Volume 1 - No. 1 - December 2020

CMA Agri Bulletin

AGRICULTURE TASK FORCE

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

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Behind every successful business decision, there is always a CMA

MISSION STATEMENT

"The CMA Professionals would ethically drive enterprises globally by creating value to stakeholders in the socio-economic context through competencies drawn from the integration of strategy, management and accounting."

VISION STATEMENT

"The Institute of Cost Accountants of India would be the preferred source of resources and professionals for the financial leadership of enterprises globally."

ABOUT THE INSTITUTE

The Institute of Cost Accountants of India is a statutory body set up under an Act of Parliament in the year 1959. The Institute as a part of its obligation, regulates the profession of Cost and Management Accountancy, enrols students for its courses, provides coaching facilities to the students, organises professional development programmes for the members and undertakes research programmes in the field of Cost and Management Accountancy. The Institute pursues the vision of cost competitiveness, cost management, efficient use of resources and structured approach to cost accounting as the key drivers of the profession. In today's world, the profession of conventional accounting and auditing has taken a back seat and cost and management accountants are increasingly contributing toward the management of scarce resources and apply strategic decisions. This has opened up further scope and tremendous opportunities for cost accountants in India and abroad.

After an amendment passed by Parliament of India, the Institute is now renamed as ''The Institute of Cost Accountants of India'' from ''The Institute of Cost and Works Accountants of India''. This step is aimed towards synergising with the global management accounting bodies, sharing the best practices which will be useful to large number of trans-national Indian companies operating from India and abroad to remain competitive. With the current emphasis on management of resources, the specialized knowledge of evaluating operating efficiency and strategic management the professionals are known as ''Cost and Management Accountants (CMAs)''. The Institute is the 2nd largest Cost & Management Accounting body in the world and the largest in Asia, having approximately 5,00,000 students and 85,000 members all over the globe. The Institution headquartered at Kolkata operates through four regional councils at Kolkata, Delhi, Mumbai and Chennai and 108 Chapters situated at important cities in the country as well as 10 Overseas Centres. It is under the administrative control of Ministry of Corporate Affairs, Government of India.

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

CMA

Agri Bulletin

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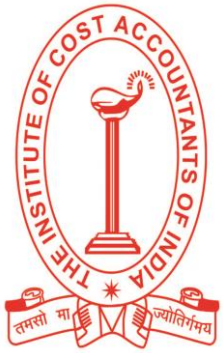

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THE INSTITUTE OF COST ACCOUNTANTS OF INDIA
(Statutory Body under an Act of Parliament)

CMA Biswarup Basu	President
CMA P. Raju Iyer	Vice-President

AGRICULTURE TASK FORCE

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सत्यमेव जयते

प्रधान मंत्री
Prime Minister

MESSAGE

It is heartening to learn that The Institute of Cost Accountants of India has organised a virtual 'Agriculture Meet' on December 23, 2020. The Concept Paper on agriculture "Augmenting the Farmers' Income: Roadmap for CMAs" being brought out on the occasion is commendable.

The growth and prosperity of the nation is intimately connected to agriculture and the all-round development of our farmers. Adopting a holistic approach, we have been giving utmost importance to agriculture sector.

From strengthening existing infrastructure to leveraging technology-intensive methods, our integrated measures are aimed at transforming the lives of our hardworking farmers.

Comprehensive steps from seed to market are constantly opening new vistas of opportunities for our farmers. Continuous boost to agriculture and allied sectors is giving farmers the independence to take decisions, providing them more options for better prices of their produce and easy access to modern methods of farming. Valued stakeholders like ICAI's such an endeavour adds strength to our resolve towards a prosperous future for our *Annadata.*

The deliberations during the 'Agriculture Meet' and the Concept Paper being brought out will surely chart out a roadmap to augment the income of our farmers.

Best wishes for all success of the digital Meet and the publication of the Concept Paper.

(Narendra Modi)

New Delhi
पौष 01, शक संवत्, 1942
December 22, 2020

CMA Biswarup Basu
President
The Institute of Cost Accountants of India
CMA Bhawan, 3, Institutional Area
Lodhi Road
New Delhi

नितिन गडकरी
NITIN GADKARI

सत्यमेव जयते

मंत्री
सड़क परिवहन एवं राजमार्ग;
सूक्ष्म, लघु एवं मध्यम उद्यम
भारत सरकार
Minister
Road Transport and Highways;
Micro, Small and Medium Enterprises
Government of India

Message

I am delighted to know that the Institute of Cost Accountants of India is organising a "Agriculture Meet" across the country to observe 'National Farmers Day' on 23rd December, 2020.

Agricultural sector plays a strategic role in the process of economic development of a country. Indian agricultural industry, with its allied sectors, is undeniably the largest livelihood provider in India. Most of the industries depends upon agri sector for their raw materials.

Cost Accountants can help the farmers in reducing the cost of the Agriculture, increasing the revenue and searching the multiple sources of additional revenues. The contribution of the CMAs in price regulation of the essential commodities, cost control of the PSUs, and wealth maximisation of the manufacturing & service sectors is well known. The entry of CMAs into agriculture sector is a laudable initiative.

I am pleased to learn that the Institute of Cost Accountants of India is bringing out the Concept Paper on Agriculture and CMA Agri Bulletin which emphasizes the role of CMAs in Augmenting the Farmers income. It is commendable that the Institute has already been taking a number of initiatives to raise awareness through various programmes that they have been organising.

I congratulate the Agriculture Task Force of the Institute of Cost Accountants of India for taking such initiatives. I convey my best wishes for future endeavours.

(Nitin Gadkari)

Date: 17th December. 2020
Place: New Delhi

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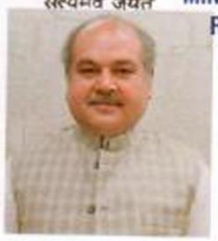
नरेन्द्र सिंह तोमर
NARENDRA SINGH TOMAR

सत्यमेव जयते

कृषि एवं किसान कल्याण,
ग्रामीण विकास और पंचायती राज मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली
MINISTER OF AGRICULTURE & FARMERS WELFARE,
RURAL DEVELOPMENT AND PANCHAYATI RAJ
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI



Message

It gives me immense pleasure to know that the Institute of Cost Accountants of India is organizing a **National Conference on "Sustainable Agriculture for Atmanirbhar Bharat" on 23rd December, 2020.**

I am proud that the Institute is the 2nd largest Cost & Management Accounting body in the World and the largest in Asia, having approximately 5,00,000 students and 85,000 qualified CMAs either in practice or in employment all over the globe.

'Atmanirbhar Bharat Abhiyan' focuses on the importance of promoting local products. The mission is also expected to complement "Make in India" initiative which intends to encourage manufacturing in India including agriculture sector which has a great potential. Atmanirbhar Krishi is important to achieve the goal of Atmanirbhar Bharat.

Sustainable agriculture envisages balanced Agri mix between food grains, pulses, cereals, vegetables and so on. Therefore the Indian farmers need to be properly educated and encouraged about the optimal agri product mix wherein the Institute of Cost Accountants of India can play a pivotal role.

I firmly believe that the Cost Accountants are capable enough in devising such a cost mechanism to reduce the cost of agricultural products substantially and to increase the operational efficiency to enable the farmers to achieve higher levels of Income.

Agricultural Costing can assist the policy planners opting balanced approaches towards inclusive growth by enabling optimized resources access and use.

I whole-heartedly look forward to the CMA fraternity for their professional involvement and assistance towards fulfilling the noble initiative of the Government. It is highly commendable that the Institute has already been taking a number of good initiatives to raise awareness in the agricultural domain for the benefit of the society at large.

I am pleased to learn that the Agriculture Task Force of the Institute of Cost Accountants of India is bringing out Concept Paper on Agriculture emphasizing augmenting farmers income.

I extend my best wishes to the Agriculture Task Force of the Institute for taking such thoughtful initiatives and wish the Conference a grand success.

(Narendra Singh Tomar)

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MESSAGE

CMA Biswarup Basu
President
The Institute of Cost Accountants of India

I am pleased to inform you that in line with the noble objective of Government of India of 'Augmenting the Farmers' Income', the Institute has constituted an Agriculture Task Force to evolve ways and means of 'Strategic Agri Cost Management'. The Institute being a Statutory body under an Act of Parliament looks forward to extend whole-hearted support to the Government initiatives in terms of preparing Concept papers on Agricultural Costing and Pricing, conducting awareness programmes and arranging discussion sessions on Pan India basis to analyse the current situation and advising on the steps to be taken in order to achieve the objectives set by the Government in this regard for the welfare of the farmers.

In this context, the Institute has also decided to observe 'National Farmers' Day' on 23rd December 2020 by organising Agriculture Meets across the country.

I congratulate CMA P. Raju Iyer, Vice President of the Institute and Chairman of Agriculture Task Force for taking initiatives towards exploring the ways and means of Augmenting Farmers Income by utilizing by skills and expertise of CMAs.

I would also like to acknowledge the dedicated efforts of Task Force members and officials for organising the Agriculture Meets and also for bringing out the first 'CMA Agri Bulletin'.

I wish the Agriculture Task Force every success of this noble endeavor.

Wish you all to take care of yourselves and your family members, and pray that 2021 would bring in new horizons for us.

With warm regards,

Biswarup Basu

CMA Biswarup Basu

MESSAGE

CMA P. Raju Iyer
Vice-President &
Chairman, Agriculture Task Force
The Institute of Cost Accountants of India

The Government of India has envisaged a journey of doubling farmers' income till 2022-2023 and envisioned many policy reforms for to achieve this goal. The Institute of Cost Accountants of India looks forward to associate with the ambitious objective of augmenting farmers' income and has constituted an 'Agriculture Task Force' for evolving ways and means for 'Strategic Cost Management Systems towards Augmenting Farmers' Income'. The Institute has also initiated formulation of "Strategic Agricultural Cost and Returns Management". The Agriculture Task Force of the Institute is likely to carve out a 'Road Map for CMAs towards Augmenting Indian Farmers' Income'.

In this context, the Institute has decided to observe "National Farmers' Day" on 23rd December by organizing physical and virtual meets at several places from 22nd December to 25th December.

I am happy to inform that Shri Nitin Jairam Gadkari, Hon'ble Minister for Road Transport & Highways and Micro, Small and Medium Enterprises, Government of India has kindly consented to be the Chief Guest and address on the "National Agriculture Meet" to be held virtually on 23rd December 2020.

I wish to inform you that the Agriculture Task Force of the Institute is also organising a National Conference on the theme "Sustainable Agriculture for Atmanirbhar Bharat" on 23rd December, 2020 at Jamshedpur, Jharkhand.

On the occasion, the Agriculture Task Force of the Institute is bringing out a Concept Note titled "Augmenting the Farmers' Income: Road Map for CMAs" and an exclusive CMA Agri Bulletin.

I am very much thankful to my Council Colleagues for extending their whole hearted support for the venture. I extend my heartfelt gratitude to the Agriculture Task force members and the officials of the Institute who had worked relentlessly for organising the Agriculture Meets and also for bringing out the first 'CMA Agri Bulletin'. I also express my gratitude to all resource persons who have contributed in this inaugural issue.

I wish prosperity and happiness to members, students and their family on the occasion of Christmas & Season's Greetings and wish them success in all of their endeavours.

With warm regards,

CMA P. Raju Iyer

AGRICULTURAL EVOLUTION
THE JOURNEY FROM AGRI 1.0 TO AGRI X.0

CMA Santosh Sharma
Agriculture Task Force Member
The Institute of Cost Accountants of India

We do not need a doctor, a lawyer, a policeman and a preacher every day. But every morning to night, three times a day you and i need a farmer. This is how important agriculture is in our life and the evolution of agriculture decides a lot in our journey to the future. Farmers are the founders of human civilization. However, they are yet to get their due.

815 million people or one in nine still go to bed on an empty stomach. And every one in three suffers from some form of malnutrition. Food production must increase by 70% in order to meet the population needs but farmland is decreasing day-by-day as urban areas are expected to triple in size by 2030, replacing them. Technology is the key in addressing this crisis and will transform agriculture with automation and remote monitoring.

However, as a human race we are not giving enough importance to the profession who is feeding our stomach. Across the globe farming is becoming less rewarding and the evolution in this area holds a lot of promise. The governments set up is such that farmers are the only ones in our economy who buy everything in retail, sells everything at wholesale, and pays freight both ways. And because of this we are squeezing everything out of the farmers not doing justice to their efforts. In order to curb inflation governments are not raising the minimum support price killing the most noble profession.

A lot of lip service by the governments to double farmer's income is being planned but on ground the results are still not seen. Technology, research and data-based information are the three support mechanisms which i bet on to improve the life of farmers so that in our journey to the future we are not left hungry.

The Agri Journey

Agriculture 1.0 – Around 12000 years ago the human race turned from hunter and gatherers to cereal crop growers. Domestication of animals and preservation of seeds encouraged people to settle and have homes. Social interactions between people increased as there was free time and energy and this gave them time to think beyond food. People realised that soil loose fertility if they continue to grow at the same place and so shifting cultivation was practiced.

Agriculture 2.0 – Livestock based agriculture started. Cows and ox became important. Land was divided into three parts and they were being swapped in a cyclical manner. One part was reserved for grasslands, second for livestock and third for the farm. Shifting cultivation became much more localised. People settled and built permanent homes along the rivers and water bodies. They observed and understood the usefulness of dung as manure that helped the soil become fertile. This increased the output from plants. The farmers learnt to store grains and found ways to protect them from rodents. Harappa and other civilizations had granaries and the lifestyle of people improved manifolds. Food consumption became more diverse from few cereals to incorporate large range of vegetables and fruits. Pest management started to get practiced in farming. Annual calendar for the crops developed for sowing and harvesting. Right timing reduced the effort and improved the harvest improving the efficiency in agriculture. Multicrop models developed.

Agriculture 3.0 – After the industrial revolution demand for non-edible crops too increased, Crops like indigo, jute were promoted. Forest land was cleared to create large farms and this gave the benefits of economies of large-scale production. Long distance transport of spices and other non-perishable edible items also started. Agriculture was still majorly lifestock based but tractors slowly started knocking the doors as high yielding variety seeds were introduced to improve output. Natural water sources were not enough for these seeds and therefore network of wells, canals and dams were bult to support industrial agriculture. Research found the use of Nitrogen, Phosphorous and Potassium and therefore fertilizers, pesticides and herbicides were introduced. This did increase the production to fill the stomachs of the growing population. But this greed also started to deplete the soil fertility as soil flora and fauna got killed.

Agriculture 4.0 – Technology and sensors are playing an important role in dairy farms and right from milking to cattle care everything is now being controlled by machines. The pros and cons of using fertiliser and machines have been understood and two approaches to solve the same is being attempted. One is through technology by monitoring and controlling the different variable by sensors and the other is through research based organic farming that is based on soil health, microbes and the diversified soil flora and fauna which takes care of the important agri variables naturally.

Introduction of machines and fertilizers killed the microbes or the natural underground friends and now we are doing their job in a controlled way with the help of sensors. Since people have settled, population has increased and water resources are drying seeds that require less water and drip irrigation that takes care of precision water levels in plants is introduced. Farming where all variables are controlled like temperature, humidity, sunlight and so on are being encouraged. Network of smart warehouses are preserving even perishable commodity for a longer period. Data based cultivation, marketing and branding have started connecting farm to the markets. Farmers are now being seen as agripreneurs and are being treated like entrepreneurs. From the unorganised sector it is moving towards the organised sectors with financing, funding and insurance facility.

Smart phones and other technologies have given a lot of power to the farmers and farming best practices are being followed to improve the farm output. Soil health cards and more accurate weather forecasts are removing the uncertainty that farming as a sector was facing. Research on nano-fertilisers and nutrient absorption by roots have helped in precision in the introduction of fertilisers and has reduced the input cost. This has led to the reduction in the use of fertiliser per unit of land by almost 50%.

Drone cameras are also being used to monitor large farms and drones are used to transport and deliver products from farm to kitchen. Agritech companies are on the rise. Research on seed and seed banks are preserving the variety and quality of the seed for better outputs in the future. Innovative agri related equipments are easing out the work load of farmers and improving their lifestyle.

On the other hand, ‘More Output Natural Agriculture from Less Input for Sustainable Advancement’ (MONALISA) techniques are also addressing the agricultural sector the natural and organic way. In this technique they are taking care of the soil and its flora and fauna and reintroducing microbes that are friendly to the plants. This is certainly a longer but a more natural way to feed the world.

Technology must not disturb the soil environment and the biodiversity as it will lead to imbalance and other complications. We must use technology but not at the cost of ruining this rich world of flora and fauna underneath the soil. In fact, technology and research must help us know this world better and understand their role in our journey ahead.

In Agri 1.0 forest soil was used for farming. In Agri 2.0 rich organic alluvial soil was used and organic composts were used to improve the health of the soil. In Agri 3.0 fertilizer was used to improve the fertility of the soil. In Agri 4.0 along with soil, soil substitutes are being explored. Hydroponics and Aquaponics are being encouraged where water with nutritional inputs is replacing soil. Coco peat, clay nutrition balls are replacing soil as the base for plant growth. Vertical farming, layer farming are addressing the shortage of land to fulfil the huge population.

Agripreneurs and entrepreneurs are building integrated farms that are sustainable. ‘Smart farms for every Smart city’ is the mantra i gave in the year 2015 to motivate entrepreneurial venture in this area. A smart city has the best of internet, infrastructure, education facilities but not the best of food. Smart farms around every smart city will make the cities more sustainable and also bridge the gap between rural and urban thereby engaging a lot of rural youth.

Agriculture 5.0

The future of agriculture is necessarily the future of human civilization. Humans have started growing radish at International space stations and this is a major breakthrough. The radishes were grown in the Advanced Plant Habitat (APH), a growth chamber for plant research, onboard the International Space Station.

On earth, the rate of adoption of technology in agriculture is pretty slow. This rate is certainly going to increase manifolds. Along with technology, society and the ecosystem the agri sector is also going to evolve manifolds. If the human race plans to have a house other than earth, then we have to ensure that the stomach is taken care of there too.

Precision nutrition for plants and intelligent versions of seed just like intelligent versions of software are going to solve many of our food problems in space and on earth.

More Output from Less Input (MOLI) technique for space or space stations and MONALISA technique for earth is going to play an important role with the help of research and technology.

Robots will act as new age farmers. And they will have temperature and moisture sensors, aerial images and GPS technology as their sense organs. They will replace the human force doing routine job, increasing the efficiency and profitability of the farms. AI and Robots will lead to precision agriculture.

According to Goldman Sachs automation may increase yields by 70% by 2050.

Floating farms will solve problems of land and water shortage and they will sell at ports

Gene edited crops will be on the rise. Better genetic and molecular understanding will lead to the beginning of personalised nutraceuticals. Optimised diets will be on the rise that will help them maximise their health and life span. Now people would be ready to spend more on food.

Plant synthetic biology is working at the intersection of Biology, Engineering, Chemistry and Medicine. Production of high value plant molecules for medicinal and industrial applications like anti-cancer, anti-malaria, drugs for pharmaceutical uses, pigments for food colouring and so on.

Vertical farms and urban agriculture will be on the rise where crops will be raised in a controlled environment. There will be agritowers in and around the campus where we'll live. This will result in fewer 'foodmiles' and year -round food production closer to where it is consumed. Advancement in hydroponics and aeroponics will reduce fresh water consumption in agriculture by more than 70% by spraying water and nutrients at the root of the plants.

Future urban agriculture will take place in factories that grow synthetic plants and meat. Industrial cultivation of insects is going to take place as an efficient protein source.

Autonomous and sustainable plant level farming is the future of agriculture. New agricultural machines are now going to collect data on soil and plant health and trigger actions on each plant individually, in real time.

Blockchain will solve the issues with supply chain in agriculture and centralization on money in the hands of few to have an equalizing impact. People increasingly want to know how, where, and who is producing their food. So, tracing of the agri produce with the help of Blockchain will help in bringing more transparency, branding and getting proper price for agri produce.

Reducing agri wastage is going to play a very important role. There are a number of areas of improvement like extending shelf life and logistic issues including optimising the cold chain, delivery and sale of perishable products and repurposing food waste into biofuel or fertiliser.

In the name of technology we should however not kill the microbes and the rich bio diversity that nature has designed for a peaceful co-existance. We must design to be in the 25-75 operating window between extremes of traditional and technology driven agriculture.

Agri X.0

Just like light, music affects man, animal and plants which could be seen from the EEG reports, hormone levels and cell growth respectively. Plants are more intelligent and responsive to the environment than we think. Different plant types have different taste and therefore their music differs. Green music having a classical base with sounds of song birds insects, water, wind and so will be applied to plants. Virtual environment to mimic the natural ones will make agriculture less dependent on natural factors and make it more technology controlled.

Intelligent seeds that will give customised food with the exact nutrients that the body needs including medicinal value will be designed for people and that can be produced anywhere. which will shape Agriculture X.0.

Space relevant agriculture and food will gain importance. The platform in which seeds are planted is going to change and will not remain the soil found in earth.

Nutritional pills as precision food will take care of our health and well-being. More nutrition from less food for more time and for more people will be on demand.

The taste buds would be richly engaged with the help of virtual reality and neural impulses to get a real food feeling on a digital platform. This coupled with precision food will take care of both health and taste.
The Dissolve the Box solution to such similar situations would be not to give birth to desires that unnecessarily engage the mind, body and soul. And if the unwanted desires are absent there is no need to artificially address it through the backdoor with these gadgets or wish machines. This will be a choice that human beings will have to make. And a lot depends what choice you and i or our generations to come are going to make.

Challenges in food production and distribution

1) Climate change is a threat to food production. Drought, flooding and freak weather are going to pose continuous stress in food production.
2) Ground water levels are continuously falling in many countries while the demand is continuously increasing. Today 71% of the fresh water tapped by humanity is used in agriculture.
3) Now we have around 8 billion people to feed but this will rise to 10 billion by 2050 and 11.2 billion in 2100.
4) Agriculture is going to become very capital intensive in the future and this will lead to more vertical integration.
5) There are a number of concerns about the role of giant companies like Du Pont, John Deere and Monsanto that raise questions like who is the owner of the data, whether their technologies and seeds will make farmers totally dependent on these companies are some of the ethical questions we need to answer.

Conclusion

We must avoid toxic foods that the body is not designed to accept naturally. The fertilizer and pesticides that we used has diverted the problem of food shortage and created new ones in the form of developing cancerous cells, low immunity, fast ageing and many other complications and lifestyle diseases.

Scientific developments must continue but we must accept them in our lives only when all the pros and cons have been clearly understood and when it is in line with human evolution. We must not accept or reject something just because a strong lobby is favouring or against it. The toxic food is acting as a slow poison and this may not be very evident in the short run but it is certainly going to affect the generations to come. First we must certainly try and harness the intelligence of nature with the help of technology to address our food problems. By going against nature, we will have to pay it very dearly because it will make our beautiful earth inhabitable.

SMART FARMS FOR EVERY SMART CITY
DOUBLING FARMER'S INCOME

CMA Santosh Sharma
Agriculture Task Force Member
The Institute of Cost Accountants of India

mart farms around every smart city is the call of the day and is going to be a game changer. A smart city will have the best of internet, infrastructure, education and entertainment facility but will lack farm fresh food. In order to make these smart cities sustainable we need to build smart farms around the smart cities.

For instance, M'ma organic farms just outside the steel city of Jamshedpur is a model project where the city dwellers get farm fresh milk, vegetables, fruits and other farm products absolutely fresh within minutes of harvest. This successful model can easily be replicated and by doing this we see the following benefits.

1) Smart cities become better place to live with the help of smart farms around.
2) This model bridges the gap between Bharat (people living in villages) and India (people living in towns) promoting broad based growth.
3) It engages the rural youth in villages thereby reducing the migrating pressure on cities.
4) Youth will not have to migrate anymore to look for jobs in the cities and are socially well off as they stay with family and friends.
5) Agri import reduces as the country becomes self-sufficient in food. In fact, it becomes a source of export as excess food crops can act as export revenue bringing in forex.
6) It improves the happiness quotient, reduces the carbon footprints and improves the quality of life as city dwellers can chill out in these fresh fields just around their cities.
7) The demand can be understood better and accordingly the supply can be planned out around it. Data driven agriculture will help the farmer's in realising best prices for their produce.

How

1) Farmer's will have to shed their redundant thought process and will have to upgrade, think and act as agripreneurs.
2) They will have to use sustainable technologies to improve efficiency.
3) They have to come together to form cooperatives and FPO's.
4) They have to take charge of the market (both online and offline) and has to apply an efficient supply chain to sell their products.
5) They have to design services around their farms where city dwellers come to learn, enjoy, have refreshments and they pay for these services at the farm.

The Role of Government

1) The government should only act as a facilitator in ensuring that farmers are able to live their dreams by making timely financial facilities available to them at affordable cost.
2) They should help the farmers with soil cards, weather forecasts and better corp insurance schemes.
3) Excess produce must be channelized by the Government for exports or for big industries. Slowly the Government should also allow this to be driven by the farmers themselves.
4) The government must allow more research and development to build products and services around agriculture. For example ethanol being used as fuel for transportation.
5) The government must focus on diversified growth strategies and provide opportunities to these agripreneurs to make India more self-sufficient and powerful.
6) Contract farming must be fair and must not be favouring either the farmer or the industry.
7) Dispute resolution mechanism at all levels must be quick and simple.

These few steps can help in doubling farmer's income and will be sustainable in the longer term. Empowering the farmers with facilities and markets are more important than MSP in the long run which is not sustainable and will make farmers weak in the long run. The intent must be to make the farmers stronger and ensure even small and marginal farmers are participating in the growth and development and have the power to dream big and not hang themselves with trees they themselves planted.

SUGARCANE FARMING:
YIELD MANAGEMENT IS THE GAME CHANGER

CMA (Dr.) Sreehari Chava
Practicing Cost Accountant, Nagpur
Agriculture Task Force Member
The Institute of Cost Accountants of India

Abstract

The article attempts to explore and evaluate the net income that accrues to the Indian farmer per acre of land from sugarcane cultivation. It starts with a discussion on the chain of activities of sugarcane farming and goes on to depict the sugarcane cycle.

The article lists the normative costs of sugarcane cultivation relevant for Central India and pinpoints the agricultural risks. Thereafter, cane farming margins per acre are computed per season as also per annum. Additional yield that would accrue on account of productive agricultural practices is also computed and the impact of yield management is brought forward.

The computations and discussions throw up the fact that an increase of 33.33% in the yield pushes up the annual margins by over eighty percent with a multiplier impact of over 2.4 (80 ÷33.33 = 2.4), thus correlating the principles of Marginal Costing.

I. Warm Up

India produces around forty crore tons of sugarcane every year cultivated in about fifty lakh hectares of farm lands with an average yield of eighty metric tons per hectare. Here is an attempt to explore and evaluate the net income that accrues to the Indian farmer per acre of land from sugarcane cultivation.

II. Farming Activities

Sugarcane farming may, broadly, be classified into a chain of nine activities comprising:

1. Soil Preparation
2. Plantation
3. Earthing Up

4. Nutrient Management
5. Inter Culture & Weed Control
6. Pest Control
7. Irrigation Management
8. Maturity & Harvesting
9. Ratoon

Each of these activities is discussed in brief in the ensuing paragraphs.

1. Land Preparation

Sugarcane crop stands in the field for more than a year and is sensitive to soil salinity. Soil quality as also soil preparation has a direct bearing on the yield. As such, proper soil preparation is very important towards qualitative crop and yield management. Soil Preparation consists of ploughing, disc harrowing and ridge making.

Ploughing is the technique adopted to pulverize the soil and to give the soil a better aeration. Ploughing is done during summer. In the process of ploughing earthen mounds are created. Therefore, disc harrowing is done to crush the mounds and make the soil soft and cultivable. Disc harrowing is undertaken after ploughing and exposing the land to atmosphere for a month or two. Ridge Making is a specific operation required particularly for sugar cane cultivation wherein ridges are made to plant the plantlets or seeds. All of these operations are performed, preferably, by a tractor.

In the region of central India, the cost of ploughing may work out to Rs.1500/- per acre assuming that three tractor-hours are needed for the purpose at the rate of Rs.500/- per hour. The rate per tractor-hour goes up to Rs.800/- for disc harrowing and ridge making. Accordingly, the cost of disc harrowing may be put at Rs.800/- with one tractor-hour and that of ridge making at Rs.1200/- with one and a half tractor hours.

Soil preparation facilitates proper growth of the crop by stabilizing air and water content in the soil; enabling root development; controlling diseases and pests like termite & borer from attacking the crop; and making the soil breath.

2. Plantation

Plantation can be done by two methods; either by seeds i.e. bene, or plantlets. One thousand sticks for seeding or six thousand plantlets may be considered as appropriate for an acre of land. The cost may work out to Rs.7/- per stick in case of seeds and Rs.2.25 per plantlet in the alternative. Plantation labour, generally, aggregates to twenty labour days comprising two male labour days and eighteen female labour days. The wages per day for a male labour may average to Rs.275/- and Rs.175/- in case of a female labour.

Use of seeds is cost effective but suffers from higher mortality rate as compared to plantlets. If seeds are used, it should be genetically pure and healthy with an age of 9 – 11 months. This turns out to be the most important factor in the getting proper yield. Seeds take thirty to forty five days for germination below the soil and hence cultivation cycle stretches that longer.

If the farmer opts for plantlets in lieu of seeds, the extra time consumed for germination can be used for taking some short crop. Further, in case of plantation cane matures earlier and tends to fetch better selling rate. Thus, there lies a dual advantage to opt for plantlets over the seeds though prima facie it appears to be expensive in terms of basic cost.

3. Earthing Up

Earthing up includes light as also main earthing up operations. In case of light earthing up, soil is applied to the bottom of sugar cane plant, so that the plant stands stable above the ground. Light earthing up can be done with the help of a pair of bullocks. In case of main earthing up, ridges are converted into furrows and vice versa with the help of bullocks or tractor power. As a result soil is applied to the bottom of sugar cane plant upto four feet of height and helps it to stand stable. Main Earthing up is done after four months of plantation.

Light earthing up may cost Rs.800/- per acre with one tractor hour whereas main earthing up may go upto Rs.1600/- per acre with two bullock days at the rate of Rs.800/- per day.

4. Nutrient Management

Nutrient Management may consist of organic manures such as yard manure and green manure or inorganic manures comprising chemical fertilisers.

Yard manure may be made up of cowdung; pressmud from sugar factories; farm wastes like soybean, tur, cotton, rice, etc,. All these decomposed bio wastes are rich in natural nutrients. Yard manure should be applied on the soil after ploughing and before disc harrowing. Once it is applied, it gets mixed with the soil properly and then ridge making can be done.

Green manure is produced out of a farming process wherein some short term crops like sun hemp, dhaincha, green gram, soybean etc. are grown in the field for a short period of time; and then buried in the soil before flowering. Green manures are usually sown before active monsoon. Green manure helps in developing flora & fauna and improving the bacterial count of the soil.

