and hence were able to take precautions to minimize damage.

3. Crop Insurance

Crop Insurance assures reimbursement of at least the farmer investment in the event of natural calamities such as floods and cyclones and hence is a critical function to support farmers. Substantial research on this in the Indian context was done and reported by (Sk, 2012) (Jose, 2016), and (Chetana, 2018). Farming, like any other business, involves managing risks, and hence crop insurance is becoming an essential and useful solution for the farmer.

Crop insurance is at an advanced stage in countries like the US, where farmers can avail of crop insurance even for delayed planting and natural calamities. (Hazell & Varangis, 2019) The USDA provides crop insurance through Federal Crop Insurance Corporation. A complete list of agents across the country is available and helps farmers make use of it. USDA spends around $8 billion per year towards crop insurance.

The Pradhan Mantri Fasal Bhima Yojana (Min. of Agr & Farmers Welfare, 2019) is the flagship crop insurance program in India. Crop insurance is applicable for farmers with or without loans for notified crops across the states, and the cost is 2 percent of the sum insured for Kharif and 1.5 percent of the sum insured for Rabhi season. Crop insurance is an area-based insurance program, and insurance needs to be taken by specific area wise farmers. It covers loss due to natural calamities, even though they are local. This premium to be paid by farmers is relatively low compared to other countries as the Government pays a significant portion of insurance premium.

However, the India crop insurance system is not as advanced stage as in other countries primarily because government schemes are manual leading to time delays in claim payments. Artificial Intelligence (AI) and Machine Learning (ML) are helping in implementing newer models such as Growing Degree Days (GDD) for measuring hyperlocal temperature and IoT sensors to capture field data to augment the insurance claim process. Other deterrents in delays, compared to the US, are because of the number of crops and the nature of types of problems that are unique and complex in the Indian program. Farmer awareness is vital in this area, and the RTGS system, together with other websites, is trying to address this.

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IV. CONCLUSION

This paper studies various agriculture variables used in the information dissemination of Governments through the portals for use by farmers, officials of the Agriculture Department, and various other stakeholders. The second aim of this study was to make a cross-country comparison, with the US, as to the farming practices there compare with that of India.

Agricultural data compiled by the Andhra Pradesh Government at the state level and by the Central Government at the union level is deiminated through the RTGS and other information systems. This dissemination is helping farmers in making better farming decisions. This study finds that the support programs/measures rendered in India are on similar lines to other global practices. Few programs such as the Dial for support program, advance financial support, and loan waivers slightly seem to more prevalent in India. Features like the new farmer support and seed funds for agriculture are unique, and no such implementation is available in India. Crop insurance system needs to go a long way in India as it is still at an initial stage compared to other countries like the USA and Brazil. Despite this information and resource availability, agriculture in the state of Andhra Pradesh is still not strongly seen as a business but only as a last alternative. India is yet to pick up automation of farming, which is aggressively used in developed countries using modern technology in agriculture and connected to Government IT systems to gather info and plan automatically.

This study identifies that RTGS acts as an enabler for the farmers to make use of the available data in protecting their crops and eventually leading to better agricultural output. A natural progression of this study is to train the various stakeholders on how to use the information disseminated so that the features can be used to the fullest extent.

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