Three types of chemicals fertilizers, i.e. Urea, DAP, Iffco 10:26:26 and micro nutrients are ideally used in sugarcane farming. They are applied in four stages; viz. initially before plantation, then after one month, two months and four months from the plantation.

The farmers generally spend upto Rs.4,000/- per acre in case of organic manure and around Rs.6,000/- in case of fertilisers. The dosages do differ from soil to soil and climate to climate. Farmers also tend to spend about a thousand rupees towards micro nutrients.

5. Inter Culture & Weed Control

Inter Culture & Weed Control Operations are intended to remove the weeds grown in between the rows of main crop. These weeds unnecessarily eat up the nutrition of the soil and make the main crop weak. Weed removal is essential from time to time specially after rainy season.
De-weeding can be done either manually or it can be carried out with the help of de-weeding spray. Due to non-availability of labourers for hand weeding, chemical weed control is now becoming more and more popular.

Spraying of Atrazine @ 2 kg a.i./ha at pre-emergence and 2-4-D sodium salt @ 1 kg a.i./ha at post emergence (8 to 10 weeks after planting) controls weeds effectively. Trash mulch @ 5 tonnes/ha at 45 days after planting is useful to control weeds and avoid cost on hand weeding/hoeing. On an average, the de-weeding cost computes to Rs.2000/- per acre assuming 2 litres of chemicals @Rs. 600/- per litre and labour charges of Rs.800/-.

6. Pest Control

Pest Control refers to the control the diseases and pests on sugarcane. Insecticides and pesticides are sprayed, from time to time, on the crop to make it healthy and grow faster. The spray is incidental and contingent and the annual outflow on this count may range anything upto Rs.1500/- per acre in case of plant crop and Rs.2500/- in case of Ratoon.

7. Irrigation Management

Water is the one factor that is needed throughout the life span of a sugarcane plant. About 1.20 lakh litres of water per week for 40 weeks is the estimated consumption per acre. Accordingly, a 7.5 HP pump at 4 hours per week with a flow of 30,000 litres per hour can irrigate an acre of sugar cane.

Sugarcane yield can be improved by adopting better irrigation water management and scientific crop production practices. Adoption of any one of the modern irrigation techniques such as straight ridges and furrows with gentle slope, contour furrows, leveled furrows, drip irrigation and a combination of sprinkler plus straight furrows can improve the water management methodology.

The water sources could be own wells or irrigation canals. In both the cases electricity is used for drawl of water and labour hours could remain the same. However, in case of canal water the cost of water is to be borne by the farmer. The cost of irrigation may range upto Rs.8,000/- per acre depending upon the need and source.

8. Maturity & Harvesting

Sugarcane maturity period ranges between 12 to 15 months depending upon the variety. Cane is to be harvested only when it is mature enough. Practical tests to judge maturity include: (a) general yellowish colour of whole crop, (b) cessation of growth, (c) swelling of eye buds, (d) metallic sound of cane, (e) breaking of cane at the nodes and (f) Brix saccharometer reading between 21 and 24. Irrigation is withheld for about 10 to 15 days prior to harvesting.

9. Ratoon

Ratooning is an ancient method of propagation in sugarcane in which subterranean buds on the stubble (the part of cane left underground after harvesting) give rise to a new crop stand, which is usually referred to as the 'ratoon' or the 'stubble crop' as opposed to 'plant crop', which is raised from seeds or seedlings.

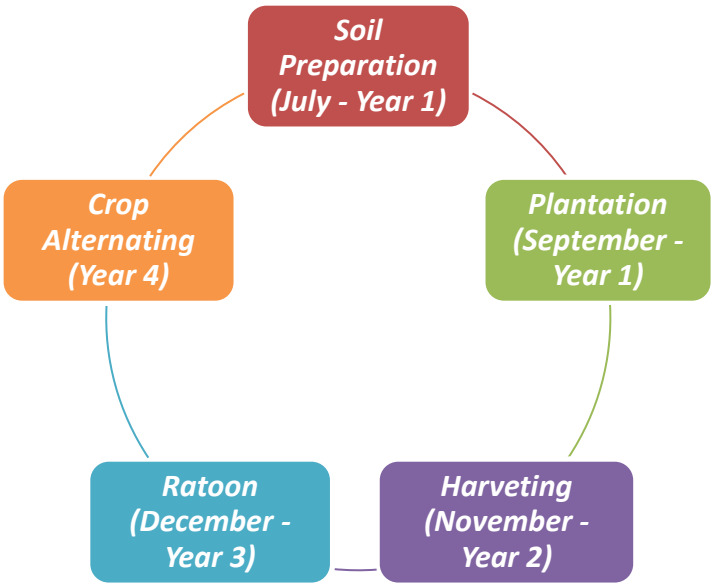
Ratooning reduces the cost of cultivation by dispensing with additional seed material and some agricultural activities such as soil preparation, yard manure and preparatory irrigation. It also results in early ripening of canes by at least a month or so, and thus adds to the effective crushing period.

The number of ratoons in sugarcane production cycles may vary from two (which is normal) to four. A decline in cane yield in successive ratoon crops, the so-called "ratoon decline", in the order of 20%, had been reported from many sugarcane-growing areas in India.

III. Sugarcane Cycle

Assuming that the plantation takes place in September in year one, soil preparation would commence in July; the plant harvesting can take place 14 months hence, i.e. in November of year two; and the ratoon would be ready 13 months thereafter, i.e. in December of year three.

Year four is to be used for crop alternating. Crop alternating, here, refers to going for an alternate crop such as cotton in between two sugarcane cycles, viz. after harvesting the ratoon of current cycle and before preparing the soil for next cycle.



Crop alternating is essential from the aspect of preserving the soil strength by means of avoiding mono cropping. Further, the soil becomes richer for the alternative crop due to two factors, i.e. (a) sugar cane trash and roots get mulched in the soil enriching the green nutrients, and (b) some nutrients available in the soil which are not needed for sugar cane remain available for next crop. As a result, the farmer can obtain higher yield from the alternative crop too.

The farmer can easily revert back to sugar cane next year. Thus the agri-cycle of sugar cane may span over 4 years with three years for two harvests of sugarcane and one year for the alternative crop.

IV. Normative Cost

The term normative cost is coined out to reflect the expenses incurred by a diligent farmer on a compatible soil in the region of Central India. These expenses have been classified and computed activity-wise, i.e. soil preparation, plantation, and so on.

The detailed computations relating to normative costs per acre are furnished in annexures as follows:
Annexure 1: Normative Cost of Plant Crop with Seeds;
Annexure 2: Normative Cost of Plant Crop with Plantlets; and
Annexure 3: Normative Cost of Ratoon.
Table 1 provides a summary of the costs detailed in the annexures.

Table 1: Normative Cost per Acre of Cultivation of Sugar Cane (Rs.)

Serial	Activity	Plant Crop		Ratoon
		Seeds	Plantlets	
1	Soil Preparation	3500	3500	1500
2	Plantation	10700	16675	
3	Earthing Up	2400	2400	1600
4	Nutrients	11045	11045	10930
5	Interculture & Weed Control	2350	2350	1750
6	Pesticides	1500	1500	2500
7	Irrigation	8500	7650	7650
8	Total (1..7)	39995	45120	25930

As may be observed from the table, the normative cost of cultivating sugarcane works out to Rs.39,995/- per acre for Plant crop with seeds; Rs.45,120/- per acre for Plant Crop with plantlets; and Rs.25,930/- per acre in case of ratoon.

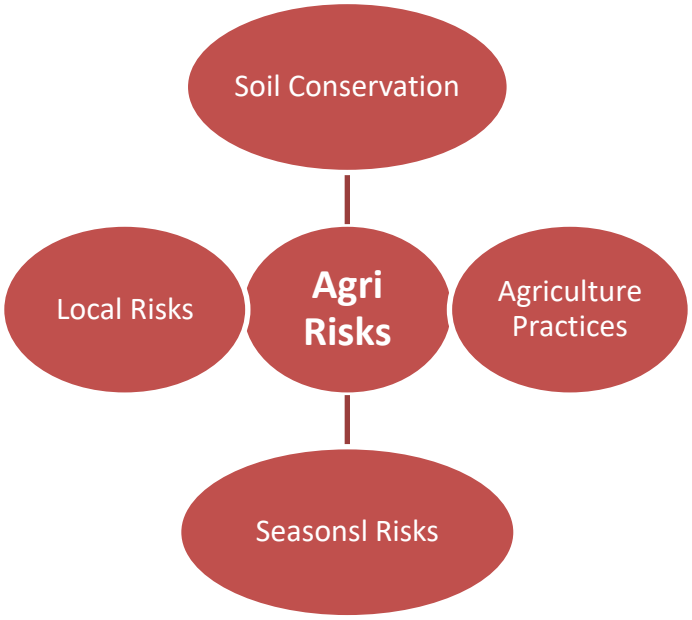
The activity costs of cultivation, as above, have been computed on the basis of normative outsourced rates. Therefore, the wear & tear of the agriculture implements and the labour days put in by the farmer himself stand included in the computations.

An interesting feature that comes to fore, here, is that maximum portion of the elements of costs of cultivation; viz. could it be seeds or plantlets, could it be nutrients or other material; could it be tractor hours or labour days; as considered in the computations referred above, tend to remain fixed per acre per season. Once the cropping decision is taken, these costs remain committed and do not change. The variable elements are limited to contingent activities such as pest control and weed control.

V. Agri Risks

Agri-risks have a direct bearing on agri-yield. The normative yield may go up or fall down owing to the quantum and level of the related risks. The risks relating to sugarcane cultivation may be listed as:

1. Soil Conservation
2. Agricultural Practices
3. Seasonal Risks
4. Local Risks



Soil Conservation: Soil conservation implies preserving the soil characteristics and thereby retaining the soil fertility. Soil characteristics may vary from area to area and even from farm to farm in the same area. The type of soil e.g. black cotton, sandy, loamy, laterite, etc.; nutrients available in the soil; last crop taken and water table of the area are the major determinants of soil quality. The soil condition can be checked by using soil testing devices. It can help in determining the nutrients (manure & fertilizers) to be used for a particular crop. Soil condition can improve or deteriorate depending upon the agricultural practices being adopted by the farmers.

Agricultural practices: Agricultural practices refer to the farming procedures adopted in a particular area with respect to farm care and management, viz. practices and procedures relating to quantum and qualitative aspects concerning variety of the cane planted, farm yard manure, green manure, chemical fertilisers, weed management, etc. Agricultural practices impact the yield in the long run. To be more specific, even if the area is having unhealthy soil and low water table, efficient agricultural practices can enhance the yield apart from improving the soil fertility.

Seasonal Risks: Seasonal risks refer to contingent risks resulting from climatic changes and include unanticipated pest attacks, heavy rains, flooding, harsh summer, and so on. Cane is a crop which requires balanced climatic conditions and hence needs to be protected from seasonal risks with timely remedial measures such as pest control, earthing up, nutrient management, etc.

Local Risks: Local risks are specific to the location. For example an area in the proximity of forest may be prone to wild animals spoiling the crop; an area on the river bank is subject to the risk of flood, etc. Along with the farming practices, local risk prevention and mitigation should also be adopted properly.

The key for risk mitigation, evidently, revolves around adhering to productive and effective agricultural practices which would encompass normative scheduling of the farming activities; i.e. from soil preparation to harvesting; and adhering to the schedule scrupulously without any violation or deterrent.

VI. Farming Margin

Farming margin is the net income that accrues to the farmer after defraying all the cultivation expenses and interest on the working capital. The fact to be remembered, in this context, is that the working capital needs of the farmer equal up to the total of cultivation expenses as the revenue is realised only after harvesting the crop.

In a normative model the average yield per acre may range between 30 Mt to 40 Mt per acre or 75 Mt to 100 Mt per hectare. The yield may go up further or fall down below depending upon the level of related risks and their mitigation.

Assuming an yield of 30 Mt, which should be the minimum, for plant crop and 24 Mt for ratoon; and further assuming a cane price of Rs.2250/- for the seed crop as also ratoon and Rs.2500/- per Mt for the plantlet crop; the computations of farming margin are detailed in annexure 4. Table 2 provides the summary of the said computations.

Table 2: Farming Margin per Acre of Sugar Cane (Rs.)

Serial	Description	Plant Crop		Ratoon
		Seeds	Plantlets	
A	Revenue			
1	Yield (Mt)	30	30	24
2	Price per Mt of Cane	2250	2500	2250
3	Revenue	67500	75000	54000
B	Cost of Cultivation	39995	45120	25930
C	Primary Margin (A-B)	27505	39880	28070
D	Interest on Working Capital @ 8% p.a.	3200	3610	2074
E	Farming Margin	24305	26270	25996

The aggregate farming margin per acre of sugarcane, accordingly, works out to Rs. 24,305/- for the principal crop of seeds; Rs. 26,270/- for the principal crop of plantlets; and Rs.25,996/- for the ratoon crop.

The assumed sugarcane cycle being of three years, the margin per cycle would consist of margin of one principal crop and that of ratoon; and the annual margin needs to be derived by dividing the margin per cycle with the number of years, i.e. three. The annual farming margins are computed, accordingly, and are furnished in table 3.

Table 3: Annual Farming Margin (Rs.)

Serial	Description	Seeds	Plantlets
A	Margin for the Cycle		
1	Principal Crop	24305	26270
2	Ratoon	25996	25996
3	Total	50301	52266

B	Sugarcane Cycle in Years	3	3
C	Margin per Year (C = A÷B)	16767	17422

Thus, the average margin of sugarcane farming per annum works out to Rs.16,767/- for seeds and Rs.17,422/- for plantlets. It needs to be recalled that these average annual margins reflect the net income accruing to the farmer after providing for all expenses including own efforts. Therefore, these margins may be considered fair and reasonable in the Indian context.

VII. Yield Management

Agricultural practices adopted by model farmers establish the fact that the minimum yield of 30 Mt per acre, considered for the purpose of computing the farming margin as above, can be enhanced by a minimum of 33.33%, i.e. to 40 Mt per acre; by adopting productive agricultural practices, adhering to the schedule of activities scientifically all through the chain and overcoming the seasonal and local risks; and that too without incurring any additional costs what so ever.

In such an eventuality, the yield would go up by 10 Mt in case of principal crop and by 8 Mt in case of ratoon. There being no incremental costs, the entire revenue accruing on account of the additional yield would straight away shore up the farming margin.

Table 4 provides the computations relating the impact of the additional yield on the farming margin.

Table 4: Impact of additional yield on Farming Margin (Rs.)

Serial	Activity	Adasali		Ratoon
		Seeds	Plantlets	
A	Farming Margin as at table 2	24305	26270	25996
B	Additional Revenue			
1	Additional Yield (Mt)	10	10	8
2	Price per Mt of Cane	2250	2500	2250
3	Revenue	22500	25000	18000
C	Revised Margin (A+B)	46805	51270	43996
D	Percentage of Increase over A	92.57%	95.17%	69.24%

Evidently, the farming margin for the principal crop increases from Rs.24,305/- to Rs.46,805/-, i.e. by 92.57%, in case of seeds; from Rs.26,270/- to Rs.51,270/-, i.e. by 95.17%, in case of plantlets; and from Rs.25,996/- to Rs.43,996/-, i.e. by 69.24%, in case of ratoon. Undoubtedly, the increases are quite significant.

The consequential impact of these increases on annual margins is computed and furnished in table 5.

Table 5: Impact of additional yield on Annual Margin (Rs.)

Serial	Description	Seeds	Plantlets
A	Margin for the Cycle		
1	Principal Crop	46805	51270
2	Ratoon	43996	43996
3	Total	90801	95266
B	Sugarcane Cycle in Years	3	3
C	Margin per Year (C = A÷B)	30267	31755

Apparently, the annual margin in case of seeds goes up from Rs.16,767/- to Rs.30,267/-, i.e. an increase of 80.52%; and in case of plantlets it moves from Rs.17,422/- to Rs.31,755/-, i.e. an increase of 82.27%. The annual margins of over thirty thousands of rupees per acre may, obviously, be construed as one of the high-rung inflows for an Indian farmer.

VIII. Quick Bite

The note worthy point is that agriculture costs, for a majority of the crops, tend to remain fixed per acre per season. Therefore, every unit of additional production adds up to the revenue, i.e. farming margin, as is advocated by the principles of Marginal Costing. As may be been seen from the computations and discussions in the preceding paragraphs, an increase of 33.33% in the yield pushes up the annual margins by over eighty percent with a multiplier impact of over 2.4 (80 ÷33.33 = 2.4).

Imagine the impact on Indian Farmers' Income; a situation wherein forty crore tons of sugarcane produced in India every year can be increased, at least by twenty five per cent, to over fifty crore tons without much of additional farming costs whereby their annual income can be pushed up by about seventy five per cent! Hence, the inference "Agri Yield Management is the Game Changer" and that is the technique which can pave the way to augment the Indian Farmers' Income in years to come!

Annexure 1

Normative Cost per Acre of Plant Crop with Seeds

Serial	Particulars	UOM	Qty	Rate	Rupees
1	**Soil Preparation (by tractor)**				
i	Ploughing	Hrs	3	500	1500
ii	Disc Horrowing	Hrs	1	800	800
iii	Ridge Making	Hrs	1.5	800	1200
vi	Sub Total (i..iii)				3500
2	**Plantation**				
i	1000 sets @ 7 per stick	Sets	1000	7	7000
ii	Male Labours	Mandays	2	275	550
iii	Female Labours	Mandays	18	175	3150
iv	Sub Total (i..iv)				10700
3	**Earthing Up**				
i	Light Earthing up Operation (Tractor)	Hr	1	800	800
ii	Main Earthing up Operation (Bullocks)	days	2	800	1600
iii	Sub Total (i+iii)				2400
4	**Nutrients**				
4.1	**Organic Manure**				
a	Yard Manure (Cow dung)				
i	Two Tractor loads @1500 per Tractor	Trolly	2	1500	3000
ii	Transport and Labour Charges		2	500	1000
iii	Sub Total (i..ii)				4000
	Or				
b	Application of Green Manure				
i	Cost of Seed (Dhaincha/ Jute)	Kg	35	90	3150
ii	Tractor Rent/ Labour charges	Hr	1	800	800
iii	Sub Total (i..ii)				3950
c	Say				4000
4.2	**Chemical Fertilizers**				
i	Urea	Bags	2	260	520
ii	DAP	Bags	2	1175	2350
iii	Iffco 10:26:26	Bags	2	1175	2350
iv	Labour Charges	Days	3	275	825
v	Sub Total (i..iv)				6045
4.3	**Micro Nutrients**				1000
4.4	**Total (Nutrients)**				11045
5	**Interculture & Weed Control**				
i	Seed Treatment	Ltr	2	300	600
ii	Weedicide	Ltr	2	600	1200
iii	Labour Charges	Mandays	2	275	550
iv	Sub Total				2350
6	**Pesticides**				1500
7	**Irrigation**				
a	Canal Irrigation				
i	Irrigation charges				5000
ii	Labour Charges	Mandays	10	275	2750
iii	Sub Total				7750
	Or				
b	Own Irrigation				
i	Electricity Charges	KW	1000	3	3000
ii	Labour charges	Mandays	20	275	5500
iii	Sub Total				8500
c	Say				8500
8	**Total (1..7)**				39995

Annexure 2

Normative Cost per Acre of Plant Crop with Plantlets

Serial	Particulars	UOM	Qty	Rate	Rupees
1	**Soil Preparation (by tractor)**				
i	Ploughing	Hrs	3	500	1500
ii	Disc Horrowing	Hrs	1	800	800
iii	Ridge Making	Hrs	1.5	800	1200
vi	Sub Total (i..iii)				3500
2	**Plantation**				
i	6000 Plants @ 2.25 per stick	Plants	6000	2.25	13500
ii	Male Labours	Mandays	2	275	550
iii	Female Labours	Mandays	15	175	2625
iv	Sub Total (i..iii)				16675
3	**Earthing Up**				
i	Light Earthing up Operation (Tractor)	Hr	1	800	800
ii	Main Earthing up Operation (Bullocks)	days	2	800	1600
iii	Sub Total (i+iii)				2400
4	**Nutrients**				
4.1	**Organic Manure**				
a	Yard Manure (Dung)				
i	TwoTractor loads @1500 per Tractor	Trolly	2	1500	3000
ii	Transport and Labour Charges		2	500	1000
iii	Sub Total (i..ii)				4000
	Or				
b	Application of Green Manure				
i	Cost of Seed (Dhaincha/ Jute)	Kg	35	90	3150
ii	Tractor Rent/ Labour charges	Hr	1	800	800
iii	Sub Total (i..ii)				3950
c	Say				4000
4.2	**Chemical Fertilizers**				
i	Urea	Bags	2	260	520
ii	DAP	Bags	2	1175	2350
iii	Iffco 10:26:26	Bags	2	1175	2350
iv	Labour Charges	Days	3	275	825
v	Sub Total (i..iv)				6045
4.3	**Micro Nutrients**				1000
4.4	**Total (Nutrients)**				11045
5	**Interculture & Weed Control**				
i	Seed Treatment	Ltr	2	300	600
ii	Weedicide	Ltr	2	600	1200
iii	Labour Charges	Mandays	2	275	550
iv	Sub Total				2350
6	**Pesticides**				1500
7	**Irrigation**				
a	Canal Irrigation				
i	Irrigation charges				4500
ii	Labour Charges	Mandays	9	275	2475
iii	Sub Total				6975
	Or				
b	Own Irrigation				
i	Electricity Charges	KW	900	3	2700
ii	Labour charges	Mandays	18	275	4950
iii	Sub Total				7650
c	Say				7650
8	**Total (1..7)**				45120

Annexure 3

Normative Cost of Ratoon per Acre

Serial	Particulars	UOM	Qty	Rate	Rupees
1	**Soil Preparation (by tractor)**				
i	Stubble Shaving Operations	Hrs	2	500	1000
ii	Trash Mulching				500
iii	Sub Total	Hrs	2	500	1500
2	**Earthing Up**				
	Main Earthing up Operation (Bullocks)	days	2	800	1600
3	**Nutrients**				
3.1	**Organic Manure**				
a	Yard Manure (Dung)				
i	Tractor loads @1500 per Tractor	Trolly	0	1500	0
ii	Transport and Labour Charges		0	500	0
iii	Sub Total (i..ii)				0
	Or				
b	Application of Green Manure				
i	Cost of Seed (Dhaincha/ Jute)	Kg	0	90	0
ii	Tractor Rent/ Labour charges	Hr	0	800	0
iii	Sub Total (i..ii)				0
c	Say				0
3.2	**Chemical Fertilizers**				
i	Urea	Bags	3	260	780
ii	DAP	Bags	3	1175	3525
iii	Iffco 10:26:26	Bags	3	1175	3525
iv	Labour Charges	Days	4	275	1100
v	Sub Total (i..iv)				8930
3.3	**Micro Nutrients**				2000
3.4	**Total (Nutrients)**				10930
4	**Interculture & Weed Control**				
i	Weedicide	Ltr	2	600	1200
ii	Labour Charges	Mandays	2	275	550
iii	Sub Total				1750
5	**Pesticides**				2500
6	**Irrigation**				
a	Canal Irrigation				
i	Irrigation charges				4500
ii	Labour Charges	Mandays	9	275	2475
iii	Sub Total				6975
	Or				
b	Own Irrigation				
i	Electricity Charges	KW	900	3	2700
ii	Labour charges	Mandays	18	275	4950
iii	Sub Total				7650
c	Say				7650
7	**Total (1..6)**				25930

Annexure 3

Farming Margin per Acre of Sugar Cane

Serial		Particulars	Seeds	Plantlets	Ratoon
A		**Revenue**			
	1	Yield per Acre (MT)	30	30	24
	2	Rate per MT (Rs.)	2250	2500	2250
	3	Revenue	67500	75000	54000
B		**Cost of Cultivation**			
	1	Soil Preparation	3500	3500	1500
	2	Plantation	10700	16675	
	3	Earthing Up	2400	2400	1600
	4	Nutrients	11045	11045	10930
	5	Interculture & Weed Control	2350	2350	1750
	6	Pesticides	1500	1500	2500
	7	Irrigation	8500	7650	7650
	8	Total (1..7)	39995	45120	25930
C		**Primary Margin**	27505	29880	28070
D		**Interest on Working Capital @ 8% on Cost**	3200	3610	2074
E		**Farming Margin**	24305	26270	25996

DATA CULTURE FOR AGRICULTURE

CMA Dendukuri Zitendra Rao
Agriculture Task Force Member
The Institute of Cost Accountants of India

"Anna Datha-Sukhibhava" is the ancient prouncement of our cultutre.Taking a cue from this, the whole India should safeguard the precious specie called "farmer" whose occupation is to feed so many living objects including you and me.Agriculture – known as VYAVASAAYAM in my telugu states with its origin from Sanskrit implies "Sacred Effort". It should not result in punishment to the Farmer. This is the motto with which I intend to summarise my views in the following lines.

A. Backdrop

I was hearing to one melodious Telugu poem in my childhood about the villages which implies that "*A visit to a village can refresh the soul"* and this scene is to be sustained at any cost; in spite of changes in external aspects such as ecological, technological, environmental aspetcs. We cannot afford to have "The Hero" of our country – the Farmer as a disturbed man in spite of supports from the Governments by means of Infrastructrure, Subsidies and optimal price for the produce of the Farmer. On holistic study for the period 1960 to 2018; the average contribution of agriculture to Gross Domestic Product in India is around 28%. Even for the FY 2018 the same is around 15% - still higher than global average of 10%. The economic survey for the FY 19-20 emphasizes the promotion of entrepreneurship at District Level in order to create wealth at grass toot level. Farmer – a borne entrepreneur needs to be encouraged for – with certain downstream value added activities for the agricultural produce. Doubling the Farmers's Income is also been discussed in all gatherings of social activists or economists. The question is doubling from what level. Is it from Rs.10/- to Rs.20/- or is it from Rs.100/- to Rs.200/-. There should be clarity. Minimum support price (MSP) to the farmers for their produce is the discussion point across all segments of our society. The basic frame work for deciding the MSP is the "cost of production". What constitutes cost has become an issue in spite of several scientific studies in this regard. **The Institute of Cost Accountants of India** is specialized in Cost Management studies and hence it can have a say as well. In the process the Institute can collate the views of various stake holders for onward summing up to Policy Makers. As the ultimate motto is the well-being of an important stake holder of this country – the FARMER – the Institute's role would be highly appreciated. Government intends to assure Minimum Support Price (MSP) to farmers on the basis of 1.5 times of the **cost of production**. Thus the concept of **Cost of Production** for the agricultural activities taken up by our Farmer fraternity has come into lime light. As "COST IS A FACT" the process and the methodology for fixing the same is to be studied from varied dimensions. *The issue is rerlated to economic, social and technical feasibility of the agricultural activity.* Confining the discussion to the economic reasons an attempt is made to bring to the notice of all the stakeholders - a probable and possible action plan that can be an apt solution for the well-being of FARMER and thus the man kind is not deprived of food grains. In 2018 - I brought my thought process to the notice of Prof. M. S Swaminathan (the father of Green Revolution in India)

whose Framework and Formula for Minimum Support Price to Farmer is bench mark for Governments. ***In my interaction with this great man he opined with clarity that our Institute has a great role in serving the Agricultural Sector.***

B. Cost Structure in Public Domain

As I understood from several officials, economists, experts and other stake holders – the Cost structure that is generally been followed is based on the recommendations of Prof.MS Swaminathan. The Template talks of costs at different stages viz., A1, A2, B1, B2, C1, C2 and C3 as detailed below:

A1	Total Input Cost – Direct Spent on Cultivation
A 2	Rent Paid for Lease land + Cost at A1
B 1	Interest on value of owned capital asset + Cost at A1
B 2	Rented Value of owned land + Cost Cost at B1
C 1	Imputed Value of family Labour + Cost at B1
C 2	Imputed Value of family Labour + Cost at B2
C 3	Cost at C2 + Managerial Cost at @ 10%

The Government is been debating to consider the A2 (The prime input operational costs) plus Family Labour as the basis for Cost Of Production and intends to fix the MSP as 1.5 times of said COP. The important aspect is the Data that is considered to arrive at the above values. The environ for the farming activity is so dynamic – the outcomes are unpredictable.

C. **Existing mechanism for Cost calculation.**

In the present set up – lot of Statistical Data on the aspects of yield, productivity, crop pattern and extent of cultivation etc., are available from Ground ZERO level – but **the actual costs** incurred by farmer in specific are not available. It is available always on approximation basis. With the help of data generated from various states in the country, Commission for Agricultural Costs and Prices (CACP) recommends the prices of selected 23 crops such as paddy, wheat, corn, maize, sugarcane, ragi, cotton and soya. While recommending the MSP, CACP takes into consideration aspects such as Demand and Supply, Cost of production, Price trends in the market etc.. Objective of CACP is to evolve a balanced and integrated price structure in the perspective of the overall needs of the economy and with due regard to the interests of the producer and the consumer.

I made an attempt to understand the sample size of the primary data that is been recknoned for this exercise and the same is understood to be small. Moreover – One MSP for the whole Nation is again a sort of injustice to a sect of Farming Community. It is fact that the data is not comparable from year to year, from place to place and from farmer to farmer. The returns to a Farmer depend upon two components viz., Yield and the Market Rate. Both these components have good amount of Risk and UNCERTAINTY. Hence studies are to be taken up mapping the RISK PROFILE of each of the FARMER. Then only perhaps - we can witness a satisfied FARMER. Another interesting information that I heard is that there were no suicides reported from sugarcane cultivators though they are reluctant to cultivate sugarcane because of practical inconveniences. The reason for this is the **farmer wise data collection** mechanism that is been practiced in order to provide the required support. All that I am advocating in this write up is "Data collection on a broader Platform – thus Maximising the Data population"

D. Suggested Methodology

We can plan to arrive at the cost of cultivation and cost of production of each of the Farmer for each type of of the crop that he/she produces. The academicians and experts on larger canvass should envisage to bring to the lime light the cost disparities from one agro climatic Zone – one state to the other and so on. Since the MSP is been handled by Central Government – they can envisage to appoint village level COST COUNSELORS or COST COLLECTORS (CCs) as **Interns** to be replaced at an interval of every 3 years. They need not be regular employees on the rolls of Government. Candidates can be young Graduates / Under Graduates to be sourced from the surrounding nearby villages – to serve in the designated villages. In the process nearly 6 lakhs young persons to be designated as COST COLLECTORS or COST COUNCELLORS would get involved in the project at any given point of time churning out valid PRIMARY DATA for an appropriate village level or District level consolidation as derivative. The Farmer specific data would always be available as backup. Thereby the support activities to Farmers can be planned by the policy makers. Any government agency can be nodal authority for this whole project. This approach can have certain add on benefits such as

- In case of natural Calamities the farmer is assured of **costs** he parted with. It would be an easy task for the Government to arrive at the actual financial loss
- The data collected can be used as perfect data for varied stake holders like market forces, Financial Instituitions, Government agencies, Insurance players, Input suppliers etc..The banking and Insurance sectors can be efficiently be monitored by Governments.

E. Research - Training - Skill Development

In one of the Budget pronouncement – Hon.FM was advocating the concept of Internship opportunities under Education and skill development. Extending this concept to the Agricultural activity – we can bring the youth nearer to agricultural activity. In this process even Youth can take up agriculture as the life style with no sense of insecurity – which would ensure the capacity built up. Imparting the training on the Data Collection process coupled with inter personal and articulation skills would result in ppotential development of Human Resources at couple of lakhs a year that would enable them to be employable across the globe in many general areas. The skill/training/occupation to the youngsters would instill confidence in their thought process – so that they can march ahead in some career or other including agriculture. If not on similar lines - amidst the Covid 19 scenario – the volunteer establishment initiative of **Government of Andhra Pradesh** proved to be very useful proposition.

With its new initiative of striving for Augmenting the Farmers' Income - The Institute of Cost Accountants of India with its PAN India presence and involvement in the project ; can bring good value addition as discussed hereunder:

1. Developing Cost Structiures and Data Card structures
2. Providing Training to the Interns on the methodologies
3. Involving Practcing CMA community to associate with the task of vetting the data collected with the sense of social responsibility.
4. Publishing Cost Data of varied crops of varied Zones/States.

F. Finally….

Both Central and State Governments are provding substantial Budget outlays for the welfare of the farmer such as Fertilisers and Seeds subsisidies - supplying Electricty for Farming absolutely at free of cost or at concessional rate - Cash support in the form of Rythu Bandhu , Rythu Bharosa and PM Kisan Nidhi schemes. In addition - huge capital budgets for the construction of Irrigation Projects are been provided. The outflow ultimately need to evolve a "Satisfied Farmer". The thought process envisaged in this write up can also have the following advantages.

* The deserving benefeciaries (farmers) would certainly be given the required support
* Farming activity would be brought into Organized environment and the advantages falling on will ensure full co-operation from Farmer.
* Correlating with the Total Environmental value concept - Farmer with ecological concern (water consumption and pesticides usage) can be encouraged and be rewarded. For Ex:Farmer with optimal utilization of pesticdes and water resources can be encouraged by offering interest subsidies on the Crop Loans.
* Real Time data Monitoring leads to Effective decision making and proper communication to the Farming community.
* Data collection can be extended to all the crops with out recourse to those subjected to MSP fixation. I am happy that in my pursuation to bring these thoughts to the notice of varied stake holders; the officials of Government of Andhra Pradesh gave a hearring to me in Sept 2019 and were willing to take the services of our Institute for collecting the Cost of Cultivation of Onioin and Tomato.
* With Government focusing at organizing the farming community through Farmer Producer Organisation (FPO) set up - all the more the Data collection can be coordinated through them by attaching the Cost Collectors / Cost Counsellors to the near by FPOs
* MSP should emerge as Profitable Price but not just as Break Even price. There should be gain from every farmer's perspective considering him as an Entreprenuer.

I only wish that the all our efforts would *ensure that the farmer WOULD carry on the farming as a matter of pride and comfort. Let us not forget : nearly 58% of Indian Population know only one trade and that is* AGRICULTURE.

18:78

ATMA NIRBHAR KRISHI – AN OPPORTUNITY FOR CMA

CMA N Raveendranath Kaushik
Agriculture Task Force Member
The Institute of Cost Accountants of India

It remembers me the days when Agriculture sector used to contribute to major share of our GDP and after series of Economic reforms were introduced, today we find that there is significant drop in the Agriculture sector contribution to GDP. The sector employs 60% of India's total population and the majority of our rural population depends on Agriculture for their livelihood. This is one of the sectors which have the capacity and capability to absorb the huge population and there by generate income and employment. In a country like us, where we see huge demographic dividend and it is also projected that this trend of enjoying demographic dividend continues for next 32 years, then it will become a serious challenge as to how we will be able to productively utilize this demographic dividend? There is a fall in Agriculture land holdings due to urbanization ,industrialization and migration but, we are seeing on the other side the population is increasing. Now we are witnessing that there is a tremendous stress on the cultivable land as more and more population needs to depend on less and less available cultivable land for survival.

Inter-ministerial committee setup by the Government of India in April 2016 to look in to the various issues relating to Doubling of Farmers Income, came out with the following suggestions which are very important from the perspective of Income growth, they are:

1. Improvement in Crop productivity
2. Improvement in Livestock productivity
3. Saving in Cost of Production (efficient resource utilization)
4. Increase in Cropping intensity
5. Diversification towards high value crop
6. Improvement in real prices received by the farmers
7. Shift from farm to non-farm occupation

After adopting the above recommendation, Government came up with lot of initiatives and reforms to benefit the farmers. There are around 17 different initiatives of famer welfare which government has launched apart from the state government initiatives. The latest one is under the Atma Nirbhar Bharath Krishi which mainly focus on comprehensive market reforms and creation of Agriculture Infrastructure Fund (AIF) worth Rs 1 lakh crore and allocation of Rs 500 cr for Bee Keeping initiative.

CMA and Atma Nirbhar Krishi

As a CMA, I got quite good exposure when I initially worked on some consultancy project of Horticulture Department of Government of Karnataka and few assignments from Agriculture Finance Corporation and also few evaluation studies of Karnataka Evaluation Authority. The various assignments undertaken created a space for lot of interaction with Agriculture Experts, Researchers, Farmers etc which helped me a lot to understand the various intricacies and challenges which haunts our agriculture sector. Even though, as a CMA we are not domain experts in Agriculture but as a cost professionals we can get associated with the agriculture domain experts and bring revolution in areas of Agri Costing and Pricing. I thank the Institute for coming up with the wonderful initiative of setting up a Task Force on Agriculture Costing and in days to come we can explore lot of opportunities in which our services can be extended and also as a professional body it will enhance our visibility in contributing towards Nation development.

If we see the Inter-ministerial recommendation, the third and sixth point of the recommendation is the one where our profession directly can be helpful. We can also be helpful in the other recommendations to some extent but our domain expertise can be demonstrated in areas of ***saving of cost of production i.e by effective utilization of resources and improvement in real prices received by farmers.*** I feel the followings are some of the roles which a Cost Accountant can perform in order to achieve the said objectives:

1) **Developing a Cost Standard for Agriculture Sector** : After having few discussions with the Agriculture Economist, I found that they do follow costing but, there is no proper standard for the same. There are no common guidelines or direction under which they do costing. They sometime follow FAO (Food and Agriculture Organization) which has its own limitations. The approaches what they follow most of the times are based on assumptions which are subject to lot of constraints. Even though they collect lot of data but, most of the data is not getting used properly because of not following proper approach. There is a urgent need to work on a Cost Standard for Agriculture Sector which our Institute can take up on priority basis by involving agriculture domain experts in it.
2) **Valuation of Tangible and Intangible Assets used in Agriculture**: There is a urgent need to have a proper mechanism in place for valuation of Tangible and Intangible Assets which directly and indirectly contributes towards Agriculture production. In one of the discussion with Agri Economist, they expressed that they still lag in understanding on how to amortise an Intangible Asset and how to Value the Research and Development activities which they carry out in Agriculture areas. These types of issues can be addressed by our profession by bringing a Standard Operation Process (SOP) after having consultation with the Agri domain experts.
3) **Utility Pricing and Benefit analysis:** There are lot Utilities which are aiding the Agriculture Sector and most of these are given by the government either at free or at subsidized rates. There is no formal practices where in the Utility Benefit analysis is carried out. This is very important areas of focus as the government can visualize how much utility it gave free of cost and at subsidy and what is the benefit it achieved by doing so. There should be some sort of comparatives which needs to be accounted through proper measurement. Institute can come up with a mechanism and suggest the government as to how it can optimize the use of utility and the benefit derived there by.
4) **Customise Cost Data Tool:** Right now there are huge data which is been collected by different agencies from various farmers, but most of the data is not properly getting used. Institute can play a big role here, we can brining in some customization in Cost related information and can inculcate the same in the tool so that it will improve the efficiency, accuracy and saving time to large extent.
5) **Cost to Benefit Analysis:** Agriculture doesn't stop with only growing crops, it includes even horticulture, sericulture, pisciculture, bee culture, live stock raring etc ..I got an opportunity to work for Matsyasampada yojana of the government and when I went and met few farmers who wanted to take up piscisulture along with agriculture for extra income generation activities, I was surprised to hear from them that they had taken up pisciculture just because they were asked by gram panchayat to do so. So, there is absolutely no proper Cost to benefit analysis which is done either at the time of allocation of the scheme and sometimes schemes are implemented in those areas where it doesn't generate any benefit. Presently, government only invite experts in those fields and FPOs etc and after having consultation with them it will implement the schemes, Institute can work closely with the government by helping in conducting a Cost to Benefit analysis of each and every schemes which it tries to roll out and suggest the viability of implementation of such schemes.
6) **Setting up of Agri- Costing cells in Agriculture Universities and Research Center:** The Institute through MOU should set up a Agri-Costing Cell in Agri University and Research center to create more awareness to students and research fraternity on Costing and Pricing. I visited few Agri University and during my interaction with the Faculty and also after going through the syllabus on Costing and pricing, I found that Costing for them means only Fixed and Variable Cost and their way of classifying a transaction into fixed and variable is just done on thumb rule and not on any scientific principles. Institute can play a major role here and we can certainly help the Agriculture Universities and Research Institutes in redrafting the syllabus and getting it vetted with proper cost principles and concepts in it.

There is definitely lot of scope for our Institute to play in Agriculture Sector. The present government commitment to "Reforms and Perform" will definitely act as a boost to Professional bodies like us where we can now try to explore opportunities in areas which will fall under our domain. The passion and commitment shown by the Institute should not lose its momentum in days to come and together as a professional body we can definitely help the government in building the nation and also contribute to our Honorable Prime Minister mission of "Doubling the Farmer Income"

Let us work towards our small efforts to make **"ANNADATHA SUKI BAVA** " (Let the offerer of Food be blessed with happiness"

REFORMS IN AGRICULTURE SECTOR

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Hardly there was a time in India, particularly after the Economic reforms of 1991, agriculture sector showed prosperity. Reforms in India were mainly related to Industrial and International transactions. The agriculture sector was not showing any recovery, farmers' suicides were the outcome of agrarian crisis, the consequence of agrarian distress is in terms of movement of people from rural to urban areas of the country. Worsening of the agriculture crisis and policy initiatives seems to go hand in hand. Many discussions were held relating to Indian Agriculture when farmers' suicides were at the peak; it needs to be realized that those suicides are the consequences and not cause agrarian distress. They are its outcome and not its origin and are still the saddest manifestation of the crisis. Farmers, by and large, are on the verge of collapse, and the crisis is not just about the collapse of agriculture and cultivation. It cannot be equated with drought, as the highest number of suicides has happened in the year of a bumper crop, and it is built in the crisis of prices. Distress has been picked due to deficit monsoon, low prices of key crops, and a slump in rural wages.

Farmers borrow money from the bank and put all the money into the farmlands, but sudden unseasonal rains caused widespread crop damage. How precarious situation is, how fragile farming economy is? Recent liberalization in the farm market is hoping that it will make the system more efficient and allow for better price realization for farmers. Agriculture expert Dr. Ashok Gulati pointed out that "the recent bills passed by the Government of India are like giving industries de-licensing." There is a possibility of emerging two classes, those who want to take advantage of open markets/private procurement and those who will use mandis/ Government procurement. Many experts pointed out that only 6% of the farmers derive benefit from the upper procurement limit could be around 10% of the total farmers. The government claims that they will make arrangements in agriculture marketing so that barriers will be removed and set up a new agriculture policy so that there will be no restrictions; this may lead to a reduction in intermediation cost is the argument relating to allowing farmers to sell their products directly to the private traders. Unfortunately, markets don't work when it comes to farm produce. However, Economists Ramesh Chand and Ashok Gulati provide examples of private corporations Nestle and Hatsun. They have been buying milk from hundreds of thousands of small milk producers sided by government cooperatives for years; This has helped expand the demand for milk by expanding markets; therefore, Economists like Arvind Pangariya conclude that "Corporates won't drive out mandis, they will instead help expand markets." With the planned deregulation, minimum support prices (MSPs) and government purchases will gradually be replaced by corporate buyers with excessive market power and the farmers' fear, especially of small farmers. By allowing the holding of larger stocks, big players may start entering and will try to influence markets by holding stocks of essential commodities. How to make market-friendly activities farmers friendly is the challenge in these agriculture reforms. The three important bills passed by the government on 20th September 2020 are as below:

1) The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill 2020.
2) The Farmers (Empowerment and Protection) Agreement on the Price Assurance and farm Service Bill 2020.
3) The essential Commodities Bill 2020.

Farmers' Produce Trade and Commerce Bill:

This legislation seeks to provide freedom to farmers to sell their produce outside the notified APMC and is aimed at facilitating remunerative prices through competitive alternative trading channels. Farmers will not be charged any cess or levy for sell of their products under this act. It is also pointed out that it will open more farmers' choices, reduce marketing cost and help them get better prices. Farmers' produce costs go outside the physical premises of mandis or deemed markets notified under various State agricultural produce market laws to provide a facilitative framework for electronic trading. Farmers will be able to engage in direct marketing, thereby eliminating intermediaries resulting in full realization of prices.

The Farmers Agreement on Price Assurance and Farm Service Bill 2020.

The bill aims to provide a national framework on farming agreements that protect and empower farmers to engage with agri-business firms, processors, wholesalers, and the sale of future farming produce at a mutually agreed remunerative price framework fairly and transparently; This is nothing but contract farming, in which prices of agriculture would be mutually agreed upon before farming.

The essential commodities bill

The act was originally enacted during World War II. The grocer was only allowed to keep a specific amount of sugar and grains. There was a typical Inspector raj as it used to be in the industrial sector. This bill seeks to remove commodities like cereals, pulses, oilseeds, edible oil, onion, and potatoes from the list of essential commodities. In a particular period, if there is a 100% rise in the price of vegetables or for rice, wheat, cereals, if there is a 50% raise, then there would be the imposition of stock limits. However, the fear is of the formation of cartels by traders and the possibility of price distortion with this mechanism's help.

The two important issues in the recent farmers' protest are the MSP mechanism and the Agriculture Produce Marketing Committee Act. Market forces may not help the farmers to get the remunerative prices for their produce. The idea of bringing MSP was to protect farmers from sudden crashes in the agriculture produce market and incentivize farmers to bring technology; however, it seems that this purpose of bringing change in agriculture with farmers' help could not be achieved. In the present situation, with a heavy financial debt burden for the government, it is not possible to make massive investments in the agriculture sector. Private players entering the agriculture sector through contractual farming, trading, and incentivize structure relating to production storage may bring investments in farm sectors right from production to distribution. Prosperous agriculture requires big investments that can be made by the private sector is one of the reasons for bringing three farm bills.

Role of Central Government

Critics have pointed out that agriculture is the state subject. There is no role of the Central Government; however, as per article 249 of the constitution, the central government can enact legislation if the issue is of national interest. Entry 33 categorically points out that the centre can make laws in the matter of agriculture. The government is offering greater choices to farmers through markets without demolishing the existing MSP system. Economist Ashok Gulati further reminds us that private corporations such as Nestle and Hatsun have been buying milk from hundreds of thousands of small milk producers side-by-side with government cooperatives for years. Rather than exploit the producers, they have helped expand the demand for their milk by expanding milk products' markets. Milk and poultry do not have MSP, and farmers do not have to go through the Mandi system; This may be due to the products' nature; milk and eggs are highly perishable items and need an efficient market network. Can it be compared with cereals and pulses? The market-friendly system needs to be farmers friendly.

Opposition from States

Punjab has a robust mandi system with a strong relationship between middlemen and farmers. If the farmer needs money, he goes to Arthiya (Middleman); if there is no Arthiya, there is no farmer, such as the strong bonding between the two. Farmers fear that not selling agricultural produce through Arthiya means depriving one of the important sources of borrowing. Arthiya is like the ATM of the farmers in Punjab and Haryana. Punjab and Haryana farmers derive maximum benefits from the MSP and procurement system, as evidenced by the numbers indicated in the following table.

Procurement of Rice and Wheat by Government
(Procurement % of total production)

Sr. No.	State	Rice	Wheat
1	Punjab	95%	73%
2	Haryana	70%	80%
3	Odisha	21%	-
4	West Bengal	7.3%	-
5	Uttar Pradesh	3.6%	11%
6	Bihar	1.7%	-
7	M.P.	-	40%
8	Rajasthan	-	15%

Source: Report of the Commission of Agriculture Costs and Prices

MSP has protected Punjab and Haryana farmers from sudden price crash; these two states thrive on producing wheat, rice surplus. FCI acquires these for national buffer stocks, and at the same time, mandis help the farmers perform distribution operations smoothly. Taxes on mandi operation before GST implementation was 14% after GST it is now 8.5% out of which 2% goes to mandi committee in the form of mandi tax, and 6% goes to the state government, Punjab is getting revenue of Rs. 5,000 crore every year out of this mandi system, this has helped Punjab Government to provide free electricity and other facilities to farmers out of this revenue.MSP was blessings for the farmers. Production of wheat and rice went up in Punjab and Haryana mainly due to hybrid varieties of seeds and irrigation. M.P. and Chhattisgarh also started growing rice and almost crossed Punjab in the production of wheat.

MSP has become a liability for the government and struck into the self-destructive paddy-wheat cycle. Now the situation is India has too much wheat and too much rice. Norms for buffer stocks are 41.2 million tonnes; against this, India held 97 million metric tonnes of wheat and rice in June this year; this was two and a half times more than the norms. Inadequate storage has further created problems. The excess stock value, which FCI was held in June, was Rs.1lakh 80 thousand crores. The government is buying expensive at one place and selling cheaper at other places, creating a price distortion situation.

Where does India go from here?

India has too much grain, private market contract farming people might move to vegetables, oilseeds, pulses. It is expected that these farm bills would help bring change in the cropping pattern. India's import bill of oil is about 10 billion dollars. To control this expenditure, there is a need to grow mustard, sunflower, groundnut in larger countries and would be useful in controlling the import of oil; the country also needs more maize, agriculture diversification is the need of the hour. To make people shift to other crops is not an easy task; this requires persuasion and not coercion.

Role of Agriculture in India

This year in the first quarter, GDP in India showed an overall negative growth of 23.9%, whereas agriculture grew by 3.4%. Though the contribution of agriculture in total GDP is not rising beyond 15-16% of GDP, this sector still has its importance in feeding millions of people. However, the situation is quite precarious when we talk about small and marginal farmers; 86% of our farmers cultivate two hectares or less and often in fragments. Though the problem is location-specific, by and large, there is a problem of the viability of farm size to implement modern technology and use of equipment. Availability of water through the irrigation system is another area of concern; e.g., Maharashtra has created 48.25 lakh hectares of irrigation potential, out of which 29.54 lakh ha is irrigated. The state has an 82% rain fed area. A sustainable farming system requires assured irrigation and crop diversification. Farm incomes remained low and erratic; in other sectors of the economy, income increase during the last 40-45 years is much higher than the increase in farm incomes. By and large, agriculture, in general, has remained at an impoverished stage.

Role of Cost Accountants:

While determining MSP, different types of costs need to be considered. Farmers incur different kinds of costs; some are explicit in which farmers pay from their own pockets, or it is paid out the cost. Some costs are implicit where farmers themselves perform some tasks independently and not appoint outside the labor force. Farmers are using their ancestral land for farming; using equipment for this; he would have paid interest for borrowing

capital to purchase these assets. Swaminathan Committee has suggested adding 50% over and above a farmer's input expenses. Making calculations of input costs needs to be assigned to professional cost consultants like the industrial sector.

Concluding Remarks:

The state government's fear is of loss of revenue if private mandis are allowed to function, Central Government can allow farmers to charge cess on private mandis. There is a need to bring institutional change; our farms are too small for tapping scale economies or effectively exploiting markets. In India, 86% of farmers have to hold below 2 hectares, i.e., about 126 million people are small landholders. These small farmers will not be able to take produce to far off places. Smallholders are more diversified from wheat and rice; they need to be aggregated to improve bargaining power. What we need is smallholders pooling resources and farming cooperatively in small groups.

MSP needs to be extended to other commodities apart from wheat and rice to encourage farmers to cultivate and grow other crops. The National Farmers' Commission's recommendation of providing an MSP of 50% over and above a farmer's input expenses needs to be implemented.

The number of farmers who benefitted from MSP and APMC is not more than 10%; this clearly shows a lack of awareness among India's farmers. Empowering farmers by providing knowledge of policy-related changes and training programs would help smoothly implement the policies; This is one way of building trust and faith and bridging the divide between farmers and policymakers.

There is no doubt that our agricultural laws need reform and liberalization. Therefore, in the present situation, it would be advisable, as suggested by many scholars, to suspend reforms for some time and let farmers sit down with policymakers and finally come up with new reforms that would be agreed upon.

MSP - THE BONE OF CONTENTION IN THE NEW FARM LAWS: FROM A CMA PERSPECTIVE

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Agriculture which contributes yet 14% of GDP of the country has lost attraction of being nurtured even in the house of traditional agriculturists. As per data published in 2020 by Ministry of Statistics and Programme Implementation, Govt. of India, it caters employment still to 42 percent of population. The classical occupation has turned into "an alternative to no work" for many, particularly the small and marginal farmers. A survey done by the Centre for the Study of Developing Societies in December 2013 shows that 76% of farmers would prefer to leave agriculture as an occupation. Similar observations were reported in other surveys. The younger generations even in a traditional house of agriculturists want to migrate to the cities in search of other jobs and livelihood. The last available census data reveal that from 1952 to 2011, occupation in agriculture reduced to 54.4 per cent from 69.9 per cent. But the contribution of agriculture in the country's GDP declined faster to 14.4 per cent from 51.9 per cent. Thus, the importance of the provisions of the new farm laws has to be understood in the backdrop of the traditional occupation yielding a very poor return till recently.

Minimum support price (MSP) is the price fixed by Government of India to protect the producing farmers against excessive fall in price of the produces during bumper production years. MSP is thus a guarantee price for their produces from the Government. The target was to enhance the agricultural competitiveness of the small and marginal farmers of the country. However, a section of large farmers of the country, who mainly produce paddy and wheat in Punjab and Haryana, take advantage of the MSP by supplying against the government procurement to earn a decent return on their investment.

Through the first of the three new legislations, The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act 2020, the central government attempted to free agricultural marketing from the clutches of the *arhatiya* (commission agent) community. It allowed trade beyond the premises of the regulated Agricultural Produce Marketing Committees (APMCs). The APMCs are prevalent in the two agriculturally rich states of Punjab and Haryana unlike other states where those have very minimal existence. Kerala, Manipur, Mizoram and Sikkim along with the UTs like Andaman & Nicobar Islands, Lakshadweep, Daman & Diu, and Dadra and Nagar Haveli never had an APMC, law whereas Bihar repealed it in 2006. In 2013 vegetables and fruits were shifted out of APMCs. But with this reform a rumour spread that the guaranteed MSP of the listed commodities is going to be abolished. It fuels fire to the political misinterpretation of the two other legislations. The second legislation practically introduced contract farming in an unrestricted manner, not selectively as pre-existing. The third legislation paved the way for overstocking commodities which were given the "essential commodity" tag, thus enabling the farmers to earn price advantage throughout the year.

Politicians, including the legislators in Punjab and Haryana hold control of the APMC mandis which they consider as their earning arms. They are afraid of losing their source of earnings once the new farm laws come into practice. They are wooing the strong lobby of *arhatiyas* that they would lose the 3 per cent commission on lost sale in future. The Punjab state government will also eventually be a big loser if the new central laws come into being. The state government charges high levies of 8.50 and 14.50 per cent on wheat and rice till 2019 including 3 per cent each as market fee and as rural development cess in its regulated markets. From 2017 onwards the state also started collecting charges in the private markets after legalizing the trading in the state APMC Act. In recent times no single legislation had to face so much opposition. The farmers moved finally into the national capital region for the mass protest against the new laws mainly from the two neighbouring states,

Punjab and Haryana, considered the epicentre of the unrest. A country-wide *bandh* was also called on 8th December, 2020.

The Agricultural Price Commission, later renamed Commission for Agricultural Costs and Prices (CACP), fixes MSP for a select group of 23 crops, 14 among them *kharif*, 7 *rabi* crops and 2 other crops. It was originally constituted in January, 1965 and renamed in 1985 as said above. The commission averages the cost to produce a crop in different regions. The Swaminathan-chaired National Commission on Farmers suggested in 2006 to add 50% to the weighted average cost to determine the MSP. The central government in a historic decision in its Union budget of 2018 announced implementation of that for the first time in the country. The debate as regards calculation of MSP was initiated after Swaminathan went on record in February 2018 that the commission had meant C2 as the cost of production. If looked into the formula, C2 includes all necessary components of cost of production like A2 consisting of cost of inputs (seeds, fertilizers, pesticides, depreciation on farm implements and buildings, interest on working capital and hired labour), an imputed cost of family labour (FL), and finally the most controversial notional rent of owned land. Besides, at the final stage, interest on the value of owned capital assets other than land and rent paid for any leased-in land are also to be added to arrive at C2. CACP fixes MSP in such a manner which does not consider anything beyond A2 and FL. It is argued by CACP that the rent of own land, included in C2, is not incurred by an estimated 88 per cent of the farmers.

APMC trade includes government procurement which takes place under Food Corporation of India (FCI) and other state agencies. This is known as centralized procurement. Under the decentralized procurement, a state is able to supply its surplus production to the FCI central pool against the shortage of other states to meet the demand of the public distribution system (PDS). But the government procurement centres around the two major crops, paddy and wheat. There are 21 other listed crops for which a system of government procurement exists more or less in papers only. Since 2002, close to 69 to 73 per cent of the production left with the farmers was sold outside APMCs below the MSP. As per a NSSO report of 2016, only 36 per cent of the trading could be identified to take place in the regulated market.

The Indian system of MSP was earlier challenged at the World Trade Organisation (WTO) for violating multilateral trading rules. WTO rules cap government procurement for subsidised food programmes at 10 per cent of the total value of agricultural production based on 1986-89 prices. Instead of MSP, the government was preparing for a direct income support scheme for farmers as hinted by late finance minister Arun Jaitley at the beginning of 2019. The central government extended Rs. 6,000 per year income support under the *PM-Kisan* scheme irrespective of agricultural landholding after introducing it in December 2018. But the sharecroppers and landless labourers who do not own any land are kept outside the purview of the scheme. A debate already existed as regards the farmer population in the country being covered by MSP. Although the Shanta Kumar-headed High Level Committee on Restructuring of FCI estimates a maximum 6 per cent of farmers covered, there are opinions that it covers much more. The Committee in its report in January 2015 had noted 5.21 million of the total estimated 90.20 million agricultural households to avail MSP in 2012-13. But, in a recent column in *The Indian Express*, it was claimed that it covers 25 million-plus farmers across all crops, including pulses and oilseeds, which could be anywhere between 15 per cent and 25 per cent. To calm down the ongoing unrest the cabinet ministers and the prime minister have assured that there will be no change in the existing system of MSP, although it is understood that it's the time to reassess the MSP system. So the issue of agitation against the central farm laws so as to demand guaranteeing of MSP is more a case of politicizing. It would hamper the reforms undertaken in the whole agriculture sector in order to improve profitability of the sector as a whole.

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CMAs IN STRATEGIC AGRICULTURAL COST AND RETURNS MANAGEMENT

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Abstract

Agriculture and allied sectors are the life line of any nation's economy – notwithstanding its share in GDP – as these primarily help in meeting the food and nutritioal security needs of the nation. These sectors help in marching towards and achieving most of the SDGs - targeted to be achieved by 2030. These sectors are also the backbone to the rural economy and rural economy drives demand for goods and services. Globaly nations are comitted to practices brought in under the themes of Sustainable Agriculture, Natural Resources Management and such others; now the world is embracing new approaches under Climate Smart Agriculture, Cyclical Economy and Landscape Management etc. The focus under these, is to enusre that the precious Earth is maintained and managed safe while continuing to indulge with agriculture and allied sectors. On the other hand those engaged with farming and allied sectors as cultivators or producres are often subjected to extreme vulnerablity with increasing costs, diminishing returns and high degree of risks. Enagement of CMA profesionals in supporting those associated with Food and Agri Value Chains contributes to the sustainability at the field level, enhanced GVA and in ensuring compliance with PPP[1] framework.

Preamble

The **Mission of Agriculture** can be stated as "*To meet the food and nutritional needs of global population; securing the livelihoods of millions through employment and entrepreneurship; and help achieve overall socio-economic inclusion*".

The Report of the Royal Commission on Agriculture (1928) can be stated to be first step in the modern India even before independence to focus on agriculture. The Indian agriculture can also be looked at as pre-Green Revolution, post Green Revolution and post economic reforms of 1991. The recent initiative on doubling of farmers' income brought in new focus.

The developments across the globe are focused on sustainable agriculture, natural resources management, climate smart agriculture, landscape management and such others. These primarily aim at balancing the needs of food security and nutritional security; with concerns on biodiversity, environment protection and natural

[1] Planet, People and Profit (PPP) coined by John Elkington.

resources management. In one sentence while ensuring the food, nutritional and livelihood securities the precious Earth shall be passed on to the future generations for their safe and secured living.

This document presents insights including based on knowledge and experiences gained over two decades through consulting practice focused on agribusiness and inclusive finance. These are intended to bring focus CMA's contribution to one of the core sectors on the economy.

Intertwined Sectors

Agriculture, Cooperation, Agricultural Marketing and Rural Development are inter-related sectors; these are further in need of support services/facilities including on storage, handling, processing, mobility, communications and energy and also need variety of goods/manufactured products, finance etc. The need to ensure conducive policy and regulatory framework is highly essential.

Agriculture and Allied Sectors

Agriculture is generally referred to represent plants-based cultivation while others associated with animals are referred to as allied activities. The allied activities include dairy, piggery, goatery, fishery (aquaculture), poultry (aviary), honeybee cultivation (apiculture) etc. Horticulture often considered as subset of agriculture, predominantly refers to fruit and vegetable crops while certain others like plantation crops etc. may also get classified under this. The associated sectors are significant as the same supplement and compliment the agriculture to derive synergies through Integrated Farming Systems and help in strengthening generating revenues through more than one stream and thereby reduce vulnerability of the households associated with agriculture. The contribution to exports by products from sectors such as aqua-marine, dairy and poultry is another significant aspect.

The constituents of agriculture value chains in the context of this document include agriculture, horticulture, allied sectors, (referring to farming or cultivation or rearing animals etc.), agribusinesses (including farming as a business proposition and variety of other activities that are not otherwise forming part of another sector), food businesses (including agro and food processing, handling, agro/food marketing, retailing, food service etc.)

The doubling of farm income is an ambitious target considering the complexities involved. The variations in agro-climatic conditions and farming systems; and others that can impact farm income like access to quality inputs and other resources, access to finance (A2F), adequacy and timeliness of such access, access to specific support facilities and services, investments in research, academics, extension services, irrigation, energy, mobility, communications etc.

The cost of production at the farm level consists of inputs cost, labour cost, costs on use of agricultural equipment/implements, transportation and financing. The inputs cost includes those related to seeds, fertilisers and pesticides. The postharvest level costs include those on packing material, warehousing, transportation and commission/levy paid at the time of sale.

The costs of processors are more akin to manufacturing activity except for the difference that most of the produce from agriculture and allied sectors and some of processed products are perishables in nature and hence can have limited shelf life as well as are need of specific handling.

CMAs and Agriculture

The Institute of Cost Accountants of India (hereafter referred to as ICMAI), a statutory body under an Act of Parliament and its class of members referred to as Cost and Management Accountants (CMA) are well positioned to associate with and support the agriculture and allied sectors. One of the Objectives of ICMAI is "To develop the Cost and Management Accountancy function as a powerful tool of management control in all spheres of economic activities".

The agriculture and allied sectors being integral to and important constituent of the economy, are within the scope of the services provision by CMAs. Some of the CMAs may already be rendering services to large or corporate farms, agribusinesses and food businesses. However, with about 85 percent of the Indian farmers being of small and marginal category, CMAs engagement with all stakeholders of the agriculture and allied sector value chains is of paramount importance for the ICMAI to march towards its stated objective/s. The

insights of a CMA as consulting practitioner on some of the critical areas for such engagement by CMAs with agriculture and allied are presented hereunder.

The preferred objectives at the farm level and farmer household levels are:

- To enhance and double the *Net Farm Income* periodically while minimising the risks.
- To supplement with incomes from allied sectors or intercrops or other ways so as to enhance the overall N*et Income* at the farmer household level over an agricultural year, while minimising the risks and challenges arising out of health, hygiene, sanitation and disasters or others.

There exists scope for CMAs' professional management services with thrust on:

- Strategic Management that helps in resources access, allocation and use while minimising the risks and increasing Net Farm Income through:
    - Agricultural Returns Maximisation with increase in production and realisation through sale of produce
    - Agricultural Cost Optimisation with scientific inputs and crop management.
    - Agricultural Risks Minimisation with appropriate risk mitigation and risk transfer measures.

Need for Strategic Management

The significance of agriculture and allied sectors as well as challenges/concerns related to these sectors are often under debate and bring focus on the need for strategic management. An article that appeared in one of the business newspapers had the header: "Can we Apply Peter Drucker to Governance?". This led to an introspection "Can we Apply Peter Drucker to Agriculture?" with a clear answer "*Yes*" and without any doubt it was not "Why Not?". Strategic Management encompasses resources access, use and optimisation by any entity and at every level within the entity. A farmer or producer of products from agriculture and allied activities is an entrepreneur and can be referred to as Agripreneur. This is at the micro level of the economy. At the State and Central levels the food and nutritional security needs and the contribution of agriculture to the GDP directly and through creating demand for other goods and services is very critical. Hence the strategic management of agriculture and allied sectors using the principles and practices of management, in particular those from Cost and Management Accounting can add value and result in:

- Optimised access, allocation and use of scarce resources, which always have direct and/or opportunity cost associated with. Such optimisation can also be the result out of need-based feasibility assessment and development of Strategic Plans or Business Plans or Detailed Project Reports.
- Enhancing productivity – including factor level – throughout the value chains and at all levels of the economy.
- Optimised net returns that accrue to all stakeholders including farmers/producers, businesses, lenders/investors, researchers, technology providers, governments etc. In the globalised economies resources deployment by governments are often focused on output/outcome/impact either in social and/or economic forms.
- Enhancing the share of India's agricultural exports within world agricultural trade; which is about 2 percent in year 2017[2].
- Ensuring the food, nutritional and livelihood security of the nation's population.
- Objective performance - with CMA's professional support - by entities and their associates including collectives like Producer Companies (PCs), Farmer Producer Organisations (FPOs), Cooperatives, Producer Groups (PGs), Self Help Groups (SHGs) etc. Some of these are often under focus on issues such as book-keeping, accounting, financial statements as compiled and reported, profit planning, investment decisions, management information systems, decision support systems etc. (Most of the FPOs and PGs are facing challenges in the preparation of proposals, business plans and accessing financial services).
- Overall improvement in the development indices including HDI, per capita income etc. and in marching towards the achievement of SDGs with the target year of 2030. Agriculture and allied sectors impact almost every SDG directly or indirectly.

[2] WTO Trade Statistics

- Conducive policy and regulatory environment with need-based support through subsidies or grants or export pricing or trade promotion initiatives or program/scheme support etc. CMAs with their specialisation can be actively engaged including on development of necessary frameworks and templates.

The strategic management as proposed through the engagement of CMAs towards agricultural cost optimisation, returns maximisation and risk minimisation are to be with focus on:

- Farmers or producers; and their collectives
- Businesses and entities associated with the value chains
- Governments

Doubling of Farmers' Income

The CMAs are professionals with specialisation in accumulation, assessment and analysis of costs and support in decision making with the application of variety methods, techniques and tools. The farm level challenges are too complex. With the use of Occam Razor[3] principle, complex situations can be analysed with simple assumptions but implementation would certainly be a daunting task. Using such principle, an indicative equation on doubling the farm income:

A. Present Income

f(FI) = Q * P (-) C, wherein,

FI stands for Farm Income
Q stands for Quantity of Produce sold
P stands for Price realised (net) at the time of sale
C stands for total cost of sales (cost of production plus postharvest costs)

B. Suggested approach to increase the Income from Farming

↑ Increase the quantity produced (Q) by '**x**' percent through:

- Improvement in Yield per unit of cultivated area; *with application of productivity enhancement approaches of CMAs, supplementing the efforts of agronomists, agricultural scientists and other technical specialists.*
- Support to farmers through provision of Extension or needed Techno-Managerial Services throughout the crop phenology *with capacity building and other need-based support by CMAs on cost and surplus management*.
- Market oriented produce from the farms by ensuring inputs and practices as aligned to market preferences.
- Production risk management through appropriate risk mitigation and risk transfer measures *with professional services support of CMAs on risk assessment and management approaches.*

↑ Increase in Net Sales Realisation per unit of Produce sold viz., Price (P) by '**y**' percent through:

- Access to markets through as many formal and transparent channels as possible. *CMAs can support in assessing feasibility on establishment or strengthening of marketing and market intelligence infrastructure.*
- Markets that enable 'reasonable and rational' prices for the produce so that the farmers are compensated with 'net returns' as commensurate with their investments and efforts. *The principles and practices from Cost and Management Accounting help in development or refining the models, methods and practices in support of deriving pricing structures*.
- Market Intelligence that ensures rationale to resources access and allocation; *the resources allocation shall be based on frameworks derived through application of Marginal Costing Techniques.*

[3] Also spelled Ockham's razor, also called law of economy or law of parsimony, principle stated by the Scholastic philosopher William of Ockham (1285–1347/49); The principle gives precedence to simplicity

- Ensuring the produce is of characteristics or features as preferred by markets. Example long grain rice of specific length; well ripened and healthy Mango; Tomato without seeds, less water and higher flesh thickness for processing.
- Engagement on Value Addition including through primary or above level processing. *The application of costing principles such as Incremental Revenue shall be greater than Incremental Cost, Total Cost concepts, Value Engineering, Decision Making including on investments, make or buy (produce own seeds, farm yard manure or other bio fertilisers OR buy the same from market/others).*
- Market risks on access, transparency in systems and pricing. *The CMAs' experiences and expertise derived from manufacturing and services are to be used in problem definition and designing solutions.*

↓ Decrease cost of Production (C) including upto point of Sale by '**z**' percent through:

- Access to inputs while complying with '5Rs' viz., Right Quantity, Right Quality, Right Time, Right Cost and Right Source. *Cost and Management Accounting supports the inventory management, supply chain management and resources allocation as per production needs.*
- Inputs use optimisation: Ensuring resources use/application as per needs is essential towards cost optimisation. The variety and quantity of seeds required, the quantity of fertilisers or crop protection measures or others required at each stage of crop phenology and their specific type/characteristics/composition/features are important factors to be monitored. *Variance Analysis and application of techniques from Standard Costing, Budgets and Budgetary Control can significantly contribute towards cost optimisation. These can further be supplemented with frameworks such as Monitoring, Evaluation, Accountability and Learning (MEAL) from Project Management as every crop season is like a project.*
- Exploring options on crops for which the scarce land available can be put to use can be well analysed with the *application of techniques from Cost and Management Accounting such as Key Factor Analysis..*

Illustrative arithmetic on doubling of farm income is as under:

Equation	**Present**	**With Interventions on Increasing Net Farm Income**
f(FI) = Q * P (-) C, wherein, • FI stands for Farm Income • Q stands for Quantity of Produce • P stands for Price realised (net) at the time of sale or realisable value per unit. • C stands for total cost of sales (cost of production plus postharvest costs)	Assume Q = 100 units P = Rs. 40 per unit C = Rs. 3,000	Increase in Q by x% Increase in P by y% Decrease in C by z% Assume x = 15% Assume y = 5% Assume z = 6% Revised value based on above assumptions: Q = 115 units P = Rs. 42 per unit C = Rs. 2,820
	Net Farm Income = Rs. 100*40 (-) 3,000 or Rs. 1,000	Net Farm Income = Rs. 115*42 (-) 2,850 or Rs. 2,010

Assumptions: The farm yields are lower in India compared to that from certain other countries hence the yield increase is assumed at higher level; increase in prices of agricultural produce can lead to increased food inflation and hence considered these at a conservative level; reduction in agricultural cost of production has higher scope but this is also considered at conservative level.

Conclusion: Traditionally the agricultural economics domain has been supporting the agricultural policy planning. The domain of agribusiness emerged from agricultural economics but over the years branched out and established by itself. The CMAs can supplement the contributions of agricultural economics and agricultural scientists at the macro level; engage themselves intensively throughout the value chains of agriculture and allied

sectors for the optimised access and use of resources; can help in achieving cost optimisation, return maximisation and risk minimisation for the farmers at the micro level and through enhanced GVA and sustainability at the macro level for the economy.

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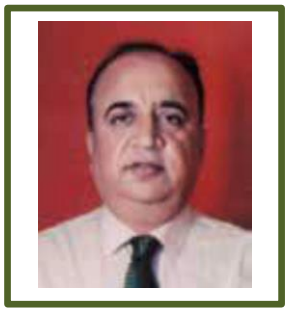

FARM BILLS – MYTHS AND REALITY – A DISCUSSION

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Before starting a discussion of the three farm bills, recently passed by the parliament during Monsoon session, let us see some figures below –

- Food grains constitute 18% of the total output against livestock sector (30%) and Fruits & vegetables and high value commodities (19%) in our country.
- Fruits and Vegetables and high value commodities output per hectare is 12 times larger than cereals.
- 85% of the farmers of the country are poor who contribute 51% of the value of agriculture output.
- During FY 2019-20, per capita agricultural GDP was Rs. 45000.00 while non-agricultural was Rs. 2.48 lakhs
- Average income of agricultural GDP in Punjab, having assured market for cereal procurement is Rs. 2.80 lakhs which is almost 6 times higher than the India's per capita agricultural GDP and 1.1 times of country's non- agricultural GDP.
- The Agricultural income of households is highest in Punjab due to highest procurement by FCI / Government agencies.
- West Bengal and UP are the top producers of rice and wheat respectively, have the lowest average procurement of 12% only and lowest usage of godown capacity (12%) by FCI,
- Mandi Tax in Punjab is as high as 8.5%, earning an annual Rs.3500.00 crores,
- In Punjab, total ***electricity subsidy*** bill comes upto Rs 9,674 crore per year. The state government gives free ***electricity*** worth Rs 6,060 crore to ***farmers***, 200 units of free ***power*** to per family of the SC-BC community for Rs 1623 crore and industries are given Rs 1,990 crore ***subsidy***.
- Punjab's farmers get an additional Rs 5,600 crore of subsidy. Add this to the fertilizer and electricity subsidy and total annual comes to Rs 18,875 crore; divide this by the 1.09 million farming households in the state has and, it turns out, each household gets an annual subsidy of Rs 173,165.
- On average, mandi prices are 20-50% lower than the MSP for most crops
- Drawing on the most recent estimates (not always for the same years), annual central government subsidies to farmers for the whole country would be of the order of Rs. 120,500 crores as the sum of fertilizer subsidies (Rs. 70,000 crores, 2017/18), credit subsidies (Rs. 20,000 crores, 2017/18), crop insurance subsidies (Rs. 6500 crores, 2018/19) and expenditures towards price support (Rs. 24,000 crores estimated for 2016/17).
- Annual State government subsidies are almost of an equal amount of Rs. 115,500 crores to as the sum of power subsidies (Rs. 90,000 crores, 2015/16), irrigation subsidies (Rs. 17,500 crores, 2013/14), and crop insurance subsidies (Rs, 6500 crores, 2018/19). In addition, in the year 2017/18, state governments announced loan waives totaling to Rs. 122,000 crores.
- Overall farm subsidies of the country amounts to 2-2.25% of GDP.
- While the importance of subsidies to farmer livelihoods may vary by region, by crop and by farm size, they form a substantial part (20%) of aggregate farm income. Yet, even a substantial rise in subsidies cannot address the sectoral gaps in productivity (which are much too large) or compensate for small farm sizes.
- Power subsidies imperil our already stretched groundwater resources and directly attack the sustainability of our natural resources.

- Electricity consumption in Indian agriculture is far greater than in any comparable large country.
- Correspondingly, the Indian withdrawal of groundwater is more than that of China and the United States put together.
- Excess procurement by the Government is costly to consumers and involves other kinds of waste that come in disposing off the stocks. This is generic to procurement-based price supports and such costs were also experienced in other countries that implemented these policies.
- Due to MSP, the farmers of Northern India are still producing crops which rot in godowns of FCI and consumed by rats.
- Due to same reason, the farmers produce those crops which produce a lot of PARALI; burning of which creates havoc of pollution in Northern India during winter season, specially in the national capita Delhi. Its cost to environment is beyond computation.

To being further reforms in country and to improve the income of the farmers of the country, the Government of India got three farm bills passed in parliament –

1. THE FARMERS (EMPOWERMENT AND PROTECTION) AGREEMENT ON PRICE ASSURANCE AND FARM SERVICES ACT, 2020
2. THE ESSENTIAL COMMODITIES (AMENDMENT) BILL, 2020
3. THE FARMERS' PRODUCE TRADE AND COMMERCE (PROMOTION AND FACILITATION) ACT, 2020

Main points of these Acts with main oppositions by different farmers' / political groups have been summarized below –

The Farmer (Empowerment and Protection) Agreement of Price Assurance and Farm Services Bill, 2020

Provisions

* Farmers can enter into a contract with agri-business firms, processors, wholesalers, exporters or large retailers for sale of future farming produce at a pre-agreed price
* Marginal and small farmers, with land less than five hectares, to gain via aggregation and contract (Marginal and small farmers account for 86% of total farmers in India)
* To transfer the risk of market unpredictability from farmers to sponsors
* To enable farmers to access modern tech and get better inputs
* To reduce cost of marketing and boost farmer's income.
* Farmers can engage in direct marketing by eliminating intermediaries for full price realisation
* Effective dispute resolution mechanism with redressal timelines.

Opposition

* Farmers in contract farming arrangements will be the weaker players in terms of their ability to negotiate what they need
* The sponsors may not like to deal with a multitude of small and marginal farmers
* Being big private companies, exporters, wholesalers and processors, the sponsors will have an edge in disputes.

The Essential Commodities (Amendment) Bill, 2020

Provisions

* To remove commodities like cereals, pulses, oilseeds, onion and potatoes from the list of essential commodities. It will do away with the imposition of stockholding limits on such items except under "extraordinary circumstances" like war
* This provision will attract private sector/FDI into farm sector as it will remove fears of private investors of excessive regulatory interference in business operations.
* To bring investment for farm infrastructure like cold storages, and modernizing food supply chain.
* To help both farmers and consumers by bringing in price stability.
* To create competitive market environment and cut wastage of farm produce.

Opposition

* Price limits for "extraordinary circumstances" are so high that they are likely to be never triggered.

Farmer's Produce Trade and Commerce(Promotion and Facilitation) Bill, 2020

Provisions

*To create an ecosystem where farmers and traders enjoy the freedom to sell and purchase farm produce outside registered 'mandis' under states' APMCs.
* To promote barrier-free inter-state and intra-state trade of farmers' produce
* To reduce marketing/transportation costs and help farmers in getting better prices
* To provide a facilitative framework for electronic trading

Opposition

* States will lose revenue as they won't be able to collect 'mandi fees' if farmers sell their produce outside registered APMC markets.
* What happens to 'commission agents' in states if entire farm trade moves out of mandis?
* It may eventually end the MSP-based procurement system.
* Electronic trading like in e-NAM uses physical 'mandi' structure. What will happen to e-NAM if 'mandis' are destroyed in absence of trading?

After studying the three Acts and understanding the problems, raised by the farmers' / political organization, following points emerge which must be taken care of –

1. As reported in different news channels and newspapers, the Government has now become ready to bring in writing that MSP based procurement system would continue. No doubt, continuation of MSP will help some of the farmers of some of the states but many nations of the world will oppose this because India is a signatory of WTO and it cannot take any such step which will restrict the trade. Moreover, Government provides MSP from the money which it collects from tax payers. Agricultural income is out of income tax and most of the other taxation system which means farmers do not contribute anything in national exchequer in the form of taxes and continuation of MSP or any increase in it will increase burden on national exchequer as well as on tax payers.

2. MSP is not calculated on cost basis; rather it is always increased on prevailing rates keeping populism and vote bank in mind. Government do not use "cost-benefit analysis" sort of methods for calculating MSP and since, market & price under MSP are pre-determined, the farmers, especially rich ones, pass all sort of inefficiencies of production to the Government (and ultimately to customers and exchequer)

3. MSP does not motivate farmers to use latest technologies while farming and make farming an "under-productive" activity.

4. According to farmers, in "contract farming" arrangements they will be the weaker players in terms of their ability to negotiate what they need. They are right but contract farming is not mandatory under these farm acts. It is a choice in the hands of farmers. If they find that they are not getting reasonable rates from the private players they are not supposed to enter into contract farming. Every citizen of our country has a free right to choose their employer, employees, partners, business, suppliers, customers etc while doing business and same rule will apply on farmers also.

5. This argument of the farmers is correct that big private companies, exporters, wholesalers and processors, the sponsors will have an edge in disputes. But not only in farming, it happens every sphere in life. Rather in this case, farmers have MSP in their support, if they feel not satisfied in negotiation with private players.

6. Now food habits of Indians are changing and accordingly the production of crops have to be changed. Farmers, dependent upon MSP, will never adopt the farming of new crops. New Acts provide farmers a choice to either produce those crops which can be sold in mandis and under MSP or adopt farming of new crops with high productivity and prices by private players.

7. So far the safety of the land of the farmers are concerned, the ACT is where much clear about it. See the clause 8 of

Quote

No farming agreement shall be entered into for the purpose of—

(a) any transfer, including sale, lease and mortgage of the land or premises of the farmer; or

(b) raising any permanent structure or making any modification on the land or premises of the farmer, unless the Sponsor agrees to remove such structure or to restore the land to its original condition, at his cost, on the conclusion of the agreement or expiry of the agreement period, as the case may be:

Provided that where such structure is not removed as agreed by the Sponsor, the ownership of such structure shall vest with the farmer after conclusion of the agreement or expiry of the agreement period, as the case may be.

Unquote

8. As I detailed in the start of this article, due to MSP and Mandi System, some of the farmers of some of the states are in better condition in comparison to their counterparts of other parts of the country. These farm Acts are not snatching any prevalent facilities of these rich farmers but providing an opportunity to earn reasonable income to their poor colleagues of other states. That is the reason that farmers of other states are not supporting the agitation.

9. World is changing very fast and our country is also changing & growing. We can not leave farmers behind from this story of growth. Government has taken a bold step towards reforms by introducing these three Acts. I remember, the then Prime Minister Late P.V.Narsimha Rao had faced same backlash from many strata of the society when he had introduced reforms in India in 1991 with his Finance Minister Dr Manmohan Singh. Today our country is reaping benefits of those reforms. I am confident that today if Government remains firm, the whole country will reap benefits in future.

DIGITAL TRANSFORMATION OF AGRICULTURE - SEEDS IN THE WOMB OF TIME

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Background

The first green revolution of India started from mid 1960s mainly because the rate of growth in agricultural harvests could not keep pace with population growth. The revolution was predominantly driven by the ultimate objective of achieving self-sufficiency in food and contributing to mitigate shortage elsewhere in the world. India adopted high-yielding varieties of seeds. Government's initiatives gradually helped farmers with improved availability of irrigation facilities, fertilisers, and insecticides. This was followed by limited mechanisation of cultivation using tractors, pumps, deep tube wells, and other low-end devices for harvesting, etc.

The process of green revolution continued with contributions from various research work for cross breeding of plants and seeds, all weather farming of erstwhile seasonal crops and vegetables, improving soil testing, manure applications farming techniques, etc. Farmers now grow many crops, vegetables and fruits of western origin which were never grown in India just about two decades before. Another revolution joined the march, and that was white revolution.

But even after seventy-three years of independence, Indian farmers are deprived of the rightful price for their harvests, because of too many intermediaries. Their produces are subjected to adulteration, contamination, wastage, and spoilage due to unscrupulous traders and non-availability of affordable storage, supply chain and cold chain facilities. Reliability of harvest cannot be established due to lack of quality-based gradation and traceability to the origin of farmland and farmers.

Farmers in India do not have easy access to technical advisories and services related to weather conditions, soil testing, crop scouting, etc. They do not get right quality and quantities of inputs such as seeds, fertilisers, etc. at the right prices and at the right time. Last but not the least crop loans from banks and insurance for coverage against perils of nature are also not available without pains and hurdles. These situation for agriculture and agriculturists may not be much different in many underdeveloped and developing countries.

Objective

]The predominant objective of this paper is to ideate a comprehensive digital solution which can address the above issues and mitigate miseries of farmers who grow food for all but do not get rightful rewards for their hard work. The author would like to contribute in his limited way towards making this journey for digital transformation joyful and rewarding from the perspectives of all stakeholders and particularly for marginal farmers. The proposed solution with limited modifications would also be able to mitigate similar miseries in areas of horticulture, animal husbandry, fruit orchards, sericulture, etc.
.

Industry 4.0 and Agriculture

Agriculture contributes about 15% to Indian GDP. According to a recent estimate of ILO around 42% of Indian working population is engaged in agriculture. Most of these farmers belong to lower middle and marginal category. They do not get the rightful return against their hard labour.

But the present scenario is different in industry and service sectors. The entire world has entered the era of fourth industrial revolution which is essentially driven by digital transformation. In about a decade's period many Goliaths have been disrupted and 'destrupted' by 'startupian' Davids powered by digital tools and applications. India is no exception to that, albeit at a slower pace. According to Venture Intelligence[W1] presently there are about 30 Unicorn in India and many more 'Soonicorns' are in the race. The bigger question is whether digital transformation of agricultural activities is possible? Can agriculture, manufacturing and service sectors of the economy collaborate and integrate their platforms to ensure for farmers the rewards they rightfully deserve?

Economic Times[W2] reported in July 2020 that, *"Surprisingly, tech companies and startups see an opportunity to upgrade around $400 billion Indian agriculture sector. There are 896 agri-tech startups providing tech tools for pre-harvest, post-harvest and during plant growing periods, according to Tracxn data as on July 1. They have attracted $560 million of venture funding, most of it in the last three years. In two years, according to Maple Capital Advisors, agri-tech ventures will attract another $500 million*." This report indicates that the process of collaboration for digital transformation of Indian agricultural sector has already started and is gaining momentum with considerable quantum of money being invested. However, there is a need for an integrated approach.

ICT and Agriculture

The process flow of agricultural activities from sowing seeds to reaching harvests to ultimate consumers generates considerable volume of multi-faceted data by different stakeholders from different locations. Successful digital transformation involves a great deal of automated processes for timely collection of relevant data, safe storing, and meaningful analyses. The imperatives are to draw inferences from the outcomes of data analytics, strategize plans, and initiate timely actions for maximisation of value creation and minimisation of value destruction with due transparency. Therefore, use of Information and Communication Technology (ICT) is foundational requirement for solving problems for all stakeholders directly or indirectly engaged in agricultural activities.

This has been observed and concluded by many research scholars. Walter et al. (2017)[B1] concluded that, *"The use of data and information becomes increasingly crucial for the agriculture sector to improve productivity and sustainability. ICT substantially increases the effectiveness and efficiency of collecting, storing, analyzing and using data in agriculture."* Kaddu and Haumba (2016)[B2] observed that, *"ICT allows agricultural practitioners and farming communities to easily obtain update-to-date information and thus make better decisions in their daily farming."*

Post the above two research-based conclusions, digital technologies have brought in manifold improvements in automated processes for data collection, analytics and problem-solving capabilities. This is more so when there are simultaneous applications of Blockchain, IoT, Drone, AI, ML, Edge Computing, etc. in different combination(s) befitting the problem(s) to be solved in isolation or combinations.

The following part of this paper has been written in the form of an ideated use case for designing comprehensive solutions of those problems, as briefly delineated above, faced by various stakeholders in the life cycle of a crop. Efforts would be for further orchestrating splintered efforts by stakeholders in the value chain and improve collaboration with trust, transparency, privacy, information safety and security.

Kishan Blockchain for Digital Transformation of Agriculture

Blockchain has already been established as one of the most safe, immutable, transparent, and reliable technologies for conducting commercial and non-commercial transactions. The Author in some of his previous columns in this Journal has written about Blockchain which is also synonymously known as Distributed Ledger Technology (DLT). Additionally, readers can also refer one of his published papers[B3] or watch his video recorded Master Class[W3] for gathering brief application-oriented knowledge on Blockchain.

While ideating structural design, operating propositions, and applications of Kishan Blockchain Platform, hereinafter referred as KBP, for digital transformation of agriculture the author has made efforts to plug in certain other digital tools and devices to render the solution comprehensive. At the user end KBP is to be positioned as a simple 'App' that can be handheld using a smart phone, iPad, or laptop / desktop computer, etc. The front-end can be presented in any vernacular and user-friendly icons, with toggle switch for change of language. The administrator for the KBP should arrange training for farmers and other participants

Stakeholder Participants for KBP

The very first of objectives for digital transformation of agriculture should be to bring the following stakeholders under one umbrella of a KBP:

1. Cultivators - Farmers and their associates, who in course of time may be assignees for all rights, assets, and liabilities of the farmers.

2. Government Agencies - Officials of Land Registry, *Jila Parishad* to *Gram Panchayet* (Local self-government from district to village level), Block Development Office, irrigation, and meteorological departments.

3. Input Vendors - Seed processors, manufacturers of farming equipment, pumps, fertilisers, pesticides, and insecticides, digital devices like drones, IoTs, sensors, etc.

4. BFSI Players - Banks, financial institutes, insurance companies, factors, etc.

5. Service Providers - Agricultural scientists, supply chain and cold storage operators, soil scientists, etc.

6. Customers: Government, organised retail chains, food processors, hotel chains, eCommerce players and co-operative marketing federations

It will be a challenge to incorporate all narratives for systems architecture and business requirements (BR) for designing and writing software for KBP. However, some of the new and critical aspects, which are unique requirements for a KBP has briefly been narrated in the following sections.

Administrator for KBP

KBP, being a nation-wide initiative for digital transformation of agriculture, can be administered and oversighted by a National Council like GST Council. Digital scientists can be co-opted as members of this Council. While discharging its roles and responsibilities for policy decisions and oversight, the National Council may decide to handover responsibilities to a professional IT organisation for developing, scaling up and maintaining the KBP on its behalf.

Nodal Structure for KBP

Scaling up of any blockchain platform is one of the major challenges for software architecting, designing, and coding team. Accordingly, several options can be considered for structuring one or more KBPs bearing in mind that data collection, analytics and oversighting can be performed both at state and national levels. This is necessary for framing strategies and policy decisions for agriculture sector, and timely dissemination of technical and commercial advisories to farmers. The following options and operating features may be considered:

1. Blockchain with DTL Nodes for the following stakeholders:

   - District > Jila Panchayet > Block > Gram Panchayet > Farmers' Cooperative > Farmers and other stakeholders

     Or

   - State > District > Jila Panchayet > Block > Gram Panchayet > Farmers' Cooperative > Farmers and other stakeholders

2. Administrative authorities for above platforms can be at the supervisory node of respective Ministry of Agriculture at state and / or central government levels simultaneously with decentralisation and

delegation of authorities to officials at District, Zila Parishad and Gram Panchayet levels depending upon transactional need and ease of operation.

One or more such KBPs can also be operated by any corporate house in private sector. Government officials can also join as participants. However, it should be ensured that a common farmer at the lowest village level is not put into a dilemma of selecting the right KBP to join and for this too much of competition may be avoided

3. Recommendation and approval of transactions should be kept at one or more nodes depending upon guiding policies, SOP for operating the KBP, roles and responsibilities of each participant and nature of each transaction.

4. Integration and interoperability of the above DTL platforms across district, state and central government levels should be ensured for more collaboration and coordination for the ultimate objective of value creation for farmers.

KYP – Pre-entry Identification and Authentication Participants

The proposed KBP platform would first provide facilities to 'Know Your Participant'. It would capture all details and credentials for identification, recognition, and registration of every singly participant, irrespective of being an individual, incorporated entity or government agency. Uploaded supporting documents, towards proof of authenticity and credentials, would securely be stacked by the KBP in a digital document library. This KYP facility would be configured in compliance with all regulatory requirements which the respective participants are subordinated to.

Enforceability of transactions - Super Smart Contract

Every single commercial transaction that will be entered and executed by and between two or more of participants must have to be backed by a legally enforceable contract in compliance with respective laws and regulations. The KBP would facilitate the process by hosting templates for all possible types of contracts which two or more of the participants under a contract would have to digitally sign-off. Such transactions could be in the nature purchase of farming equipment, fertilisers, technical services, etc, loan to farmers by banks, crop insurance contract, sell of crops to buyers, and so on.

Such underlying contracts will be father-hooded by the Super Smart Contract. All such contracts will initially be drafted by legal eagles, and then codified and embedded in the Smart Contract library hosted in the KBP. It will have facilities for change of clauses and sub-clauses as mutually agreed by and between the concerned participants through offer for modifications and acceptance recorded through the platform. All these will be linked and grafted to the concerned smart contract hosted by KBP and guide all subsequent transactions.

Digital Platforms Tools and Devices for KBP

Success of any KBP will to a large extent depend upon simultaneous and integrated use of many other digital tools and devices for conducting various primary and auxiliary activities:

Integration with other Digital Platforms

- Government Blockchain for Land Records: Integration of any KBPs with such state government level land records will facilitate the process of, establishing ownership of crops, collateralisation for bank loans, contract management for selling of harvests, etc.

- Fintech and Banking Platforms: Introduction of Central Bank Digital Currency or permission for use of Stable Coins in India may take time. Therefore, seamless integration of a KBP with one or more FinTech Platforms would be necessary for financial transactions.

Use of Digital Tools and Devices

- **Internet of Things and Sensors** - IoTs can be used for multiple purposes, when integrated with the concerned KBP. The following could be some of those purposes:

    - Soil Surveillance: Sensors and IoTs can be placed reasonably deep into the land for monitoring moisture content. This will help estimating irrigation need based on advisories for no or scanty rain by meteorology department.

- Deep Tube-wells and Pumps: IoTs can be affixed to water flow meters from deep tube-wells and / or pumps for automatic generation and collection of data regarding volume of water used by a farmer. Such data can be used for charging him, and /or government monitoring depletion in levels of underground water.

- Farming Equipment: If a farmer hires equipment such as tractors, harvesting machines etc., an IoT can be fixed for multiple purposes, e.g. intimating days and hours of use for charging the farmer, health condition of the equipment and need for maintenance depending upon say period of use, heat, sound, speed, etc.

- **Drones** - These flying machines can be fitted with sensors, IoTs, digital cameras and computers having abilities for videography and geo-physical positioning. These can be integrated with the KBP and used for the following purposes:

    - Spreading of pre-measured insecticides and pesticides with reference to type of crop, field area and advisory issued by agricultural scientists.

    - Crop scouting to monitor growth, colour and physical state of standing plants, visual status of yield, time for harvesting and surveillance against pilferage.

    - Imaging of cultivated field in an unfortunate event of natural calamities to assess the extent of crop damages and insurance claim amount to be paid to farmers.

    - Pictures from drones linked to geophysical position will enable government agencies to assess areas of land cultivated for a type of crop in a given season.

- **Immersive Technology (AR, VR and MR)** - These can be used for virtually real image management of standing crop. Such video images can help farmers to realise physical condition of crop and actions needed to ensure rightful treatment for ensuring growth free from risks of insects and pests.

- **Edge Computing** - To reduce load at the central cloud computing level, various digital devices, e. g., Drones and IoTs may be powered with in-built computing devices for processing of local data before passing processed information to the central cloud storage.

RPA and Robots - Robotic process automation and deployment of robots in India would be possible in course of time. The author feels that these may be introduced in the second or third phase, bearing in mind that large number of people earn livelihood from agricultural activities.

All the above digital devices may be provided by the service vendors on rent to the farmers and / or the Central KBP administrator, except for certain IoTs and Sensors, costs for which can be borne farmers.

Artificial Intelligence and Machine Learning – Extensive data will be generated and captured by a KBP through various commercial and non-commercial transactions. Such data will never be stale for future reference and will always be updated for every crop growing season. KBP should be designed in such a manner that those data can easily be retrieved, collated, and safely stored in such a manner that will facilitate the process of using tools from the stable of AI and ML

The predominant objective is to conduct region-wise analyses of various related variables, price movements of outputs in relation to inputs, farming techniques, variation in weather conditions, type of soil, etc. It will also generate how the vendors and customers commercially conduct themselves and behavioural data of farmers. When inferences are drawn after analyses, various stakeholders, including governmental agencies, banks, insurance companies, vendors, and buyers, will be able to strategize their respective plans, initiate actions with a win-win motive for all.

Podcast Facility

All services to farmers need not be rendered through a transaction in a KBP, e. g, informing farmers and insurers about attack of pests and insects, forecast for natural perils, rain in a monsoon season when saplings are sown, and crops are grown etc. Objectives could be to help farmers to decide timing for sowing seeds and drawing water from underground or from canal. Hence, a KBP would have a configured facility to podcast such advisories as messages to all farmers. However, records for such podcasts can be kept in the concerned KBP.

Escrow Bank Account - Comfort for Stakeholders

One of the overriding objectives of a KBP is to ensure transparency and reliability for all transactions and to commit that all participants get their dues on time as per contractual terms. For this a KBP can open and auto-operate an Escrow Bank Account on behalf of each farmer. The farmer would have a lien on the balance of the account. All collection and payment transactions processed in KBP will auto trigger instructions for processing and settlement by Banks. If money is required for subsistence of the farmer, the bank will directly credit the farmer's savings account in accordance with the loan agreement.

The chosen bank should be the one which would sanction loan to the farmer against future receivables from sale of crops and / or the farmer's land as collateral(s). The farmer's personal money, drawing funds against loans, collections against approved government grants and insurance claims, if any, will be deposited to this account. Payments to all vendors and service providers will be released from this escrow account on behalf of the farmer while crops grow on the field.

The bank loan will be paid-off from collections against sale of crops. The residual positive balance will be credited to the farmer's savings account after the transaction of the season is completed for settlement of the last liability on behalf of the farmer. Any negative balance will have to be settled by the farmer or though waiver of loan by Government. In any unlikely and unfortunate event of crop failure, collection will be there against insurance claim for meeting the bank loan, the entire process of which will be managed by the KBP in sequence of auto-triggered transactions or the ones initiated by the concerned stakeholders.

Crypto Currency

Ideally all transactions for this Escrow Account should be handled using a Cryptocurrency. The author is of the view that in course of time when India will introduce Central Bank Digital Currency (CBDC) that should be the valid medium for settlement to be handled through a KBP, which every participant will be able to encash into fiat currency, i. e., INR. Till that time one can adopt any other cryptocurrency such as Stable Coins subject to Indian financial regulators approving such use.

Sequence of Events and Transactions

Design and codification of a KBP as a blockchain platform should be pervasive, versatile, and flexible enough to allow initiation and processing of all commercial and non-commercial transactions by and between the stakeholders. It should configure all transactions right from a farmer ideating to grow a crop say paddy to its selling to government, organised retailers and / or hotel chains. The concerned KBP should enable floating of tenders among and beyond the participant vendors by a farmer or a group of participating farmers for equipment, seed fertiliser, and / or any services that they may require. If any vendor wants to participate in such tenders, must first register as a participant. Similar facility should be there for exploration of price of harvests through request for quotation (RFQ) from prospective buyers.

KBP - A Virtual B2C Market Place for Vendors

From the perspective of vendors, KBP provides a tailor-made virtual marketplace that will save considerable marketing expenses for those product sellers and service providers. They will also be assured of getting paid because of funds form bank loans being available in the Escrow Account. And for these facilities all those organisations would be happy to pay participation fees. This in turn will be a source of earnings for the Administrator of any KBP to meet expenses for maintenance and scaling up as and when needed to accommodate larger participation.

Banks also will find comfort for participating in a KBP as lenders because the escrow bank account which will be operated as an integrated part of the KBP for end to end handling of transactions in a crop season from sowing seeds to realisation from sales.

KBP - A Virtual eMandi for Farmers and Buyers

KBP will also serve as a virtual marketplace for buyers in the form of an eMandi of agricultural produce. Accredited technical agency (ies) for providing services for quality inspection and gradation of crops will also be a participant(s) of a KBP. Objective is to ensure that the farmers get the most deserving price for their crop befitting its quality as graded by that agency.

Even before the Crop is harvested farmers per design can initiate reverse tendering process among the participating buyers through the KBP for exploring and discovering the right price. Exception to this could be for 'Minimum Support Price' announced by Government for procurement from farmers for harvest like paddy and wheat. All these will make the role of any intermediary redundant and ensure that farmers get their due

reward. Again, because the product will be sold directly by the farmer to the buyer no scope of adulteration and contamination would be there. Such buyers can be charged a fee for providing sourcing services by the KBP.

Supply Chain Management Back Tracing

Supply chain management service providers, including packaging of harvests, will also be participants of a KBP. One critical requirement that needs to be taken care of by them is to introduce RFID or QR Codes on every primary, secondary and tertiary level packaging for the products of each farmer. Such codes are also to be inserted in case there are instances of break bulk and repackaging. Structure for such codes is to be logically designed to identify farmer's name, if allowed, GPS position of the land where the crop was grown, type of farming done, e. g., organic or inorganic, and universal product tariff code. The package should also contain all other disclosures and declaration in compliance with related regulatory requirements.

Software for the supply chain portion of a KBP are to be coded at the back end in such a manner that would facilitate the process of tracking and tracing back the product till the ultimate farmer and his land where the same was produced. Readers may be aware that wineries prefer to know and quote the place where the grapes were produced first on the label of a wine bottle. In developed countries consumers are increasingly demanding to know details of the farm, location, type of farming done whenever the buy agricultural products.

Instructional Transactions

KBP will have to record certain transactions which will be in the form of advisories and instructions to farmers by Government agencies, agricultural scientists, vendors for manures and pesticides, meteorological authorities regarding onset of monsoon and commencement of sowing seeds, etc. Such advisories / instructions may or may not be rendered on a commercial basis against payment of fees but have important bearing in farmers' ultimate success for growing crops of the desired quality and quantity per square unit of land cultivated. Such transactions should also be recorded in Blockchain for every node of the DTL to take note of.

Conclusion

Kishan Blockchain Platform has been ideated by the author as a seed in the womb of time with the objective to generate and ensure rightful rewards for hard labour and sacrifice of Indian farmers. He will look forward to seeing that day when KBP will meet reality and be regarded as a friend of millions of farmers under the sun. The author will be happy to collaborate with any organisation who may be interested in the proposed KBP.

Note:

Contents of this paper are of proprietary nature. The author reserves all rights of the ideated method for digital transformation of agriculture through the 'Kishan Blockchain Platform (KBP)' as delineated above. He may be contacted at paritosh.basu@sbm.nmims.edu or @paritoshbasu.

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ORGANIC PRODUCTION OF MAJOR SPICES FOR DOUBLING FARMERS' INCOME OF NORTH EAST HILL REGION: AN EMPIRICAL ANALYSIS

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Background

The North East (here after; NE), green belt of India which comprises of states namely Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Tripura and Sikkim harbours a rich flora on account of its varied topography, climate and altitudes and has great potential for the development of horticultural crops including spices. It is the hub of major spices like large cardamom, ginger, turmeric, black pepper, chilli, bay leaf, *etc* which are in great demand and has tremendous potential (Hnamte *et al*., 2012). Assam is the leading state in spice production in the region followed by Nagaland (Table 1). The NE region is home to some niche spice crops like *Lakadong* turmeric, *Bird's eye* chilli, *King* chilli and *Nadia* ginger which has high market demand for their unique features (Momin *et al*., 2018).

Table 1: Area and production of spices in NE India during 2016-17

State	Area ('000 ha)	%	Production ('000 MT)	%
Arunachal Pradesh	11.44	4.79	68.72	9.02
Assam	119.99	50.22	291.3	38.22
Manipur	10.47	4.38	23.14	3.04
Meghalaya	18.61	7.79	92.16	12.09
Mizoram	24.81	10.38	97.2	12.75
Nagaland	15.69	6.56	105	13.78
Sikkim	32.25	13.50	66.58	8.73
Tripura	5.69	2.38	18.04	2.37
Total (NE)	**238.95**	**100.00**	**762.14**	**100.00**
Total (India)	**3672**		**8122**	
% share to total of India	6.51		9.38	

Source: GoI, 2018

Organic scenario in NE state

Owing to the quality of spices which are being considered as an organic, the North Eastern Hill Region (here after; NEHR) state has gained special attention in the global map. Due to scanty application of inorganic fertilizers and chemicals (Table 2) for a long period of time, the NEHR is recognized as an organic by default (Wani *et. al*, 2017). According to an estimated data available with the Agricultural and Processed Food Products Export Development Authority nearly 90.50 thousand ha of land in NEHR states is already under organic cultivation (GoI, 2017). As per the available statistics, another 77.60 thousand ha are in the process of switching over to organic cultivation.

Table 2: State wise fertilizer consumption in NEHR of India

('000 MT)

States	Nitrogen	Phosphorous	Potassium	Total
Arunachal Pradesh	0.44	0.03	0.09	0.56
Manipur	10.29	2.77	1.74	14.80
Meghalaya	-	-	-	-
Mizoram	1.61	0.29	0.42	2.32
Nagaland	1.19	0.81	0.51	2.51
Sikkim	-	-	-	-
Tripura	9.57	6.53	6.18	22.28

Source: GoI, 2017

Sikkim is the leading among NE state (Table 3), constituting around 63.74 per cent of the total organic area in the region. Assam is the second largest state in terms of area under organic farming in NE India (23.71%) followed by Nagaland (5.16%), Meghalaya (3.84%) and Arunachal Pradesh (3.49%) (NPOP, 2018). Sikkim is the only state in NE that has been confined the title of "organic state" in the year 2016. For making Sikkim a fully organic state ever in India, the Government of Sikkim underwent various phase in the agricultural farming. The state stepped into organic mission in three phases since the year 2003 which is explained briefly in Box- 1. With the assistance of the recently launched central sector scheme entitled "Mission Organic Value Chain Development for North Eastern Region" during the 12th plan period (NEC, 2017) the other NE states are in the process towards the designation "organic".

Table 3: State wise area under organic in NE state during 2015-16

State	Area ('000 ha)	Percentage share
Assam	28.43	(23.71)
Arunachal Pradesh	4.19	(3.49)
Manipur	0.25	(0.21)
Meghalaya	4.61	(3.84)
Mizoram	0.21	(0.18)
Nagaland	6.19	(5.16)
Sikkim	75.85	(63.24)
Tripura	0.20	(0.17)
Total	**119.93**	**(100)**

***Source*:** NPOP, 2018

Box-1

Phases in conversion to organic state in Sikkim

Phase I: Conceptualization

Sikkim organic mission idea was conceptualized.

(a) Constituted Sikkim State Organic Board (SSOB) on 16th Sept, 2003.

(b) Adopted seven years plan to wipe out use of chemical fertilizer and import of chemical fertilizer.

Phase II: Action plan

Promotion of on-farm production of organic manures.

(a) Capacity building.

(b) Establishment of bio fertilizer production units.

(c) Establishment of soil testing laboratories.

Phase III: Implementation

Implement organic farming programs and policies of the state.

a. MoU signed between State Government and Research Institute of Organic Farming (FiBL) Switzerland for technical cooperation on organic farming.

b. 75,000 ha of land had been certifies as organic on 31st December, 2015.

c. Certification through APEDA accredited certification agencies.

Although this region of the country produces a huge quantity of good quality spices by adopting indigenous cultivation practices, the production level however, is not much at par with the other parts of the country (Das, 2016 and Momin *et. al.,* 2018). The agri-produce grown in NEHR is by default organic but producers are not getting its premium price in form of organic except the producers of Sikkim state. Also the GoI has emphasised

for doubling farmers' income by 2020 and organic spice may be a boon for the NEHR for doubling of farmers' income Therefore, present policy paper is an overview of apparent comparative benefits realized by organic adopter over non-organic adopters.

Locale of the study

Three major spices ginger, turmeric and chilli which were widely grown in the NE states have been selected for the study. On the basis of their area of cultivation for each spice, 2-3 states (Non-adopter of organic) in the NEHR were selected with the organic acclaimed state, Sikkim as a benchmark (Table 4). The state of Sikkim (Organic adopter state) has been selected for all three commodities to work out apparent comparative economic benefits of organic cultivation over non-organic cultivation of spices.

Table 4: Selected state for each spice under study in NEH region

Major spices selected	States			Control state	Total respondents
Ginger	Meghalaya (9.94)	Mizoram (8.21)	Arunachal Pradesh (7.65)	Sikkim (12.30)	359
Turmeric	Mizoram (7.20)	Meghalaya (2.61)	Manipur (1.40)	Sikkim (1.95)	334
Chilli	Mizoram (9.14)	Nagaland (6.01)	-	Sikkim (0.09)	243

***Note*:** Figures in parentheses indicate Area (A)= '000 ha, *Source:* Field survey

Selection of respondents

From each of selected states, two districts having the highest area under the cultivation of particular spice were selected. Further, 2-4 major collection centres/block was selected where warehouses or market or a place in which spice producers of different adjacent villages disposed-off maximum of spices. A list adjacent village to collection centre was prepared along with the total number of households for selection of spice producers. At least 10 per cent of the spice growers in a cluster (minimum of 2 villages) were selected for the study. A sample of 103, 81 and 92 ginger growers of organic non-adopter states *viz;* Meghalaya, Mizoram and Arunachal Pradesh, respectively in contrast to a sample of 83 ginger growers of Sikkim state of organic adopters were selected. Similarly, a sample of 86, 95 and 75 turmeric growers from organic non-adopter states namely Meghalaya, Mizoram and Manipur states, respectively were selected in comparison of 78 turmeric growers of the adopter state of Sikkim. For the commodity of chilli; a sample of 91 and 77 from the non-adopting sate of Mizoram and Nagaland, respectively were selected by keeping 75 chilli grower of organic adopter state of Sikkim (Table 5).

Table 5: Selection of spice growers from selected states of NEHR

Spices	Selection of respondents from selected states (No.)						
	Meghalaya	Mizoram	Arunachal Pradesh	Manipur	Nagaland	Sikkim	Total
Ginger	103	81	92	-	-	83	359
Turmeric	86	95	-	75	-	78	334
Chilli	-	91	-	-	77	75	243

Source: Field survey

Economic benefits from organic spices

Ginger

The cost of production of ginger on organic farm of Sikkim (Rs.21.67/kg) incurred more than the organic non-adopter state which was due to more labour and costly planting material for organic cultivation of ginger. The organic method of ginger cultivation was found to be helpful to enhance yield in the range of 16-25% more than non-adopters except the case of Arunachal Pradesh. Organic production using principles of organic farming incurs more cost per unit area compare to non-organic adopters, because extra input and extra care management was taken by farmers. This cost used to be higher in initial 3-4 years of organic production. Once the enough humus contain in soil is built-up and field is certified de-facto then cost of cultivation starts decreasing because

it need for building enough organic content in soil is not required much compare to non-organic adopter yield of ginger. The farmers of Sikkim sold the produce at higher price (Rs.40.35/kg) compared to Meghalaya (Rs.30.08/kg), Mizoram (Rs.24.82/kg) and Arunachal Pradesh (Rs.19.14/kg) which shows the preference of consumers over organically produce of ginger. Thus, the farmers of organic adopter of Sikkim earned just double returns (Rs.18.67/kg) than of non-organic adopter of Meghalaya (Rs.9.70/kg), Mizoram (Rs.5.05/kg) and Arunachal Pradesh (Rs.5.62/kg). The break-even-point (BEP) was also better for adopter over non-adopters. The organic produce fetched a better price of their produce (Table 6).

Table 6: Comparative costs and returns in Organic ginger cultivation

Particulars	**Organic adopter**	**Organic non-adopter**		
	Sikkim	Meghalaya	Mizoram	Arunachal Pradesh
Total cost of cultivation (Rs./kg)	21.67	20.36 (-6.05)	19.77 (-8.77)	13.52 (-37.61)
Yield (MT/ha)	5.07	3.80 (-25.05%)	4.16 (-17.95%)	5.92 (16.77%)
Break-even-point (MT)	0.24	0.62 (59.68%)	0.92 (72.83%)	1.00 (75.00%)
Selling Price (Rs./kg)	40.35	30.08 (-25.45)	24.82 (-38.49)	19.14 (-52.57)
Net Income (Rs./kg)	18.67	9.70 (-48.04)	5.05 (-72.95)	5.62 (-69.90)

Note: Figure in parentheses are percentage different (increase or decrease) with Sikkim

Source: Field survey

Fig.1: Harvested Ginger at Farmer's Field

The variety of ginger are less responsive to organic inputs compared to chemical inputs since Arunachal Pradesh is more modernized and mechanized compared to Sikkim. Hence, promoting organic farming; varieties which are more responsive to organic inputs were required.

Turmeric

Contrary to the ginger production; the cost of organic turmeric production has been estimated less than the organic non-adopter farm in the states. The yield of organic turmeric was estimated higher than the other non-adopter states in the range of 4-38%. The break-even-point was also at better side on farm of organic adopter than farm of non-adopters. The selling price of the produce on the other hand was more of turmeric produced in the organic state of Sikkim (Rs.34.45/kg) than Mizoram (Rs.32.77/kg), Meghalaya (Rs.26.92/kg) and Manipur (Rs.21.38/kg). As it is the novelty of organic produce which attract to the consumer and fetched higher prices than the turmeric produced in other organic non-adopter state of the region. Consequently, the turmeric producer of organic state of Sikkim (Rs.17.07/kg) earned just double of net returns than non- adopter state of Mizoram (Rs.9.07/kg), Meghalaya (Rs.10.48/kg) and Manipur (Rs.8.18/kg). Hence, organic turmeric production is better

option for doubling of farmers' income (Table 7). Although, world famous '*Lakadong*' turmeric is always highly attractive (demanded) in the market and has ample scope for increasing income of the growers by using organic method of cultivation for its premium price.

Fig. 2: Harvested Turmeric at Farmer's field

Table 7: Comparative costs and returns in Organic turmeric cultivation

Particulars	Organic adopter	Organic Non-adopter		
	Sikkim	Mizoram	Meghalaya	Manipur
Total cost of production (Rs./kg)	17.38	23.70 (26.66)	16.44 (-5.41)	13.20 (-24.05)
Yield (MT/ha)	5.51	3.38 (-38.66)	5.04 (-8.53)	5.26 (-4.53)
Break-even point	0.11	0.34 (67.64)	0.29 (62.06)	0.31 (64.51)
Selling price (Rs./kg)	34.45	32.77 (-4.88)	26.92 (-21.86)	21.38 (-37.94)
Net return (Rs./kg)	17.07	9.07 (-46.87)	10.48 (-38.61)	8.18 (-52.08)

Note: Figure in parentheses are percentage different (increase or decrease) with Sikkim

Source: Field survey

The varieties of turmeric were found to be responsive to organic inputs compared to chemical inputs. Researchable here are just to promote organic farming in NER and there is an urgent need of arrangements of premium price of organic spices.

Chilli

Chilli being the low volume crop the farmers of the region gain more return per kg of the produce but it varies from the state to state. The organic adopter of Sikkim (Rs.16.35/kg) incurred less cost on production compared

to organic non-adopter chilli growers of Mizoram (Rs.46.69/kg) which was estimated of more than 85%, but it was more or less equal in the state of Nagaland (Rs.15.79/kg). The price of organic chilli produced in the organic state of Sikkim fetched higher price (Rs.196/kg) than the chilli produced in organic non-adopter state of Mizoram (Rs.143.29/kg) and Nagaland (Rs.189.95/kg). The net returns were estimated higher on the organic farm of Sikkim state (Rs.180.85/kg) than the organic non-adopter state of Mizoram (Rs.96.69/kg) and Nagaland (Rs.174.16/kg). The difference in net returns was more or less double to Mizoram but in case of Nagaland there was not much difference. The reason was the variety '*bhut julakia*' (Naga Mirchi) which is world famous for its taste and properties. Although the "*bird's eye*" chilli grown in Mizoram is also famous for its properties but it could not create its demand in the market much. The '*dale*' chilli of Sikkim is famous for its properties and production of it using organic method is another added advantage for its higher prices. Thus, an organic chilli production is another good option for doubling of farmers' income in the region. This shows that the farmers of organic adopter state of Sikkim gained more benefit than the farm of non adopters of organic in other selected states (Table 8).

Table 8: Comparative costs and returns in Organic chilli cultivation

Particulars	Organic adopter	Organic non-adopter	
	Sikkim	Mizoram	Nagaland
Total cost of production (Rs./kg)	16.35	46.69	15.79
		(64.98)	(-3.42)
Yield (MT/ha)	2.92	0.96	2.61
		(- 67.12)	(- 10.62)
Break-even point (MT)	0.02	0.03	0.02
		(33.33)	(Nil)
Selling price (Rs./kg)	196.85	143.39	189.95
		(-27.16)	(-3.50)
Net return (Rs./kg)	180.85	96.69	174.16
		(-46.53)	(-3.70)

Note: Figure in parentheses are percentage different (increase or decrease) with Sikkim

Source: Field survey

Fig. 3: 'Dale' chilli of Sikkim

Fig. 3: Bird's eye' chilli of Mizoram

Fig. 4: 'Naga' chilli of Mizoram at farmer's field

Conclusions

The NEHR is hot spot for spice production which is sharing 9.38 per cent production in 6.51 per cent of area in the country. Spices like ginger, turmeric and chilli grown in the region have been recognised world famous for their properties. The Lakadong' turmeric which has highest curcumin oil and 'bird's eye' chilli, 'naga chilli' and 'dale' are famous chillies grown in the region and recognised best use in pharmaceutical industries for different, medicines, pesticides and enemy weapons as these chillies are rich in *capsanthin* and *capsaicin*. The study conclude that variety of all three respective major spices were found to be responsive to organic inputs compared to chemical inputs except in case of ginger where Arunachal Pradesh was more modernized and mechanized compared to organic state of Sikkim. Promotion of organic farming in NEHR and development of varieties which are more responsive to organic inputs were need of the hours. The break-even analysis of all three selected spices shown healthy sign, though the variety was high responsive to organic inputs compared to chemical input it means organic production was not much driven by technology (yield) but more responsive to price of output in the market. So, this spice organic production was driven by high market price or market led growth comparative to technology led growth. The price led growth was not desirable path in long-run so the important lesson is to make the organic production on technology driven path. Therefore, replication of the organic model of Sikkim in other states of the North Eastern states is imperative for doubling of farmers' income.

Policy implications

From the study following policy implications emerged:

- For promoting organic farming in NER and there is urgent need to breed or develop varieties which are more responsive to organic inputs.
- Making the organic production on technology driven path rather price led.
- Among the technologies are local inputs like bio-fertilizers, seed and bio-control need to develop at local level by involving local youth, which will support slogan 'vocal for local' and FPOs with new guidelines may play very crucial role into this.
- Same time it will lead to slogan of 'Aatamnirbhar Bharat' by developing local entrepreneurship in pre and post-harvest management and technologies in spices.

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ORGANIC FARMING - A WAY TO AGRI PROSPERITY

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Introduction

Farming is the backbone of the economic system of a country. For centuries together, India has been an agro based economy. Even on this day, about 65% of the India's total population lives in villages and survives on agriculture. In addition to food, agriculture also provides employment opportunities to a very large percentage of the population. It contributes to National revenue and gives raw material to many industries such as textile, food processing, sugar, tobacco, edible & non-edible oils, paper, power generation, ethanol, etc. It provides major food items for exports and helps to earn foreign exchange.

The age old farming was dependent on weather. Land was abundant, population was less, food desires were limited; as a result there was not much stress on the agricultural production. Available resources were enough to feed the population. Management of soil fertility has remained the concern of farmers even at that time. The use of fertilizers of organic origin was prevalent to improve the soil fertility.

Rise of Chemical Farming

With the industrial revolution, many new segments came into existence and production of chemical fertilizer was one of them. In 1837, some chemists from Europe started experimenting with chemical substances on the potted plants. Later on, these experiments were extended to crops spreading over the fields. In 1842, manure formed by treating phosphates with sulphuric acid was patented, and thus first artificial manure industry was born. India, opened its first fertilizer factory at Ranipet (Tamil Nadu) in 1906. Since then, there have been major developments and growth in terms of the quantity, types, the technologies used and the feed stocks employed. Presently, the fertilizer industry in India is one of the core sectors and second to steel in terms of investment.

With the passage of time, cultivable land started shrinking and population was on a constant growth. So it was difficult to match the demand with the same set of practices. Green revolution in the late 60's was the answer to these concerns which gave an impetus to the use of fertilizers in India which constantly grew during 70's and 80's. The study carried out by Food and Agriculture Organisation, titled 'Fertilisers use in India', reported that India's fertilizer consumption has increased from less than 1 million ton in the mid-1960s to almost 17 million ton in early 2000s. As per the figures submitted in the Parliament in March 2020, the trend of annual consumption has remained in the range of 50 million ton between 2011-19.

Effect of chemical Farming - The special feature of Chemical fertilisers is that these need to be used perpetually with incremental doses to maintain the linear productivity for few years. After a few years productivity starts declining and constant use of chemical fertilizers result in soil acidification, heavy metals pollution, soil compaction, and changes in soil microbiome. This means that the pH level of soil, its fertility and bacterial count starts declining. The chemicals used also pollute the ground water and close lying water bodies. The farmers may even end up contracting respiratory diseases and skin allergies when exposed to chemicals. Consumers are getting directly affected by fertilisers and pesticides with acute health problems, such as abdominal pain, dizziness, headaches, nausea, vomiting, Liver and kidney problems, skin and eyes problems etc.

There have been many studies intending to establish link between chemical fertilisers and cancer. These grave effects of chemical fertilisers and pesticides have once again forced the mankind to think about its use.

Rise of Organic Farming - After the awareness of the health problems caused by the consumption of chemically grown food products and their ill effect on consumers and environment, Organic farming evolved on the basis of the path breaking literature published by J.I. Rodale in the United States, Lady Balfour in England and Sir Albert Howard in India. The origin of organic farming in India goes back in its recent history, to 1940s.

Organic farming is a method of crop and livestock production that involves much more than choosing not to use pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones.

International Federation of Organic Agriculture Movements *has defined* "Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved..."

Organic farming methods combine scientific knowledge of ecology and some modern technology with traditional farming practices based on naturally occurring biological processes. Organic farming methods are studied in the field of agro ecology. While conventional agriculture uses synthetic pesticides and water-soluble synthetically purified fertilizers, organic farmers are restricted by regulations to using natural pesticides and fertilizers.

Market Demand of Organic Products - is ever increasing with the people getting more n more aware and health conscious. This awareness has got a boost and as a result the demand for organic food has been climbing up consistently ever since the outbreak of the corona virus pandemic and the lockdown in its wake. One of the most important learning for people during this time of COVID 19 across the world has been the need to build 'strong immunity' as a possible shield against all deadly viruses. Organic food, being full of antioxidants and nutrients is one of the best ways to boost immunity. Hence, instead of risking their health further, people are willing to buy and even pay extra premium for organic food.

According to a report produced jointly by Assocham and Ernst & Young the organic products market in India has been growing at a CAGR (Compound Annual Growth Rate) of 25 per cent and it is expected to touch Rs.10,000 - Rs.12,000 crore by 2020.

As per APEDA statistics, Indian Organic exports rose to Rs. 5,151 crore in 2018-19, with an increase of 50 percent over previous year. Considering a CAGR of 50 percent, organic exports can be expected to be doubled to Rs 10,000 crore by 2020-21. As per the present international market trends, India will be looked upon by the world as an alternative to China for the supply of organic agricultural products and hence there is a great opportunity for the country to enhance its exports of organic products.

Comparative Analysis

Organic and Conventional systems of farming have their own merits and demerits. Advocates of both the systems have their own reasons to propagate the methods. But its Cost Benefit Analysis can give the real idea about the efficacy of the system.

The factor which is in favor of chemical farming is that it gives better yield as compared to organic farming. But this is true only for the initial years. When a farm is shifted from chemical farming to organic farming, initially the yield is reduced by 25 - 50%, depending upon the crop. But gradually, production improves every year and after 4 - 5 years of organic practices, yield is almost at par with the chemical farms minus the toxicity of the produce. Whereas in case of chemical farming, yield is deteriorating every year, even if the quantity of fertilizer used remains the same.

Another important factor which goes in favour of organic farming is independence of farmers with respect to seeds. In case of organic farming, the farmer retain seeds from its earlier crop, where as in case of chemical farming, mostly seeds are purchased from the market. So cost involved is increased, cash flow shrunk and independence of farmers is sacrificed.

The details of comparative farming cost per acre of land by using organic manure and chemical fertilizers are appended as an annexure to this article. In case of organic farming cost of seed, chemical fertilizers, pesticides and weedicide is almost negligible. This is directly adding up to the per acre margins for the farmer. Table below gives the comparative Revenue, Cost and Margin Per Acre for Organic & Chemical Farming for Cotton crop.

Table - Farming Margin Per Acre of Cotton Crop

Sr.	Activity	Organic Farming	Chemical Farming
A.	**Average Yield (quintal)**	6	8
B.	**Sale Rate (Rs./Quintal)**	5000	5000
C.	**Revenue (Rs.)**	30000	40000
D.	**Cost (Rs.)**	17500	31900
E	**Margin**	**12500**	**8100**

The aggregate farming margin per acre of cotton, works out to Rs. 12500/- with the organic farming and Rs. 8100/- with the conventional farming. It implies that even if organic yield is 25% less, the margin is higher by 54% over the chemical farming margin. Margin can certainly be enhanced with the increase in farm productivity.

Way Ahead -

Organic farming creates ecological balance, gives better income to farmers, health to consumers and happiness to society at large. **In nutshell, the organic farming is adding up to the farmers' prosperity and also to the happiness quotient of the Nation**. It can be made further profitable by adopting following practices:

1. To compensate the decline in revenue occurred due to initial switchover years, **Multi cropping** can be adopted.
2. **Farm management schedules**, like timely sowing, irrigation, de-weeding, nutrient dosing etc. to be adhered with.
3. **Physical monitoring** also plays an important role and can add to better quality of produce
4. **Additional activity** e.g. dairy farming, poultry etc can add to the additional income to the farmer
5. Adding ancillary income by **value addition of products** using various processing methods e.g. dehydration/ solar drying of vegetables, grinding of spices, making pickle, jam, sauce etc.
6. **Crop alternating** is a method to improve the productivity of the soil and thereby improving the yield and revenue.

Thus, the organic farming may, certainly be perceived as a "Way to Agri Prosperity"

Annexure 1

Normative Cost per Acre of Cotton Crop

Sr.	Activity	Organic Farming	Chemical Farming
1	Soil Preparation	800	1000
2	Seed Bed Making	500	500
3	Seed		1500
4	Sowing Labour - 4 female workers @150/day	600	600
5	Manure (Material + Labour)	3000	-
6	Fertilizer (Material + Labour)		5400
7	Weedicide (Material + Labour)	2400	2500
8	Pesticide (material + Labour)	600 *	5600
9	Nutrient (Material + Labour)	700 *	
10	Soil Mulching (Bullock – 4 days @1200/day)	900 **	4800
11	Water (3 times in 1 crop season)	2000	2000
12	Harvesting @Rs.10/kg	6000	8000
13	Total Cost	17500	31900

* This is only labour cost, as material is generated from the farm and live stock waste
** Its assumed that organic farmer owns a pair of bullocks and cost incurred is only towards the labour cost of operator.

STRATEGIC AGRICULTURE COST MANAGEMENT - ROLE OF COST AND MANAGEMENT ACCOUNTANTS

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Preamble:

Agriculture is the backbone of our Country. Agriculture is the main occupation of all villages in India. Without Agriculture no body can survive. It means no one will exist without food. Agriculture plays a pivotal role not only in our country but the entire Universe. It is just like Solar system wherein all plants have to rotate around the earth regularly. Therefore, whoever engages in agriculture directly and indirectly are called Annadathas nothing, but Farmers also called as Agriculturists. All industries are surviving with Agriculture. Without Agriculture no one can exist in the entire world. All citizens of almost 215 Countries are depending on Agriculture for their livelihood. Humankind and all creatures will survive because of consuming the food on regular basis. The Food comes from Agriculture. Trees are grown by the people, for the people and to the people which give fruits and such fruits are consumed by the people for survival. Without agriculture, there are no villages, without villages there will be no towns, without towns there will be no cities, without cities there will be no Capitals, without Capitals there are no States, without States there are no Countries, without Countries there is no internationality in the World. Now we conclude that everything will have chain link. It is just like Pen and ink Bottle which ultimately means no one survive without food and the food comes from Agriculture. Therefore, every Country shall give prominence to the Agriculture. We as professionals have to concentrate on Agriculture and treat as Second Green Revolution. Hence the role of Cost and Management Accountants play a Pivotal Role not only in our Country but all over the World.

Introduction:

India is one of the best countries in Agriculture. In principle it is an Agro-based Country. The Agriculture is the main occupation for the villages. Agriculture with its allied Sectors is inevitably the largest livelihood provider in our country. Most of the industries also depend upon the Agriculture sector for their Raw materials. Indian traditional agriculture methods, types, systems, procedure are entirely different and it is an art by itself. Continuous investments in technological development, infrastructure and irrigational facilities, modern agricultural farming methods, techniques, principles and practices, methodologies, continuous Research and development, transportation facilities, Central and State Government Agricultural schemes, development of Banking and Institutional Financial facilities for Agriculture and allied sectors, Setting up of Agro- based Industries, Agricultural Marketing Corporations, Agricultural Co- operative Banks and Agricultural Co-operative Societies, provision for Agricultural Credit and subsidies, Government grants etc., are the major contributing factors for the agricultural growth in India. Similarly, the growth of Agriculture is predominant in Foreign Countries like USA, Canada, United Kingdom, China, Africa, South America, Russia, Mangolia, Japan, Netherlands, New Zealand Indonesia, Malaysia, Singapore, Thailand and Australia.

Strategic Cost Management in Agriculture:

Indian agriculture has undergone rapid transformation for the last three decades. The globalization, liberalization and privatization have pave the way for new avenues for agricultural modernization in our country. This not only lead to commercialization but also triggered various modern technological and institutional innovations due to huge investments from Corporate entities. The World Bank has extended lot of financial assistance in

the development of Agriculture in India. In recent years huge funds are coming from Foreign Direct Investors to promote the Agro- based industrial sectors.

It is noticed that more and more of Agricultural lands are getting converted to non-agricultural purposes in India due to huge demand of industrial and infra-structural development. The Agricultural lands have been converted by the local Governments and made industrial sites and sub-urban areas have been created for residential, commercial and industrial purposes.

Recently nearly 33000 acres of prime agricultural lands have been acquired by the Government of Andhra Pradesh for establishment of State Capital. 25

Huge Agricultural lands have been acquired for Educational Universities, Air Ports, Defence Establishments etc., in our Country. Sometimes, to wipeout huge losses and debts, the Farmers used to sell their land to the Industrialists and land Promoters. About Five years back in Andhra Pradesh, KIA Motors Ltd have acquired about 400 acres to establish the Car manufacturing Company near Kurnool. If it is continued like this, in the long run there will be shortage of food grains besides India will face real problem of inflation in the country and it has to depend on other Countries to meet the scarcity of Food items. A kind of SWOT analysis has to be made in each and every District in India for the purpose of growth in production of Agricultural Produce. Even though there is positive growth of output and productivity in the Agriculture Sector with best modern machines and automation, but it is not enough to meet the demand of the growing population in our Country.

INDIA AT A GLANCE IN AGRICULTURE PRODUCTION

With a population of 1.27 billion India is the world's second most populous country. It is the seventh largest country in the world with an area of 3.288 million sq kms. It has a long coastline of over 7,500 kms. India is a diverse country where over 22 major languages and 415 dialects are spoken. With the highest mountain range in the world, the Himalayas to its North, the Thar desert to its West, the Gangetic delta to its East and the Deccan Plateau in the South, the country is home to vast agro-ecological diversity. India is the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops. Worth $ 2.1 trillion, India is the world's third largest economy after the US and China.

India's climate varies from humid and dry tropical in the south to temperate alpine in the northern reaches and has a great diversity of ecosystems. Four out of the 34 global biodiversity hotspots and 15 WWF global 200 eco-regions fall fully or partly within India. Having only 2.4 percent of the world's land area, India harbours around eight percent of all recorded species, including over 45,000 plant and 91,000 animal species.

India's economic growth in financial year 2018 is expected to accelerate to 6.75 percent in 2018 on improved performance in both industry and services. India is the world's sixth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP). The country ranks 139th in per capita GDP (nominal) with $2,134 and 122nd in per capita GDP (PPP) with $7,783 as of 2018 (World Bank data). Agriculture accounted for 23% of GDP, and employed 59% of the country's total workforce in 2016.[146]

Agriculture, with its allied sectors, is the largest source of livelihoods in India. 70 percent of its rural households still depend primarily on agriculture for their livelihood, with 82 percent of farmers being small and marginal. In 2017-18, total food grain production was estimated at 275 million tonnes (MT). India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. India's annual milk production was 165 MT (2017-18), making India the largest producer of milk, jute and pulses, and with world's second-largest cattle population 190 million in 2012.[153] It is the second-largest producer of rice, wheat, sugarcane, cotton and groundnuts, as well as the second-largest fruit and vegetable producer, accounting for 10.9% and 8.6% of the world fruit and vegetable production, respectively.

However, India still has many growing concerns. As the Indian economy has diversified and grown, agriculture's contribution to GDP has steadily declined from 1951 to 2011. While achieving food sufficiency in production, India still accounts for a quarter of the world's hungry people and home to over 190 million undernourished people. Incidence of poverty is now pegged at nearly 30 percent. As per the Global Nutrition Report (2016), India ranks 114th out of 132 countries on under-5 stunting and 120th out of 130 countries on under-5 wasting and 170th out of 185 countries on prevalence of anaemia. Anaemia continues to affect 50 percent of women including pregnant women and 60 percent of children in the country.

While agriculture in India has achieved grain self-sufficiency but the production is, resource intensive, cereal centric and regionally biased. The resource intensive ways of Indian agriculture has raised serious sustainability issues too. Increasing stress on water resources of the country would definitely need a realignment and rethinking of policies. Desertification and land degradation also pose major threats to agriculture in the country.

The social aspects around agriculture have also been witnessing changing trends. The increased feminisation of agriculture is mainly due to increasing rural-urban migration by men, rise of women-headed households and growth in the production of cash crops which are labour intensive in nature. Women perform significant tasks, both, in farm as well as non-farm activities and their participation in the sector is increasing but their work is treated as an extension of their household work, and adds a dual burden of domestic responsibilities.

India also needs to improve its management of agricultural practices on multiple fronts. Improvements in agriculture performance has weak linkage in improving nutrition, the agriculture sector can still improve nutrition through multiple ways: increasing incomes of farming households, diversifying production of crops, empowering women, strengthening agricultural diversity and productivity, and designing careful price and subsidy policies that should encourage the production and consumption of nutrient rich crops. Diversification of agricultural livelihoods through agri-allied sectors such as animal husbandry, forestry and fisheries has enhanced livelihood opportunities, strengthened resilience and led to considerable increase in labor force participation in the sector.

The Food and Agricultural Organization of the United Nations (FAO) has enjoyed valuable partnership with India since it began operations in 1948. It continues playing a catalytic role in India's progress in the areas of crops, livestock, fisheries, food security, and management of natural resources.

The priorities set in the NITI Aayog's seven year National Development Agenda and the medium term Three Year Action Agenda as well as the Union Budget represent the key overarching framework for the agriculture sector. The main objective of the government is to double farmers' income by solving the twin problems of maximising efficiency and ensuring equity in a sustainable manner.

All CPF priority areas identified clearly support smallholders in developing productivity and competitiveness and in improving livelihood and reducing rural poverty for disadvantaged groups. Wherever relevant synergies will be created between the priority areas and the activities being implemented under each priority area.

The five Strategic Objectives through their alignment into Regional Initiatives and Regional Priorities will govern FAO's support, in addition to the GoI's priorities and the priorities and outcomes laid out in the UNSDF.

Priority Area 1. Sustainable and improved agricultural productivity and increased farm incomes

Under this priority area, FAO will facilitate adaptation of Farmers Water School (FWS) in Uttar Pradesh on groundwater management to surface irrigation practices to increase crop productivity and improve water-use efficiency.

FAO will replicate learnings from Andhra Pradesh Farmer Managed Groundwater Systems (APFAMGS) and Groundwater Governance Pilot in AP to scale up in the IFAD funded AP Drought Mitigation Project to strengthen the adaptive capacity and productivity of agriculture in the rain fed areas across the country.

Furthermore, FAO will provide technical assistance to the states of Nagaland and Mizoram for the IFAD funded FOCUS project in Nagaland and Mizoram for implementation support aimed at productivity enhancement through sustainable farming practices.

FAO will also implement the grant project of IFAD in Odisha and Northeastern states for diversification of livelihoods into sustainable forest based agro-enterprises. Through the GEF funded Green Agriculture project, FAO will work on developing farmer capacities for promotion of value chains of low-input alternative crops linked to adoption of sustainable agricultural and natural resources practices. Furthermore, FAO will provide technical guidance to NRLM to establish efficient and effective institutional platforms of the rural poor that enable them to increase household income through sustainable livelihood enhancements.

In addition, FAO will pilot producer prices incentives monitoring and analysis mechanism in six states of the country to improve the evidence basis for agricultural and food policies with a particular focus on smallholder farms. FAO is also conducting a study on improving income of farmers by enhancing and sustain pulses production in the country.

Priority Area 2. Stronger food and nutrition security systems

Under this priority area, FAO's technical assistance will focus on providing technical assistance that drive the "Zero Hunger" initiative of FAO. FAO will collaborate with IFAD and WFP in Odisha for pilot projects that promote nutrition-sensitive agricultural practices and positive nutritional behaviours including hygiene and sanitation practices targeted at tribal populations through low cost technology options.

With NRLM FAO will work on reduction of absolute poverty by supporting initiatives that link with other government programs to improve health and nutrition situations of the marginalised population and break the cycle of poverty and malnutrition especially amongst women and children.

FAO will also focus on capacity building in selected regional and national nutrition training institutions/universities to improve capacities to effectively design, implement and monitor nutrition education for behaviour change with a focus on healthy diets.

Priority Area 3. Effective natural resource management, community development and assistance in transboundary cooperation to global public good

Under this priority area, FAO will implement the GEF funded Green Agriculture project that will provide models for successful landscape approaches to address the interface of biodiversity conservation in and around key protected areas.

FAO will also provide technical assistance to the states of Nagaland and Mizoram for the IFAD funded FOCUS project to assist them in developing smallholder farmers' adaptive capacity to climate change by making jhum cultivation, the predominant mode of production in the two states more sustainable and gender inclusive.

FAO is also providing technical assistance for pilot projects for strengthening Agriculture and Allied Sector Contributions to India's National Biodiversity Action Plan (NBAP), 2008 and the National Biodiversity Targets (NBT). Furthermore, under the regional BOBLME project FAO will promote enhanced sustainable livelihoods and diversification for selected coastal communities.

FAO will provide technical assistance for sustained advocacy on combating anti-microbial resistance and implementation of the National Action Plan for AMR that has been submitted by the government to the World Health Assembly of WHO and FAO. FAO will also promote innovative pilot projects on biomass based energy generation for better utilisation of farm based assets and agricultural products.

Priority Area 4. Enhanced social inclusion, improved skills and employment opportunity in the agriculture sector

Under this priority, FAO will focus on the building capacities and skills of the poor for gainful and sustainable livelihoods through employment generating agribusiness and enterprise clusters and other projects that are being supported under the DAY-NRLM and on grazing-based livestock production that is crucial to the livelihood security of the landless and the socially marginalised.

FAO will provide assistance and build capacity to strengthen agro ecological systems and farmer field school approaches that are currently being practised in various parts of the country with the objective of supporting employment generating agribusiness and enterprise clusters.

FAO will also help in highlighting and generating evidence on the importance of small ruminants and backyard poultry in enhancing overall returns from agriculture and making dryland and highland farming systems more climate resilient and thereby reducing the vulnerability of small and marginal farmers.

LIFE EXPECTANCY AND DEMAND FOR AGRICULTURAL PRODUCTS:

Moreover, the life expectancy in India has climbed to 69.73%

The current life expectancy for India in 2020 is **69.73 years**, a 0.33% increase from 2019. The life expectancy for India in 2019 was **69.50 years**, a 0.33% increase from 2018. The life expectancy for India in 2018 was **69.27 years**, a 0.43% increase from 2017. The same life expectancy in 2011 was 65.50% as compared to 42.30% in 1960. This has lead to excess demand of Food intake and would also cause food crisis in near future if the agriculture production cannot be increased substantially.

It has been noticed in recent years that the cost of labour is increasing due to increase in minimum wages for labour in villages. Agricultural sector has become total mess in some parts of the Country because of absence of the required Bills and enactments and uniform policies.

It is pertinent to note that this year 54 million Americans don't have enough food to eat as per American survey.

Management Accounting plays an important strategic tool for Contract Farming. This is due to India moving from sustenance Farming to Commercial farming and from traditional distribution channels to organised corporate retailing. Therefore, the importance of Contract farming is increasing day by day. For Example Reliance Fresh, Raitha Bazaars, Farmers markets, APMC yards, Agricultural Marketing Federations, Mandis etc.,. Contract farming is a Business Process. The Poultry farming, Producing the Commercial Crops like Vegetables, Pulses, food grains, Jaggery, Sugar, Cotton, Jute, Coconut Farming, Fruits farming, etc., in a small scale to big scale.

FARM BILL 2020:

The Government of India has introduced Farm Bill 2020 to protect the Farmers in India. They are as follows:

1. The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm services Bill 2020.
2. The Farming Produce Trade and Commerce (Promotion and Facilitation) Bill,2020 and
3. The Essential Commodities (Amendment) Bill,2020.

The First Bill protects the farmers through legal agreements between a farmer and business owner which includes the Terms and Conditions for the production of farm products and deliverables.

The second Bill provides facilities for farmers to trade their products not only through Mandis and APMC yards at Government fixed rates but can trade their products any where in the States out side Mandis to Big corporates and Companies with a freedom to sell at good price. This is one way good to the government not to control the prices and Government wants to get out of the Agricultural Business and it is a free market without any Government control. But one dis advantage may be facing ups and downs of the free market. The Government withdraw all subsidies and supports and allows the farmers to freely sell their products based on market conditions.

The third Bill deals Essential Commodities. The advantage of this bill is the government can delist the Essential Commodities whenever there is a situation of artificial demands of the wholesale traders. The Government can have powers to include and exclude the list of Commodities as essential. The Government can exercise regulatory controls during the raising conditions, famine, floods, drought situations including natural calamities. The Central Government will control the prices of essential Commodities from time to time.

ROLE OF COST AND MANAGEMENT ACCOUNTANTS IN AGRICULTURE

The Application of Strategic Cost Management Accounting Tools , Techniques and Applications, methods of Costing and Marginal Costing Techniques like Standard Costing, Budgeting, Activity based Costing, etc., can be used for better productivity and yields in Agriculture. Cost and Management Accountants role is very important for ascertainment of Cost of Production and Profitability for each and every agricultural Products. The services of Professionals are very much important for Agriculture and allied Industries Sector. The collection of Costs, analysis of costs, grouping of costs and its allocation, apportionment and absorption of Costs are very important for ascertainment of cost of each product in a more scientific way. Adoption of agricultural Accounting system is very important for all types of agro based industries and the manufacturing companies depending on Agriculture as their main raw Materials. All accounting Standards and International accounting Standards will be applicable and these standards can be used for proper accounting and reporting. Capacity Building and Integrated Reporting, Sustainability reporting, are very important for Multinational Companies

and also all industries in India. Compulsory maintenance of Cost records and Mandatory Cost Audits will help the industries for their growth and also Economic Growth of the Nation.

The Cost and Management Accountants can provide their Services to the Agriculture and allied Industries Sector in the following Areas:

1. Sourcing of Agriculture land, Construction of Farm Buildings required by the farmers, Nursery growing, preparation of project Reports for Agriculture and sericulture, Poultry Farms, Tea and Coffee Estates to avail Banking facilities.
2. Preparation of Project Report for irrigational facilities for farmers, digging of Borewells,
3. Preparation of Project reports for Contract farming, Commercial Crops, Food Grains, Sandalwood Trees, Coconut Trees, Palm Trees as required by the assisting Companies and Agencies, Local Panchayat Board Authorities, State and Central Governments etc.,
4. Costing Reports for Fisheries, Fish Farming, Cows and livestocks, Goats, Sheep growing, Commercial Trees, Sandalwood, Teak wood Farms, Mango Groves, growing of all varieties of Fruits trees, etc.,
5. Leafy vegetables, and vegetable growings,
6. Increasing the Productivity in agriculture per unit of land,
7. Minimising the input costs,
8. Cost reduction and cost control techniques,
9. Suggesting group Farming,
10. Subsidy management and government grants,
11. Research and development Cost Analysis,
12. Ascertainment of Transportation and distribution Costs,
13. Resource Mobilisation,
14. Identification and suggesting of loans for crops,
15. Fixation of Selling Prices,
16. Market strategy building,
17. Supply Chain Management and Decision making Analysis.
18. Assisting in Contract Farming between Industries and Farmers.
19. Suggesting the Cost Volume Profit Analysis, Breakeven Analysis,
20. Marginal Costing Techniques.
21. Acquiring the machines for modern farming -Cost benefit Analysis if any.

CONCLUSION:

Agriculture is the most important Sector in the Indian Economy. The Country has to be self sufficient in agricultural Production and distribution among the population. The growth of the population depends on the growth of the Agriculture. The State and Central Government should encourage the Farmers by classifying the large, medium and small farmers. The following suggestions will improve the Agriculture Sector and also help to the growth of the Indian Economy:

1. The imports of food grains shall be reduced by increasing indigenous production.
2. Focus on increase in productivity and concentrate on reduction of the costs.
3. To reduce harvest loss and increase Storage facilities including cold storage facilities.
4. The per capita availability of pulses shall be increased to have good nutrition benefits as suggested by the Indian Medical Research Institute.
5. The suggestions of the Indian Agricultural Research Institute shall be timely implemented.
6. Focus on Research and Development Activities in all the District Head Quarters to benefit all Taluks and Villages,
7. Focus on irrigational Facilities to Farmers so that there shall not be crop failure.
8. Insurance facilities shall be provided to all farmers for crop insurance at a nominal rates.
9. Proper and timely supply of manures and pesticides to farmers through Co-operative Societies on Credit basis.
10. Agricultural Seeds shall be supplied to Farmers at Government rates to improve the quality of farming.
11. Liberalised Government Policies to farmers for growing different crops, Exports, Taxes, Subsidies, Grants, Supply of Seeds and other inputs at Government controlled rates.
12. Provide the agricultural loan facilities to increase the Agricultural Production.
13. To encourage the Export of Dry Fruits and Spices through providing incentives for such exports.
14. Engage the Cost Accounts Professionals in all Agriculture and Allied Industries to enhance the growth activities for the Welfare of the population and for growth of the Indian Economy.

ABC ALSO STANDS FOR AGRICULTURE, BRICKS AND COWS

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Backdrop

Is Agriculture a Business or a Profession or an Occupation? The present mood of the nation is under big dilemma about the prosperity of Farmer. What can be solution? As evidenced in many out of Box strategies – the apt solution triggered by 10th class qualified and as CMA I am fortunate to participate in this mission and here is the experience that is been unfolded – which can be conferred the tittle of Sustainable Model with the welfare of the Farmer and at the same time ensuring the Triple Bottom Line.

Attention Received

One of my childhood-school friends called me one day in early 2019 and shared his idea of integrating **A**gri-farming with **B**ricks-making with **C**ow-farming **(ABC)**. Having stayed in a village for years and seen these ABC activities very closely, he can be good resource for operations management. But his question to me was how to execute the same in terms of investment and supply chain. Though my friend is not a qualified CMA, he is a thoughtful CMA, came to with a ball-park figure of Rs.40 Lakhs investment for the entire project. This consists of land scalping, bore-well, cow sheds, two brick making machines, 30 cows and many more accessories. He approached me with his idea, as he knows that I am a qualified CMA with silver jubilee years of industry experience.

In Action

I was fascinated towards his thoughts, in a week's time me and another youth-hood friend (also a qualified CMA) travelled to a tiny village in Odisha on the north-east boundaries of Andhra Pradesh, 200 kilometers off-Visakhapatnam. Me, and my qualified CMA friend told my child-hood friend that, your ABC idea is excellent and we both being CMAs studied lot of ABCs (ABC analysis in inventory management and Activity Based Costing etc.,) can support you. Adding further, I told my childhood friend that Union Budget 2020 envisaged doubling of milk processing capacity by 2025. We both CMA friends explained to my child-hood friend a bit about our ABCs like the way our teachers taught ABC in elementary school (three of us are real government school students)!! We assured him that we both CMAs can convert his ideas into action. Simultaneously, we must also make the project sustainable in terms *triple-bottom-line* (People, Profit and Planet). We both qualified CMAs came back to Visakhapatnam (a city nestled between Eastern Ghats and the Bay of Bengal popularly called as *city of destiny* in this part of the world) where we stay. On our way back we were brainstorming each other, taxing our brains, by currently crunching numbers and local made chips. We too became nostalgic by memorizing our CMA days, chewing on all that we learnt viz., ABCs, ROI IRR, Fixed Costs, Variable Costs, BEP, Margin of Safety etc., to implement the same in the New ABC project.

Empirical Aspects

We need data and an excel spreadsheet to crunch the data as we are living in the data-driven culture. So, we CMAs told my child-hood friend who lives in small-town neighboring the tiny-village on shorelines of river Vamsadhara, to do some conjoint analysis (it is a popular method of market research to price a product with a

pinch of statistics) to fix price for our products i.e., cow-milk and bricks. Cow milk, if sold to local dairy milk processing units it may yield Rs.25 to 30 per liter depending on the horoscope given by the lactometer and the distance from the milk-processing unit. However, our idea is to sell directly to the end-consumers (households) and if so, the yield per liter may be doubled. Again, being CMAs, we are much worried about Yield Management and the top-line, Return on Investment etc.,

Approach to Project

Now, we turned table to factors of production Land, Labor, Capital, and Organization. Being a tiny-village land is abundant and available on reasonable lease rental. 11 acres of land was identified and taken on lease with a minimum annual rental! Being surrounded by hamlets, ample labor resources available. Capital, yes, there are various ways and means, but we decided to contribute up to 30% as equity and remaining to be a debt from NABARD or any other commercial bank wherein we can avail subsidy of 25%. With our 30% we could complete majority of basic infrastructure by February 2020. We were ready to approach a bank, but it was halted by COVID-19 pandemic. Finally, the last factors of production i.e., organization, three like-minded friends; one my childhood thoughtful CMA friend who finally passed 10^{th} class with 30 years of experience in agriculture, two qualified CMAs with each silver jubilee years of experience. The project kick-started finally in mid-September 2020 as a new normal.

Ground Zero Planning

The thought process of the project is designed in such a way that, out of the 11 acres of land, 4 acres earmarked for paddy, one acre for making bricks and remaining 6 acres for dairy-farm accommodating up to 30 plus cows in 4 to 5 batches. The dry grass generated from the agricultural activity shall be used to feed the cows, husk generated from milling paddy shall be used to make and burn clay bricks. There is enough clay and shale deposit around the hamlets which can cater the requirement of raw material for making clay bricks. While, cost of land and labor are not too expensive, obviously cost of production is very low when compared to urban or semi-urban areas. Our plan is also to re-skill the labor to cater the requirement of agriculture and to deploy on bricks making during crop holiday.

Let me now reveal the results of conjoint analysis, when my friend approached the households in that small town, they are ready to buy pure cow milk at Rs.50 per liter. The reason being, if they by fresh milk directly from the dairy-farm, it is fresh without preservatives and yields almost one kilogram of ghee as a by-product from 30 liters of boiled milk i.e., one liter per day consumption of an average family. The price of pure cow ghee if purchased from market is anywhere between Rs.1,200 and 1,500 per KG depending on the brand. If they use processed or toned milk (packet milk) the ghee yield is not more than 30 to 40% of fresh milk resulting in saving of Rs.600 to 900 (opportunity cost to the consumer) assuming the price of packet milk is also Rs. 50 per liter. In fact, packet milk is 2 to 3 rupees costlier than a liter of fresh milk. Another analogy, given by the end- consumers is fresh cow milk is not only healthy due to non-addition preservatives but also yields more ghee. The elderly residents are also aware of health benefits from cow milk particularly to for infants and growing children. Over a period, the Health Index of the vicinity improves. As a result of conjoint analysis, we decided to go for direct selling which gives better yield to us in terms of price (Rs.50 per liter instead of selling between Rs.25 to Rs.30 per liter to milk-processing units). Cow-farming is ecofriendly and does not result in any kind of pollution. My CMA friend also quoted from somewhere that an analysis by agricultural scientists that we need 100% more food that we produce today, as the fertile land is shrinking, we need to embrace Agri-technology to increase food production by at least 70%.

The Revenue Model

If at any point of time 22 cows give milk at a rate of 12 liters per cow per day and remaining 8 cows being non-milking cows. By absorbing, variable cost per day of non-milking by milking cows, the variable cost per milking cow per day is Rs.300. Thus, contribution per milking cow works out to Rs.150 per day. Other fixed costs including be close to Rs.100 per cow per day. Net surplus generation of minimum Rupees one Lakh per month.

In case of bricks, the selling price per brick is approximately Rs.5 per piece. Cost of production by absorbing 10% loss due to breakage and handling is Rs.3 per piece. Transportation and handling at Rs.1 per prick. On a sale of 15 trucks (10,000 bricks per truck) a month generates surplus of Rs.1.50 Lakhs per month.

Apart from the above two revenue streams, sale of paddy, fruits, calves, cow-dung, cow-urine generates an average revenue of Rs.40,000 per month.

Going Forward

We are also dreaming up various enhancements in the second phase of our project such as deployment of Internet of Things to improve mild-yield, quality of bricks, seed balancing etc., In the third phase, setting-up of biogas (gobar-gas) gas plant, installation of solar heaters to provide boiled water to cows to make them fit.

Solar panels lighting, Closed Circuit Cameras for 24 hours surveillance. Finally, leaving no stone un-thrown, trying to enter a marketing tie-up to sell cow urine as we see some additional revenue potential, simultaneously contributing to Swachh Bharat. Since these three activities (Agriculture, Bricks and Cow-farming) complement each other, better *profitability* can be achieved, re-skilling the labor takes care of continuous employment of *people* and finally recycling of paddy husk, agriculture waste used in bricks brings in ecological balance protecting *planet.*

The Grand Finale

Our mission is to ensure sustainable farming, with a vision of becoming one of the best sustainable farms by 2025. Thereby, triple-bottom-line is achieved by this project, we can take-off from the routine and spend our vacation in the farm to improve our happiness-index in turn contributing to better Human Development of our country. This is a true transformation of DNA of CMA as EMA (Cost and Management Accountant as Environmental Management Accountant)!!! –

CMA AS A CATALYST FOR AUGMENTING FARMER'S INCOME

CMA Lt. Dhananjay Kumar Vatsyayan (Ret.)
Partner KDAM & Associates, D K Vatsyayan & Associates
Practicing Cost Accountant & Chartered Engineer

A. CMA

Cost accounting determines the costs of segment, products, projects and processes. CMA primarily aims to improve the profitability of business entity by identifying, managing and controlling non-value-added expenses. Thus, it helps to identify, where is it earning and where is it losing money? Most often it is an integral part of budget planning process. Cost and management accountants extract data and provide analysis & reports that can be applied in decisions making process. This analysis & reports will lead to long term profits and growth.

Since independence of India, growth and profitability in the agriculture sector is not in line with industrial sector and service sector. Its contribution in GDP is shrinking (% wise) in spite of good growth in dairy sector. Therefore, expertise of CMA must be utilised to evaluate proper remedies and solution.

CMA professional can be a catalyst in improving the conditions of farmer, through analyzing the agriculture data in a scientific manner and providing best options to farmers. CMA can corelate the Agri data in finance term depending upon availability of critical resources (Land, water, labor) and find an optimum solution based on soil condition, weather condition and various economic factor.

B. Farmer

"Farmers are the one, who know the art and science of cultivation. He may and may not own the land but takes risk and enjoy the reward of cultivation and his livelihood are mostly dependent on cultivation."

"A person owning at least one piece of agricultural land on his name or his parents name are categories as Farmers in Indian Govt. records". They learn the art & science of cultivation from fore fathers and pass it on to new generations. They generally follow traditional method evolved through generations. The new technology and professional management are missing in this sector.

Farmers in modern India, is not known for his wealth and independence but known for his pitiable survival in the society. The economic condition of farmers, who are major chunk of Indian society, are depleting fast. The news of farmers suicides is quite common in Indian Media. The Govt. announce many schemes and grants in favor of farmers, but all in vain.

The situation disturbs our thoughts process as citizen of this country. Is it a natural problem or man-made problem? How is the best profession of ancient time, facing worst condition and losing its charm? Educated new generations are not keen to continue this profession. There are many horrible stories circulates around about poor humble farmer of small village. Is any solution to this problem?

C. AGRICULTURE

Agriculture in its broader sense using natural resources to produce commodities, which are required for maintaining human life. It includes food, fiber, forest products, horticultural crops, and related services. It mainly consists of cultivation, horticulture, animal husbandry, fishery and forestry

Agriculture is one of the oldest professions of human kind on this planet earth. Its origin is dated back to more than 15,000 years. Where, it is traced as first step towards modern civilization. It is an art and science of cultivating plants and livestock. More than 80% of population were dependent on agriculture in old society.

With Industrial revolution and implementation of modern agriculture technique the mass is shifting from agriculture to industry & service sector. Country like India, 50 % population are still dependent on agriculture, whereas less than 5% population are dependent on agriculture in developed economy

Fig 1 - Farmer making the sari (Kyari) after ploughing

Let us first discuss the farming methods, stages of cultivation, various issue of farmers, the farm yield and return on investment.

D. **Farming Methods practiced in India**–
Various agriculture methods are being adopted in India, which has evolved based on change in climatic condition, weather, social-cultural practice and technological innovation. However, it can be broadly classified under five categories.

a) Primitive farming – More popular in areas having less population and plenty of forest around. It is also called slash and burn method. Once crop has grown and it is harvested, farmer burn the land and move to different patch of clear land. The burnt and abandon land regain its fertility in due course of time naturally.

b) Subsistence Farming – It is generally being practiced by marginal farmer having small area of land. Majority of Indian farmers fall under this category, who use the output mainly for their own consumption. They use indigenous tools like a hoe, Dao, digging sticks, etc. This is the most natural and cheap method. Here, the growth of crop is dependent on rain, soil fertility and other environmental

condition. The use of chemical fertilizer, artificial irrigation, pesticide etc. are bare minimum. The yield per hectare is moderate and fertility of land remain intact.

c) Intensive Subsistence Farming – It is being done on commercial basis by rich farmers having adequate size of land. They use modern agriculture equipment, scientifically developed seeds, fertilizers, pesticide and proper irrigation. They generate surplus produce for commercial application. This type of farming contributes to the economy of the country with higher yield.

d) Commercial Farming – Major crops grown commercially in India are wheat, pulses, millets, maize and other grains, vegetables, and fruits. It is being practice in Punjab, Haryana and West Bengal. The select the crop best suited to the respective weather & soil condition. It is being managed like an industry with input from various expert and usage of modern equipment.

e) Plantation Farming – It is a mix of agriculture and industry. It is practiced across big piece of land and uses latest technology for cultivating, yielding and sustaining. The produce cultivated is used as raw material to respective Industries. The main crop grown are tea, coffee, rubber, banana, coconuts, sugarcane etc.

E. Stages of Cultivation

Cultivation is one of oldest profession of human kind. It is labour intensive and require ample water at various stage of cultivation. The important activities of cultivation are as under.

1. Land / Soil preparation
2. Sowing
3. Hoeing
4. Weeding
5. Irrigating
6. Fertilizer and Pesticide application
7. Harvesting
8. Handling of Parley
9. Transport of crop
10. Storage of crop

F. Important issues of Farmers

a) **Irrigation** - Less than 40% of land is covered under irrigation system (Canal, well or Bore well) and more than 60% of land is not having proper irrigation system. So, 60 % farmers gamble with nature every year. Drought & flood are a common phenomenon for them. If monsoon fails in two consecutive years, it is a most horrible situation for a farmer to face.

The level of ground water is depleting very fast, because on one hand excessive exploitation of ground water and other hand it is not being charged adequately during the rainy season. Water bodies like ponds, lake etc. are not being preserved well and water body land are being reclaimed by people and used for different purposes.

b) **Information & Awareness** – The farmers are generally not aware of best suited crop, soil condition, best seeds, the fertilizers and pesticides to be used. The quantity and periodicity of water, fertilizers and pesticide to be applied is a far cry for majority of farmers.

Farmer generally consult the fertilizer/ pesticides seller, who is not a qualified and knowledgeable person. Based on some trend and past experience, he advices the farmers about dose and name of costly fertilizer/ pesticides to be used. Farmers apply each and every possible fertilizer / pesticide as suggested by him, which increases the input cost at one hand and they don't achieve the optimum yield from the land on the other hand.

CMA supported by agriculture expert can provide useful and calculated data to farmers, which can help them to maximize their yield and profitability.

c) **Govt Schemes** - The various schemes & initiative launched by Govt. should win the confidence of farmers. Some good scheme worth mentioning are as under.

1. **Soil health card** - Soil health card is excellent government initiative for the farmers to know which nutrient is missing in his field. So that he applies only that specific nutrient fulfilling the soil requirement.

2. **Crop Insurance** - Crop insurance will help farmers to negotiate natural calamity in a better way. Its present penetration is only around 15%.

3. **Drip irrigation** – Drip irrigation help to reduce water consumption, labor requirement, fertilizer etc. and maximize the yield of land. The initial cost of drip irrigation is high in spite of govt. subsidy, which discourages the farmers.

4. **Govt Institution** –
    a. KVK – Krishi Vigyan Kendra (KVK) were established to support farmers to adopt new techniques of agriculture. Govt established 650 centers all over India. However there ground work in not up to the mark.
    b. ICAR - Indian Council of Agriculture Research needs more fund to undertake effective Research.
    c. Agriculture University – Govt has established first agriculture university in 1950, which followed by establishing many agriculture college and university. However, real benefit of university and college are not yet felt on ground. Farmers residing in same locality are also not benefited. It needs to be looked upon.

d) **Land holding** – Average land holding falls around 2.9 acre per family, which is again scattered at various location. In this situation, it is not feasible to apply modern agriculture equipment. Small and medium farmers are not able to afford costly seeds, fertilizers and pesticide. Thus, the yield per acre drops substantially and subsequently the income of farmers.

e) **Natural calamities** – Natural calamities like storm, cold wave, Locust attack, drought etc. effect the agriculture sector heavily. Some areas also affected by attack of wild animals. As the forest are shrinking, wild animals attack the crop and destroy the same.

Crop insurance is being tried as solution to this problem, but it is taking time to settle and win the confidence of farmers.

f) **Infrastructure** – Infrastructure like market accessibility, storage space etc. are underdeveloped in India. The connectivity of village from city has improved substantially in recently. However, field like soil testing lab, cold storage etc. needs to be strengthened further in order to help farmers.

g) **Product Pricing** – The Price of agriculture product are decided by the principal of demand and supply. It is not based on cost plus method. It is observed that only 20% to 35% price paid by a consumer reaches to farmers. Like vegetables are sold @ Rs 50 per Kg, the price received by farmers will be @ Rs 10 per Kg to @ Rs 15 per Kg. Rest money is being sucked by market system.

CMA can play a major role to increase the farmer's share and reduce the share of market system. Govt. intervention with support of CMA in regulating the market system may help the farmers.

h) **Social Customs** – Indian society spends a lot on social celebration like daughter marriage, ritual after death etc., In order to maintain the social status, farmers fall in trap of money lenders and loose the economic freedom. A social reform along with adequate financial structuring needs to be undertaken by society leaders. CMA can help in the process of financial structuring.

i) **Cash-Crop Trap** - The cash crop (Onion, Potato, Green Vegetables, Sugarcane etc.) yield higher returns than conventional crop (Wheat, Rice, Maize, Pulses etc.). The input cost (Seed, fertilizer, pesticide, irrigation cost etc.) of cash crop are higher than conventional crop. In case of natural calamities or price crash of product (Because supply is higher than demand), farmers are adversely affected.

The financial institution along with CMA can play a major role with Govt. support in regulating this situation and safeguarding the farmers against exploiter like money lender.

j) **Poverty elimination Schemes** – Govt. has introduced many schemes like MANERGA, Subsidized food grain (Rs 2 per Kg) to poor etc. with view to eliminate poverty. These schemes are providing easy money and life support to poor, which is demotivating labors to work in agriculture field, because agriculture work is hard and tough. Farmers are facing acute shortage of labor force.

Linking of MANERGA scheme with agriculture work will serve both purpose of poverty elimination and availability of labors for agriculture work.

k) **Labor Migration** – The Industry, service sector etc. are able to pay higher wages to labors and agriculture sector is not able to match the labor remuneration. So, labors are migrating to city and abandoning rural areas. It is creating infrastructure problem in cities on one hand and farmers are not able to find labors for agriculture work on other hand.

Starting of Agri-based industries in rural areas will employ the labor locally. It will help the farmers and labors as well. CMA can play major role in evaluating various socio-economic projects as viable solution to this problem.

l) **Social Stigma** - It is general perception in society that educated person should work in Industry or service sector and agriculture sector is only for uneducated class. Working in Agriculture sector is beyond the dignity of educated class. This false prides & stigma is discouraging even farmers to work in their own field, if they are educated. The unemployed educated sons of farmers are spending time in discussing politics, filmi chats, TV serials, mobile networking etc. and not supporting their parents in agriculture work.

This stigma needs to be tackled socially. The involvement of qualified professionals like CMA will help to break the barriers of social stigma.

m) **Multi crop** – Different crops are having different gestion period. In order to take advantage this gestion period some farmers are seeding multi crop at a time. Crops of lesser gestion period are harvested first and allow the crop of longer gestion period to grow.

For example, sugarcane plants are planted as per sugarcane requirement. potato / onion is also seeded in the empty space left over. By the time sugarcane reaches the growth phase, the potatoes / onions are harvested. Thus, it increases the utilization of land and improve yield per hectare along with cash flow. It is being practiced by few farmers, which needs to be adopted by majority.

n) **Integrated Farming** - Farmers should undertake various activity along with cultivation like animal husbandry, fishery, vermis composting, horticulture, bamboo / tree plantation on boundary etc. Proper calculation by professional like CMA about yield and return on investment can help farmers to increase their income.

G. Indian Crop

Major crops in India are grouped based on seeding season and thus it is groped in three categories as (1) Kaharif (2) Ravi and (3) Zaid. The Ravi and Kharif are derived from Arabic language indicating the season.

a) Kharif – Meaning Autumn or rainy season, it starts from Jun- July and ends in Sep – Oct. Farmers saw the crop in the month of Jun – July, start of rainy season and harvest the crop in Sep- Oct, end of rainy season. The crop generally irrigated with natural rain and it is expected that there will be no requirement to supplement the irrigation. However, the Kharif crops are subject to natural calamities like flood & drought every alternate year. The major crop falls under this category are Maize, Rice, Bajra, Soybean, Cotton, Groundnut etc.

Fig 2 – Paddy field – 2 weeks after sowing

b) Ravi – Meaning Spring season. It starts from Sep-Oct and ends in Feb – March. Farmers saw the seed, when the soil is humid at the end of rainy seasons. The crop germinates with natural humidity of soil. However, it requires irrigation because there is hardly any rain during this season. There are some crops which does not require irrigation, but yield of these crops are very low. The major crops fall under this category are Wheat, Barley, Mustard, Green peas, Sunflower, Major Pulses, Potato, Onion etc.

c) Zaid Crop – There is gap between Ravi crop and Kharif crop i.e. Mar to Jun. This crop is cultivated in the gap between two main crop seasons. The crop increases the yield of land and income of farmers. Since there is hardly any rain during this period, it is mostly dependent on irrigation. So, this crop is cultivated on irrigated land only. The main crop falls in this category is green vegetables.

H. **Resource required for various type of crop** –

The resource required for various crop will vary depends on location, rainfall and various other factors. Return per unit of resources is a crucial factor where CMA can play a major role. Optimizing the gain will benefit the farmers ultimately.

Sr.	Crop	Unit	Water (Lit)
1	Rice	Per Kilo	3000-5000
2	Cotton	Per Kilo	22,500
3	Sugarcane	Per Kilo	1500-3000
4	Soya	Per Kilo	900
5	Wheat	Per Kilo	900
6	Sugarbeat	Per Kilo	550-750

Table 1 - Water requirement per Kilo of harvest.

The water requirement, recovery and crop duration will vary based on type and sowing period of sugar cane. A typical data provided for reference. CMA can make use of such data in calculating optimum crop mix to maximize the farmer's income.

Crop Type - Water required, Crop duration and Crop Recovery

Sr.	Type	Water Required Lac Litre/ Hec	Recovery %	Agriculture Duration (Month)
1	Adsali	243.75	12.30	17.00
2	Pre seasonal	206.25	12.00	14.50
3	Suru	168.75	11.85	12.00
4	Ratoon	168.75	10.50	11.00

Table 2 - Typical Sugar cane cultivation data

I. Economics of Sugar Cane cultivation and multi crop cultivation –

A typical calculation based on data collected from a framer of Solapur district of Maharashtra is indicated here for reference. When only sugar cane is cultivated as single crop, the income per acre per annum is Rs 20,000/- to 25,000/-. When the sugar cane is cultivated along with onion the income per acre per annum goes to Rs 60,000/- to 65,000/-. (Increase of 2.5 to 3 times). When sugar cane is cultivated with maize the income per care per annum is Rs 36,000/- to Rs 41,000/-.

Such calculation by CMA will certainly help the farmer to select the best crop suited to its land holding in terms of various constrains like availability of water, labor and time.

CMA can also support in terms of yield mapping of land. Implementation of farm yield mapping will reduce the farm input cost and double to triple the crop yield. Thus, higher yield with lower input cost will help the farmers to increase its income and ultimately improves the its economic condition. The economic strength of India will grow only after economic condition of farmers will improve because 50% of Indian are related to Agriculture Sector.

Narayan Mohan Neel, At + Po Kondi, Tal - North Solapur						Crop - Durations 12 - 13 Month			
				Per Acres of Land			Final	Khodva/Ratoon	
Sr	Particulars	Specification	Unit	Qty	Rate	Value	Value	Qty	Value
A. Manpower									
1	Ploughing - 1	Tractor	Hrs	3	500	1500	1,500		
2	Fine Ploughing -2	Tractor	Hrs	2	500	1000	1,000		
3	Sari - Kyari Making	Tractor	Hrs	3	500	1500	1,500		
1a	Ploughing - 1	Plough & Bull	Days	3	1500	4500			
1b	Fine Ploughing -2	Plough & Bull	Days	1	1500	1500			
1c	Sari - Kyari Making	Plough & Bull	Days	1	1500	1500			
2	Showing - Lagwat	Manual	Days	10	500	5000	5,000		
3	Weeding - 1	Female	Days	24	200	4800	4,800	24	4,800
4	Weeding -2	Female	Days	24	200	4800	4,800	24	4,800
5	Sari - Kyari	Tractor	Hrs	3	500	1500	1,500	3	1,500
6	Sari - Kyari	Tractor	Hrs	3	500	1500	1,500	3	1,500
7	Irrigation - Once in 15	Male	Days	36	350	12600	12,600	36	12,600
8	Fertiliser Application	Male	Days	3	350	1050	1,050	3	1,050
9	Pesticide - 1	Male	Days	2	300	600	600	2	600
10	Pesticide - 2	Male	Days	2	300	600	600	2	600
B. Land & Seed									
1	Land Rental		Acre	1	10000	10000	10,000	1	10,000
2	Bene - Seed		Ton	2	4000	8000	8,000		
C. Fertilizer									
1	Urea	Start	Bag	2	400	800	800	2	800
2	Potash	Start	Bag	2	600	1200	1,200	2	1,200
3	Single Super Phosphat	Start	Bag	2	600	1200	1,200	2	1,200
4	Urea	45 days	Bag	2	400	800	800	2	800
5	Potash	45 days	Bag	2	600	1200	1,200	2	1,200
6	Single Super Phosphat	45 days	Bag	2	600	1200	1,200	2	1,200
7	Urea	90 days	Bag	2	400	800	800	2	800
8	Potash	90 days	Bag	2	600	1200	1,200	2	1,200
9	Single Super Phosphat	90 days	Bag	2	600	1200	1,200	2	1,200
10	DAP	Mixed	Bag	1	1500	1500	1,500	2	3,000
D. Pesticide									
1	Spray 1		Barel	2	1000	2000	2,000	2	2,000
2	Spray 2		Barel	2	1000	2000	2,000	2	2,000

Sr	Particulars	Specification	Unit	Per Acres of Land			Final	Khodva/Ratoon	
				Qty	Rate	Value	Value	Qty	Value
E. Irrigation									
1	Water		Season	3	2500	7500	2,500	3	2,500
2	Electricity -		HP	5	200	1000	1,000	5	1,000
3	Diesel		Hrs	48	60	2880			
	Harvesting		MT	45	250	11250	11,250	40	10,000
	Total Cost		**Rs**	**45**	**1873.3**	**84300**	**84,300**		**67,550**
	Yield & Sale Proceed		MT	45	2300	103500	1,03,500	40	92,000
	Profit Product 1		**Rs**				**19,200**		**24,450**
Onion									
	Seed		Kg	2	1000	2000	2,000	2	2,000
ManPower									
1	Land Prepration	Person	Days	1	350	350	350	1	350
2	Irrigation	Person	Days	2	350	700	700	2	700
3	Re-planting	Person	Days	2	300	600	600	2	600
4	Land Prepration	Person	Days	20	300	6000	6,000	20	6,000
5	Fertilizer / Pesticide						-		
	Total Cost						9,650		9,650
	Yield & Sales		**Kg**	**5000**	**10**	**50000**	**50,000**		**50,000**
	Profit Crop 2A						**40,350**		**40,350**
	Total Profit With Onion						**59,550**		**64,800**
Maze									
1	Seed		Kg	25	25	625	625		625
2	Seeding	Person	Days	4	300	1200	1,200		1,200
3	Harvesting		Days	4	350	1400	1,400		1,400
4	Other		Days	4	300	1200	1,200		1,200
5	Crushing		Bag	13	50	650	650		650
	Total Cost						**5,075**		**5,075**
1	Yield		Kg	1300	15	19500	19,500		19,500
2	Animal Feed - Parely						2,000		2,000
	Profit Crop 2B						**16,425**		**16,425**
	Total Profit With Maze		**Rs**				**35,625**		**40,875**

Table 3 – Typical calculation of cost, yield and return in multi crop and sugar cane cultivation.

The typical capability of CMA in churning of data and extracting useful information will work as catalyst in augmenting farmer's income.

METHODOLOGY FOR COSTING IRRIGATION WELLS IN INDIA

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Green revolution in India while on the one hand resulted in increased food production, but the benefit was at the cost of groundwater overexploitation. The policy makers brought several schemes such as Million wells scheme during 1988-89 as a subscheme of NREP and RLEGP, and became an independent scheme from 1996. The intention was to encourage constructing wells free of cost to poor, small and marginal farmers belonging to Scheduled Castes/Scheduled Tribes and freed bonded labourers. It is interesting to note that tube wells and borewells were not permitted under the Scheme. On the other hand, if wells were not feasible due to geological factors, funds were provided for irrigation tanks, water harvesting structures and development of land of small and marginal farmers. From 1993, the scheme was extended to small and marginal farmers below poverty line. The farmers would construct of wells with their own labour and local labour and funds were not provided for lift irrigation devices. This lead to construction of about 11 lakh wells in the country. Groundwater was relatively considered a free resource since the open wells constructed provided subsistence water for protective irrigation purposes and electricity for lifting groundwater was provided free of cost since the early 1980s. However, as the intensity of wells increased, and due to faulty construction of wells without proper hydro-geological surveys, depleting groundwater due to over pumping, limited success in rocky and sandy strata and violation of isolation distance between wells, groundwater depletion showed early signs.

Groundwater depletion

As farmers realized the benefits of well irrigation, with increased pumping, due to installation of irrigation pump sets supported by provision of electricity at zero cost, as also cultivation of water intensive crops, the life and age of open wells / dug wells drastically reduced resulting in largescale failure. By then, due to advent of fast borewell rigs, shallow borewells of 300 to 800 feet became popular with submersible irrigation pump sets which further exacerbated the groundwater over extraction. In many areas of Deccan plateau, at present the groundwater is being extracted from 1500 to 2000 feet depth. That the provision of electricity at zero cost up to 10 HP pump set, did not necessarily mean that groundwater was free, since farmers were now forced to drill additional bore/tube wells due to initial failure, premature failure of irrigation borewells. With the steps taken by the Government not to lend for groundwater irrigation in overexploited areas, farmers began investing on groundwater drilling and pumping with their own resources. This was responsible for increasing private investment in agriculture which now stands at 75% of the total investment.

Currently, groundwater is getting depleted rapidly. The very fact that micro irrigation (drip / sprinkler) is becoming popular in several areas is the prima facie indicator of increasing cost of groundwater irrigation, as farmers are feeling the brunt of groundwater scarcity. In addition, micro irrigation simultaneously reduces use of water as well as labour. And both are increasingly becoming economically scarce resources.

When the life / age of irrigation wells were long enough, perhaps more than 25 or 50 years or even more than 10 years, the usual method of costing was to treat investment on irrigation wells as a fixed cost and which are accounted through depreciation on wells and equipment. However, with the advent of bore/tube wells in hard rock areas which comprise 65% of the geographical area of India, and with over pumping as well as violation of isolation distance, the rate of well failure began increasing leading to initial failure, premature failure of irrigation borewells.

CACP methodology

The Commission for Agricultural Costs and Prices (CACP), Government of India, in its methodology of costing ground irrigation considers depreciation on (functioning) irrigation well and irrigation pump (IP) for non-specified number of years. However, due to high probability of borewell failure, the investment on irrigation borewells can no longer be considered as fixed cost, as the farmers are forced to investment on additional well/s till they strike groundwater. This involves frequent investment on drilling and casing.

Limitations of CACP methodology in costing irrigation water

The methodology has poor basis for computation of depreciation as it considers only investment on functioning / working wells and ignores huge investments made on failed wells by farmers. Thus, the methodology is devoid of exponential rise in cost of groundwater due to increasing well failure. The depreciation on borewell is only accounted with no mention of the number of years of well life. It is to be noted that each well (like each person) has different life in years. The water volume pumped out is highly fluctuating due to interactive effects of wells influenced by the cone of depression. This is influencing probability of well failure. Thus, that part of the investment on wells (such as drilling, casing) needs to be treated as variable cost and that part of the investment on irrigation pump set, pump house, pipes and accessories needs to be treated as fixed cost. The challenge is to find the 'n' number of years well life for variable cost. Thus, the CACP cost of cultivation and the MSP (Minimum Support Price) methodology grossly discount the cost of groundwater and obviously the cost the of cultivation of groundwater irrigated crops is underestimated.

Why costing of groundwater well is important

Every input used in the production process needs to be valued / priced. For inputs available in the market such as seeds, fertilizers, labour, pesticides, herbicides, as they are paid for, their value is easy to obtain. However, for groundwater resource, as the resource is extracted / pumped by the farmers, and as the electricity to pump the water is free, farmers are made to feel benefitted psychologically. However, the farmers are incurring more than 70 percent of the cost of groundwater themselves and are net subsidizing consumers instead of receiving subsidies. With 65% of geographical area of India being hard rock area with poor recharge (of 5-10% of rainfall), where groundwater irrigation dominates, it is crucial to properly account for cost of groundwater resource.

With the need for proper costing for groundwater irrigation, new types of wells need to be appreciated. The farmers may face (1) wells with initial failure: refer to borewell/s which do/did not yield any groundwater at the time of drilling and thereafter; (2) wells with subsistence life: refer to borewell/s which yielded groundwater the number of years equivalent to the Pay Back Period (PBP). The Payback period refers to the period recovering the total investment on drilling, casing, irrigation pump set, conveyance structure, storage structure, drip / sprinkler structure, recharge structure, electrification charges of borewell, from the annual net returns on the farm. Farmers may also face (3) wells with premature failure: refer to borewell/s which served below subsistence life or the PBP and lastly farmers may face (4) wells with economic life/age of borewell: refer to borewell/s which function or yield groundwater beyond the PBP, which may also be called wells which suffer natural failure.

Electricity subsidy is not a windfall gain for farmers

In Karnataka, farmers using irrigation pump sets (below 10 hp capacity) for groundwater are not charged for electrical power. Government imposed a flat charge of Rs. 300 per hp per year up to 10 hp pump set since April 1997. However, this is not strictly adhered for the reasons of political economy. Obviously, there are no explicit payments towards electricity for pumping groundwater, other than annual operation and maintenance charges of the irrigation pump set and borewell.

Subsidy towards free supply of electricity to 21.06 lakhs Irrigation Pump sets below 10 hp, and 22.90 lakh Bhagya Jyothi / Kurtotic households increased to Rs.5381 crores for 2013-14 from Rs.4722 crores paid for 2012-13. Bulk of this increase is due to increase in the use of electricity by Irrigation Pump sets users from 15318 million KWHs to in 2012-13 to 16679 million KWHs in 2013-14

Farmers still incur cost of groundwater despite free electricity

It is to be appreciated that while farmers are not charged for electricity to pump groundwater for irrigation, they still incur the component of variable cost of drilling wells due to increased probability of well failures. However, the energy cost is the tip of the iceberg as it forms around 25 percent of the cost of groundwater. The major cost of groundwater (about 75%) is borne by farmers; and since the methodology of costing followed by Directorate of Economics and Statistics, Commission for Agricultural Costs and Prices do not properly account for the cost of groundwater and hence groundwater farmers are net subsidizing the cost of groundwater irrigated

crops. This is due to increasing probability of failure of irrigation borewells. Gone are the years when open wells used to yield water for 25 to 50 years or beyond. Also gone are the years when borewells used to yield water for 10 to 25 years or beyond. The situation at present is 'how many wells a farmer has to drill to obtain a successful well'? Thus, groundwater cost has fixed and variable cost components (Table attached). Cost of groundwater varies from Rs. 200 per ha cm to Rs. 500 per ha cm in different agro-climatic zones, exclusive of pumping cost.

The variable cost of irrigation includes cost of drilling and casing of borewell and is amortized for the economic life/subsistence life of irrigation well whichever is relevant. The repair costs are then added. This variable cost is divided across volume of water pumped. The variable cost of groundwater, thus, represents the cost of drilling and casing, since farmers are forced to invest on new borewells due to high probability of initial and premature failures.

The Fixed cost of irrigation: The investment on irrigation pump sets and accessories, conveyance structure, drip irrigation, water storage structure and so on are considered for computing depreciation assuming a field life of around twelve years. Finally, the variable cost and fixed cost each are divided across volume of groundwater used for irrigation. The labour cost of irrigation is considered along with labour costs of other cultural operations.

Variable cost of groundwater

Amortizing the investment on drilling and casing of bore wells over the subsistence life of bore well/s or economic life of bore well/s (whichever is relevant for the specific bore well) PLUS the operation and maintenance costs of the bore well.

The amortized investment is divided by the volume of groundwater extracted to obtain the variable cost of groundwater per acre-inch.

Fixed cost of groundwater

Amortizing the investment on irrigation pump sets, pump house, electrification charges, groundwater storage structure (constructed if any), groundwater delivery pipe investment, drip irrigation and accessory investment for a period of 10 years

The amortized fixed investment is divided by the volume of groundwater extracted in the recent year to obtain the fixed cost of ground- water per hectare centimetre or acre-inch.

The fixed cost of groundwater recharge structure is obtained by amortizing the investment on groundwater recharge over the subsistence or economic life of bore- well, whichever is relevant for the bore well.

Total cost of irrigation

Annual cost of irrigation pertains to each irrigation bore well on the farm and is added across all bore wells on the farm

Total cost of irrigation is then computed for each crop according to the volume of groundwater used in each crop

Cost of irrigation per acre-inch or ha cm = [total annual cost of irrigation]/[volume of water used for the crop] in acre-inches or ha cm of groundwater used.

Amortized Cost of irrigation

Amortized cost of irrigation = (amortized cost of bore well + amortized cost of pump set + amortized cost of conveyance + amortized cost of over ground structure + annual repairs and maintenance costs of pump set and accessories)

Amortized cost of borewell

Amortized cost of BW = (compounded cost of BW) X $[(1+i)^{AL}$ X i / $(1+i)^{AL} - 1)]$
Where AL = average age or life of bore well, i = discount rate considered = 2 %.
Compounded cost of BW = (historical investment on BW) X $(1+i)^{(2018\text{-year of drilling})}$
if 2018 is considered as the latest reference year
Amortized cost of Pump set and Accessories
Amortized cost of P and A = (compounded cost of P and A) X $[(1+i)^{12}$ X i / $(1+i)^{12} - 1]$

(The working life of pump sets and accessories (P and A) is considered to be 12 years as reflected by field data.)
i = discount rate considered at 2 %
Compounded cost of P and A = (historical cost of P and A) X $(1+i)^{(\text{say 2018 – year of installation of P and A})}$

Amortized cost of conveyance structure
Amortized cost of conveyance structure (CS) = (compounded cost of CS) X $[(1+i)^{12} X\ i / (1+i)^{12} – 1]$
The working life of conveyance structures (CS) is also considered to be 12 years.
The usual mode of conveyance of groundwater is through PVC pipe.
i = discount rate considered at 2 %
Compounded cost of CS = (historical cost of CS) X $(1+i)^{(2018 – \text{year of installation of CS})}$

Groundwater Use in Conventional irrigation System
The acre-inches (or hectare centimetre) of groundwater used for each crop in each season (summer, kharif, rabi) in the conventional system of irrigation is calculated as =

[(area irrigated in each crop) × (frequency or number of irrigations per month) × (number of months of crop) × (number of hours for one irrigation for the cropped area in question) × (average yield of bore-well in gallons per hour)]/22,611

This gives the groundwater use for each crop in acre-inches or ha cms

Externality per well
The externality per well = (Amortized investment on drilling and casing of bore- wells over the subsistence life of well/s or economic life of well/s whichever is relevant) / (number of wells which served PBP + serving economic life) − (amortized investment on drilling and casing of bore-wells over the subsistence life of well/s or economic life of well/s whichever is relevant) /all the wells on the farm.

Marginal cost of water = amortized cost per functioning well divided by water used in acre inches.
Opportunity cost = externality per acre inch = Negative externality divided by water used in acre inches
Price per acre inch of water = marginal cost of water plus opportunity cost
Price per acre inch of water
Price per acre inch of water = Marginal cost of water plus opportunity cost
Marginal cost of water = Amortized cost per functioning well divided by water used in acre inches
Opportunity cost = Externality per acre inch = Negative externality divided by water used in acre inches

How Externality is estimated

If A = (Amortized investment on drilling and casing of borewells of initially failed wells and wells which served for PBP) divided by all wells on the farm; B = (Amortized investment on drilling and casing of borewells of initially failed wells and wells which served for PBP) by the number of functioning borewells on the farm, then Externality per borewell = Reciprocal Externality = (B-A). If B = A, no externality exists, thus, externality = 0, as all wells as functioning on the farm. If B >A, negative externality exists. The externality on each groundwater irrigation farm is assumed as equal to the amortized investment per functioning well minus amortized investment per well. If all wells are functioning on the farm, there is no externality. The basis of the hypothesis is that all wells in hard rock areas succumb to cumulative interference among irrigation wells.

Incorporating probability of well success and failure in costing

In addition to the costing of irrigation well, it is also crucial to incorporate the probability of well success and well failure in costing groundwater especially since that determines the frequency of drilling borewells which in turn influences costing of groundwater. It is crucial to explore whether the probability of well success has increased or reduced over time, how does the probability of well success varies with adoption of coping mechanisms to combat the predicament of groundwater irrigation and to examine the influence of incorporation of probability of well success and failures in estimation of investment on irrigation borewell. Estimation of economic investment on irrigation borewell: The estimated total investment to obtain one successful borewell = {(l/p) (p) (cost of successful borewell) + (1-p)/ (p) (cost of failed borewell)}= (cost of successful borewell) + (q)/ (p) (cost of failed borewell).

Results Field studies in the Department of Agricultural Economics, UAS Bangalore have indicated that farmers sharing irrigation water among their siblings, experienced the largest (negative binomial distribution

NBD) probability of obtaining successful borewell of 0.68 (Central Dry Zone of Karnataka - Chitradurga district). However in the Eastren Dry Zone (Kolar, Chikkaballapur districts), the NBD probability of borewell success ranged from 0.27 to 0.32 (Fig 1). Thus, with the low probability of well success, farmers in Eastern Dry

Zone having drip irrigation for narrow spaced crops had to drill three borewells to get one successful well. Similarly, farmers in Central Dry Zone having drip irrigation / recharged borewell had to drill four borewells to get one successful well.

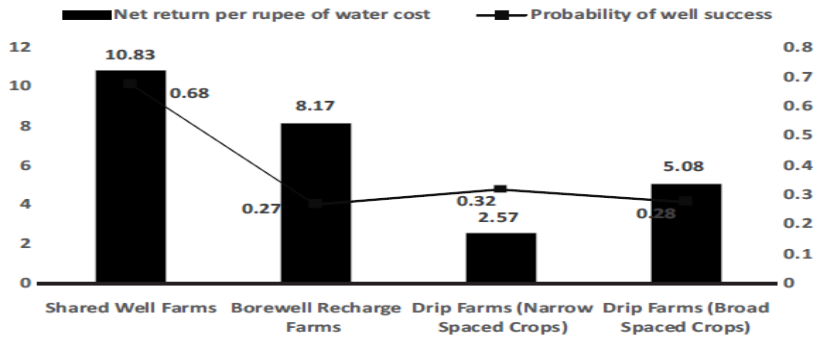

Fig. 1. Economic efficiency and probability of well success on farms with different coping mechanism

The number of wells to be drilled to obtain successful borewell by shared well farmers was just equal to one (Table 1). From the preceding results it could be inferred that the probability of well success on farm in general was modest at 0.30. While the probability of well success observed during 1990's was in the range of 0.55 to 0.66.

Table 1. Estimated Negative binomial probability of obtaining successful borewell in hard rock areas of Karnataka adopting various coping mechanisms

Particulars	Drip farms connected to narrow spaced crops	Drip farms connected to broad spaced crops	Farms with borewell recharged	Farms sharing their well water with relatives
No. of farms with zero borewells drilled before one successful well (= No. of farms with no failures)	6	15	6	21
No. of farms with one borewell drilled before one successful well	7	3	6	5
No. of farms with two borewells drilled before one successful well	6	4	6	3
No. of farms with three borewells and above drilled before one successful well	11	8	12	1
Total no. of farms	30	30	30	30
Total no. of wells on all farms in each category	139 (27.36)	150 (29.53)	159 (31.30)	60 (11.81)
Negative Binominal probability of obtaining one successful well= 1/(1+Mean)	0.32	0.28	0.27	0.68
Mean number of successful borewells per farm	2.06	2.57	2.70	0.47

Note: Values in parenthesis indicate percent to grand total number of wells (508)

Incorporating Probability in costing

The NBD probability of well success and failure/s was incorporated in the estimation of investment on irrigation well by assigning appropriate weights. Accordingly, the proportion of weighted cost of successful well ranged from 27 to 38 per cent for the drip farms connected to narrow spaced crops, broad spaced crops and on borewell recharge farms. The rest of the proportion was accounted for by cost of failed wells which formed 73 to 62 per cent of the total cost of well. The proportion of cost of failed well was the lowest in the case of shared well farms (30%) due to reduced proliferation of irrigation wells. The average depth of borewell was 717 feet in the case of drip farms connected to narrow spaced crops, 342 feet in drip farms connected to broad spaced crops and borewell recharged farms and was 274 feet in shared well farms.

The estimated unit cost by NABARD for this depth worked out to Rs. 96888, Rs. 41162 and Rs. 32656. The percentage deviation in estimated economic investment on irrigation borewell from NABARD's unit cost ranged between -16.57 to -63.54 percent. Hence, the funding agency like NABARD needs to consider the probability of well success and failure while estimating the unit cost of irrigation well in hard rock areas (Table 2). The economic investment on irrigation borewell was Rs. 265806, Rs. 112811, Rs.103581 on farms with broad spaced crops,

borewell recharged farms and shared well farms. Thus, the probability of well success played a crucial role in the overall cost of drilling and casing of irrigation well (Table 2).

Table 2. Estimated cost of borewell incorporating probabilities of well failure and success in hard rock areas

Particulars	Drip farms connected to narrow spaced crops	Drip farms connected to broad spaced crops	Farms with recharged borewell	Farms with shared borewell
Cost of drilling and casing per successful well (Rs)	100207	30519	31180	27459
Cost of drilling and casing per failed well (Rs)	77929	32003	26779	24828
Probability of successful well	0.32	0.28	0.27	0.68
Probability of failed well	0.68	0.72	0.73	0.32
Weighted cost of successful well {(3/3)*(1)}	100207 (37.70)	30519 (27.05)	31180 (30.10)	27459 (70.15)
Weighted cost of failed well {(4/3)*(2)}	165599	82292	72401	11684
Estimated investment on drilling and casing of an irrigation well = (5+6)	265806	112811	103581	39143
Total number of wells to be drilled to obtain one successful well	3.13	3.57	3.7	1.47
Average depth of borewell (ft)	717	342	342	274
NABARD's unit cost of casing and drilling for the average depth of borewell	96888	41162	41162	32656
Deviation in unit cost fixed by NABARD (%)	-63.54	-63.51	-60.26	-16.57

Note: Values in parenthesis indicate percentage of weighted cost of successful well in total investment

The probability of well success has reduced over the years. Improvement in the probability of well success could save 70 per cent of the investment on drilling and casing of borewells. The NABARD's current procedure of providing unit cost of borewell is lower by about 60 percent, since it ignores the weighted probability of well success and failure. The methodology adopted in this study will benefit NABARD and in turn scores of small and marginal farmers in availing appropriate unit cost for borewell.

Farmers are in fact net subsidizing groundwater irrigation

In order to obtain one successful a farmer has to drill at least three wells. Even then farmer is not sure - how many years the well functions to yield water. Thus, undertaking individual borewell recharge is crucial. Investment on drilling and casing forms 50 to 60 percent of the investment on borewells depending upon the hard rock, previous drilling attempts, recharge efforts. Rest is on irrigation pumps, motors, conveyance structures, drip irrigation etc. Energy subsidy is often highlighted as a windfall support to farmers, though it forms some 20% of total cost of water. The cost of groundwater forms 15 to 30% of cost of cultivation. Thus, 15% to 30 % of the cost of cultivation, is borne by farmers implicitly. About 50 % to 80% of this cost is that of investment on groundwater and the rest on pumps, energy, conveyance structure cost. Thus, farmers are bearing the major portion of groundwater cost and accordingly are subsidizing the society and not vice versa. The electricity supplied is treated as a residual since there are no electrical meters installed on farmers' wells and accordingly is only an estimate and often includes T and D losses too. Farmers and users of groundwater need to be educated to treat water with wisdom, respect and equity.

Choice of right crops, pumping right volume of water, through sound water budgeting, not maximizing output per acre, but maximizing net returns per rupee of the cost of water is crucial. Irrigation extension, a separate wing or emphasis by Department of agriculture / horticulture, taking the help of agricultural engineering and agricultural / horticultural graduates in Karnataka. Training in water use and water budgeting as also in groundwater recharge are the need of the hour.

On each borewell, low-cost water measuring devices need to be installed in order for the farmer to be aware of volume of water pumped every day for every crop and every fragment of land. Also avoid cultivation of water intensive crops such as paddy, sugarcane, maize, and cultivate low water, high value crops such as flowers, fruits, vegetables. Shift gradually to millets; but this is possible only if there is an increase in effective demand for millets. Cultivation of climate smart crops such as millets which are not only low water users, but also come to harvest in 70 to 80 days, saving in duration, and currently are priced more than that of paddy, can facilitate in sustainable use of the resource. Thus, cultivation of low water high value crops (such as flowers for example) – need of the hour. The recharging individual borewells crucial. Extension efforts towards groundwater literacy – supply and demand sides are crucial.

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'ROLE OF CMAs' - SOILLESS COMMERCIAL CULTIVATION

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Kuvempu University

Introduction:

Agriculture in India has been considered to be the backbone of the economy for centuries with roughly about 60% of its population being either directly or indirectly dependent on it for their livelihood. The country's economy is swiftly heading towards other sectors like manufacturing, service etc. with increasingly high industrialization and urbanization. The contribution to the country's GDP by agriculture has been witnessing a declining trend over the years and stands currently at around a mere 15%. A large number of factors have been the reason for such a decline in the economic contribution by the sector.

Indian agricultural practices are widely conventional in nature with a lot dependent on manual labor and yields are largely subject to favorable climatic conditions. Industrialization and urbanization have been alluring the rural youth with attractive employment opportunities and hence, leading to more and more immigration into urban areas from rural segments. This has not only resulted in reduction of cultivable land, but also led to shortage of manpower in the rural agricultural sectors with several families having refrained from continuing agricultural activities in India.

The land fertility has also been declining in India owing to indiscriminate usage of chemical fertilizers and pesticides to increase the produce as demands have been relentlessly surpassing supply. The sector has a huge responsibility of feeding the country's population whilst the percentage of population involved in agriculture has been declining. This gap is constantly on the rise which needs to be bridged soon. Goal 2 of the Sustainable Development Goals also speaks about the importance of agriculture and the goal towards 'No Hunger' can be only achieved by increase in productivity of the agriculture sector. Hence, to sustainably feed our population with high quality and nutritiously rich food we have to explore other alternative growing methods which are not only lesser dependent on labor, climate and soil fertility but, which ensures higher productivity as well. Also, alternatives of urban cultivation need to be explored for to meet the ever raising need for quality food.

Soilless cultivation has been increasingly adopted as an alternative to the conventional soil based agriculture across the world and has shown beneficial results too. Various soilless cultivation methods like hydroponics, acquaponics, aeroponics etc. have been evolved of which hydroponics has been widely adopted all across the world. Countries like Netherlands, Australia, England, France, Canada, Israel and USA have successfully adopted the hydroponic technology.

The term Hydroponics is derived from the Greek words *hydro* means water and *ponos* means labor. The literal meaning translates to water working. This is a method for growing plants using water with certain mineral nutrients, without soil or in other words, it is a soilless method of cultivation.

Hydroponics is a soilless technique of growing plants with their roots immersed in nutrient solution and the plant held by an inert medium like perlite, gravel, coco peat or rockwool. The entire system is usually placed in a controlled environment under a greenhouse set-up. This helps to face the challenges of climate change on the one hand and allows cultivation all through the year irrespective of the season on the other. This kind of

controlled cultivation also ensures better production system management with efficient utilization of natural resources and mitigation of malnutrition. The plants being placed in a protected greenhouse means lesser risk of weeds attaching them and thereby, reduces the usage of pesticides.

Hydroponics technique is the fastest growing sector in agriculture world over with the increase in population and decline in arable lands due to urbanization and poor land management. The technique is expected to dominate the food production industry in the near future and has successfully delivered results.

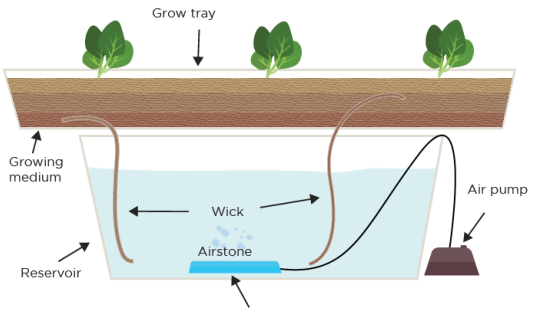
Hydroponics was introduced by an English scientist W. J. Shalto Duglas in the year 1946. He established a laboratory in Kalimpong area, West Bengal. Later in the 1960s and 70s commercial hydroponic farms were developed in Abu Dhabi, Arizona, Belgium, California, Denmark, Germany, Holand, Iran, Italy, Japan, Russian Federation and other countries (Sardare, 2013).

Hydroponic Techniques

Substantial literature exists on the techniques of hydroponics. Hydroponics techniques can be either active or passive. Active system is also known as the continuous flow solution culture or circulating system, where the nutrient solution is flows from the reservoir to the plant roots and back to the reservoir continuously usually by a pump. This system ensures continuous supply of requisite nutrients directly to the plant roots and in commercial set-ups can be fully automated as well. The passive system also known as the non-circulating method or static solution culture essentially relies on a wick or the anchor of the growing media.

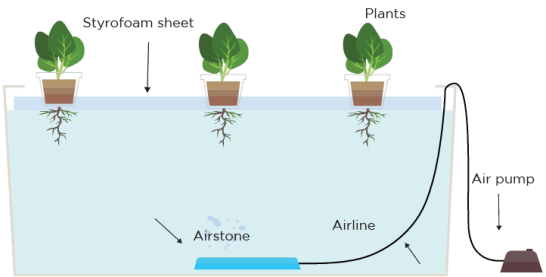
There are a lot of variations in the systems of hydroponics but they all consolidate to basically 6 core types of systems.

1. **The Wick System:** This is a passive system and involves no usage of pumps or moving parts. It is the most basic type of hydroponic system and suitable for home growers and beginners.
   The nutrient solution is provided to the plant roots from the reservoir via the attached wicks, whose capillary action plays an important role. The usual growing media that is suitable for use in this kind of a system is coconut fiber (cocpeat), perlite or vermiculite.



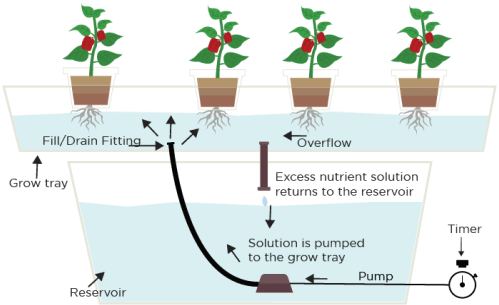
   The downside of this system is it is not suitable for larger plants and the nutrients are not efficiently used. It is only ideal for smaller plants like different varieties of leafy vegetables. Another drawback of the system is that it tends to keep the growing medium continuously wet which makes the oxygen absorbing activities of the plant roots harder. An air pump attachment may be a preferred option to solve this problem and supply the required oxygen to the plant roots.

2. **Deep Water Culture (DWC) System:** This is an active recovery system and hence, involves moving parts. Here plants are grown in net pots held by a floating platform above the container of nutrient and water. Plant roots are suspended and stretched into the nutrient-rich oxygenated solution. Active air pumps helps oxygenate the water and let roots breathe. Growing medium suitable in this system are again similar to those suitable in the wick system like, coconut fiber (coco peat), perlite or vermiculite.

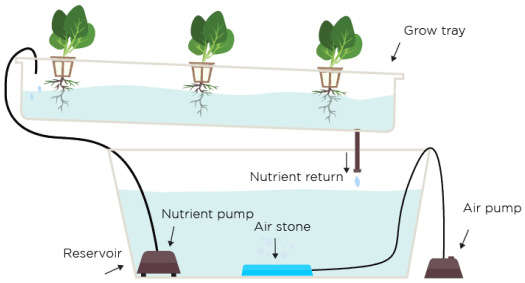


   This is the most basic hydroponic system under the active systems. It is inexpensive, easy to build and much effective in nutrient usage. However, it is not suitable for larger plants and also those having longer growing period making it most suitable again for only leafy vegetables.

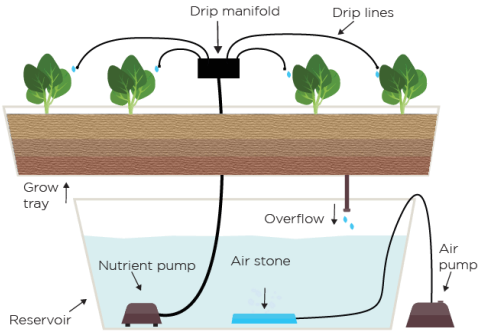
3. **Ebb and Flow System (Flood and Drain):** The Ebb and Flow system is also known as the Flood and Drain system. This is an active system in which the nutrient solution is continuously circulated. Under this system the nutrient solution is flooded in the grow tray to surround the plant roots before draining it back to the reservoir. Plants are grown using a variety of growing medium like gravel, granular rockwool, grow rocks, perlite etc. in a tray or container. A timer is usually attached to the water pump which schedules to turn on the pump at predetermined intervals allowing the system to be active throughout. Once the grow tray is flooded up to a certain level sufficient to reach the plant roots, the nutrient solution is returned back to the reservoir. This system is also again an easy to build system with minimal cost and ensures efficient nutrient management. However, the system uses power and susceptible to pump/timer failure or power outages.



4. **Nutrient Film Technique (NFT):** This is an active and recovery system most commonly employed by commercial hydroponic growers. It uses a submersible pump that continuously pumps nutrient rich water to the growing tray or a tube, and delivers the same to the plant roots. Once the flow reaches the channel's end, it drains back to the reservoir. The plant roots in this system are suspended above the water level, are constantly moist and get plenty of oxygen from the air surrounding them, additionally an air pump may also be attached to the reservoir to provide oxygen in the water and grow tubes. The NFT system is very effective in water and nutrient management with little or none growing medium used. However, the system is susceptible to pump failure and power outages and not very suitable for large and heavy plants.



5. **Drip System:** There are 2 variants in the drip system; they can either be active recovery or non-recovery system. They are the most common type of hydroponics systems in the world, especially for commercial growers. It is usually an automated system with a timer set to schedule the submerged pump which is used to supply the nutrient solution to the plants from the reservoir through drip lines. The line emitters for each plant enable the gardeners to adjust the amount of solution per plant making it a much controlled system.

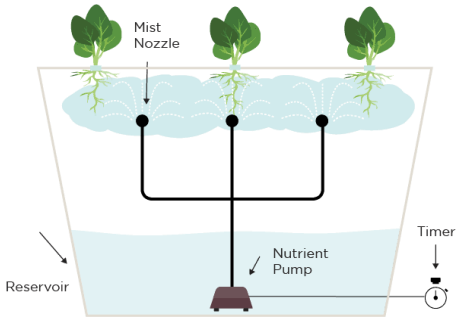


In the recovery drip system, the nutrient solution is sent back to the reservoir, while the non-recovery system doesn't collect the leach-out, which results in loss of excess nutrient solution.

However, while the recovery system is more efficient and cost-effective by reusing excess solution, the non-recovery system needs lesser maintenance. In the recovery system the pH and TDS of the solution keeps fluctuating and a regular check needs to be kept to maintain these levels, whereas in the non-recovery these levels can be set once and left until the next refill of the reservoir.

The growing medium to be used in this system maybe any slow draining one like rockwool, coconut coir (coco peat) or peat moss.

The downside of the drippers/ emitters system is the clogging, which is formed by the particles from nutrients that usually get accumulated in the emitter.



6. **Aeroponics:** The aeroponics is the most high-tech variant

of all. The plant roots in this system freely hang in the air, with no growing medium used. The nutrient solution in this system is pumped and sprayed onto the plants root system constantly. A timer is used to control the nutrient pump, but the cycle is much shorter compared to other hydroponic systems. This system ensures sufficient oxygen supply to the plant roots since the roots are freely suspended in air and also ensures effective water and nutrient management. However, this system is expensive one compared to the other variants and also more vulnerable to dryness caused by power outages with no growing medium used.

Apart from these core systems, other common systems available under hydroponics are the Kratky Method, Fogponics and Dutch Bucket among others.

Some of the well established and proven advantages of soilless greenhouse cultivation are:

1. Year-round crop
2. Crops are protected from extreme weather conditions
3. No or little use of pesticides
4. Water use efficacy is nearly about 90%
5. Reduce the environmental pollution as no use of mechanical plow and other equipments reduces the burning of fossil fuel
6. Human health friendly
7. Solar energy and wind energy can be used to generate electricity to control the hydroponic greenhouse environment
8. Sustainable urban growth
9. Reliable harvest
10. Crop can be grown in cities because soil is not required

Cost Benefit Analysis

Cost Benefit Analysis (CBA) is an effective quantitative tool that helps in estimating whether a certain course of action or alternative provides a more net benefit from an economical and societal perspective, in comparison to other alternatives available. A CBA involves identifying all significant costs and benefits associated with the alternative including the direct impact on various other elements which are then evaluated in monetary terms using different valuation methods.

CBA involves compiling a comprehensive list of costs and benefits associated with a given project or decision. The costs involved in a CBA may include the following:

- Direct costs – material, labour and other direct expenses
- Indirect costs – including various overhead costs
- Intangible costs such as impact on customers, employees or delivery timelines etc.
- Opportunity costs such as alternative investments
- Costs of potential risks such as regulatory risks, competition and environmental impacts

The benefits may include the following:

- Revenue and sales
- Intangible benefits, such as improved employee and customer satisfaction due to enhanced product quality and faster delivery
- Competitive advantage or market share

A monetary measurement shall be applied to the relevant items of cost and benefits of a particular project. However, one of the major shortcomings of a CBA is that it is based on forecasts and assumptions. Usually, a conservative approach is adopted to avoid underestimation of costs or overestimation of benefits while forecasting.

Finally, the aggregate costs and benefits are compared quantitatively to determine if the benefits outweigh the costs. If so, then the rational decision is to go forward with the project. If not, the business should review the project to see if adjustments can be made to either increase benefits or reduce costs or both to make the project viable.

Literature Review:

A review of existing literature helps in laying a solid foundation for any empirical analysis. Understanding the work already done in a particular area of study along with application of scientific methods to determine the inherent problems; help in deriving intellectual and practical solutions.

The Literature on Cost Benefit Analysis of various modern systems of cultivation is still quite meager, and of commercial hydroponics is almost non-existent. Hence, an earnest attempt shall be made to fill the gap in the field.

Statement of Problem:

From the preliminary exploration of literature, on the one hand, it has been found that literature on soilless farming worldwide exists including India, but is limited to the technical aspects of the modern techniques. Literature from a financial implication perspective on these modern cultivation techniques is meager worldwide and equivalent to non-existent in India.

Hence, the scarcity of literature on the financial aspects of the modern soilless methods of cultivation creates a gap/ vacuum in the body of knowledge in the said field. CMA's can play a crucial role in filling this vacuum by projecting a cost-benefit analysis of the soilless cultivation techniques worldwide along with a comparison against the conventional methods of cultivation.

Role of a CMA in CBA of Commercial Hydroponics:

1. Study the trends and growth of soilless commercial cultivation in India.
2. Compare and contrast the various techniques available in soilless cultivation and study their commercial adaptability.
3. Study the cost variations in cultivation of leafy vegetables and vine crops under the conventional cultivation model and modern soilless systems.
4. Evaluate the socio-economic benefits derived from soilless cultivation techniques against their associated costs.
5. Project a cost-benefit analysis model for hydroponics systems in commercial cultivation.
6. Offer value-added suggestions to the agriculture industry.

Conclusion:

Soilless cultivation in India has not been taken up seriously as a commercially viable alternative, majorly due to the perception that the initial high investment may not be justifiable. A CMA can throw some light and clarity on this perception by performing a detailed cost benefit analysis on such project and play a crucial role in reforming the agriculture sector in India.

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COSTING AND AGRICULTURE

CMA Debraj Sahu
Practising Cost Accountant

A. Change I have seen

In rural India agriculture is heart and soul of farming community. I belong to a small village from Ganjam Districts in Odisha. If I go back to schooling period and unfold my memory, cultivation was embedded with the status, habit, culture and comfort of rural population. People were prioritising Agriculture than to employment. People were waiting for their harvesting season to solemnise any occasion like marriage, plan for developing properties and fulfil any commitments. It all depends on signing status of harvesting. Agriculture was every thing. I have seen and also had experienced to some extent, the pains of the farmers, who use to work under hot sun, under freezing cold of winter, heavy rains in rainy seasons and always prone to natural threats. He is dedicated to his service even under illness. I use to hear the farmer saying "**If actual calculation is done there is no return from cultivation and suffer from losses."** Still farmers, use to cultivate, as cultivation is their only profession. They are satisfied, if it could fetch at least the food for their family. In course of time the agriculture habit in my area got changed. Land owners- gradually stopped cultivating and hired out their land, due to many fold increase in cost of cultivation, scarcity of farm labourers and direct cash loss suffered from own farming.

B. Paddy Costing I did in 2016:

It was the Fiscal 2015-16. The core feeling of farmers **"Loss from Cultivation"** had ignited me and i had questioned to some of my known farmers in my village "why do not you calculate actual expenses and revenue thereof". The very immediate answer is that every thing is at their finger tips. I could understand their gut feeling and took an initiative and do the costing of prime crop paddy. After exposing myself to the Data collection as a pilot attempt - I engaged an young guy having education below 10th standard on my rolls and oriented him with a small format for collecting data. He went to the doorstep of farmers and carried out survey for collecting data on paddy cultivation. I am happy that this played the catalyst role in the subsequent days

C. Summary of my maiden attempt

- **Sample size** : 92 Farmers
- **Range of Land Holding** : 0.12 acre to 12 .16 acres
- **Data Targeted** : Extent of Land Cultivated – Costs on Land Preparation Costs for Nursery– Seed Costs – Equipment Hire Charges – Plantation Costs – Costs of Fertilisers - Supervision expenses Transporting-Hording-Harvesting expenses etc.
- **Methodology** : For **a**nalysis, total data is divided into two parts viz. Farmers With extent of holding below 3 acres of land and above three acres of land.
- **Observations** :
  - Yield per acre of Land : 12 to 13 Quintals
  - Cultivation Cost per acre in 2015-16 : Rs.13,600 to Rs.14,600
  - Cost per Quintal : Rs.1,150/- (2015-16)
  - Selling Price per Quintal : Rs.900/- (2015-16)
  - Interest on land value – capital investment is not considered.
  - Values of straw residues is left as Bonus to farmer.

- The study was prior to announcement of MSP of 1.5 times of cost.
- Data Considered is as revealed by the farmers.
- Farmers were having apprehension; Data is providing benefits to the person who is collecting.

➢ **Subsequent activities:** I had discussed with the farmers and impressed upon them to maintain the data of cost of cultivation. I have Provided templates to record the daily utilisation of labour, expenses incurred for various inputs.

D. Catalyst Role

I have a CMA friend in Hyderabad - who use to share his thought process on different topics through a feature called "Thursday Mail" and in response to one of his mail on Agriculture – I shared my experience. In the course of further brain storming sessions "bigger canvass" emerged giving Brand to my Costing profession as well. Thereafter the mantle was carried relentlessly and I am happy for the events that are unfolding on this eventful day the 23rd December 2020.

E. Finally…

In the recent times – I thought of interacting with the farmers particularly in the context of Farm Bills and found that Public believe in Government. I strongly opine that awareness on such data recording and inculcating data culture among farmers by offering required Training would be of immense help. Farmers get the confidence if the Government officials or recognised Institutions are involved in these activities. If the farmer is assured of his welfare and be given GAURANTEE that there is force to protect his Costs – he or she would take up the cultivation activity with pride and confidence.

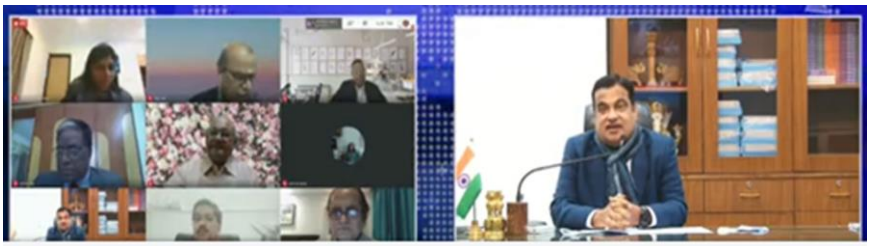
NATIONAL FARMERS' DAY CELEBRATION AND NATIONAL AGRICULTURE MEET

23rd December, 2020

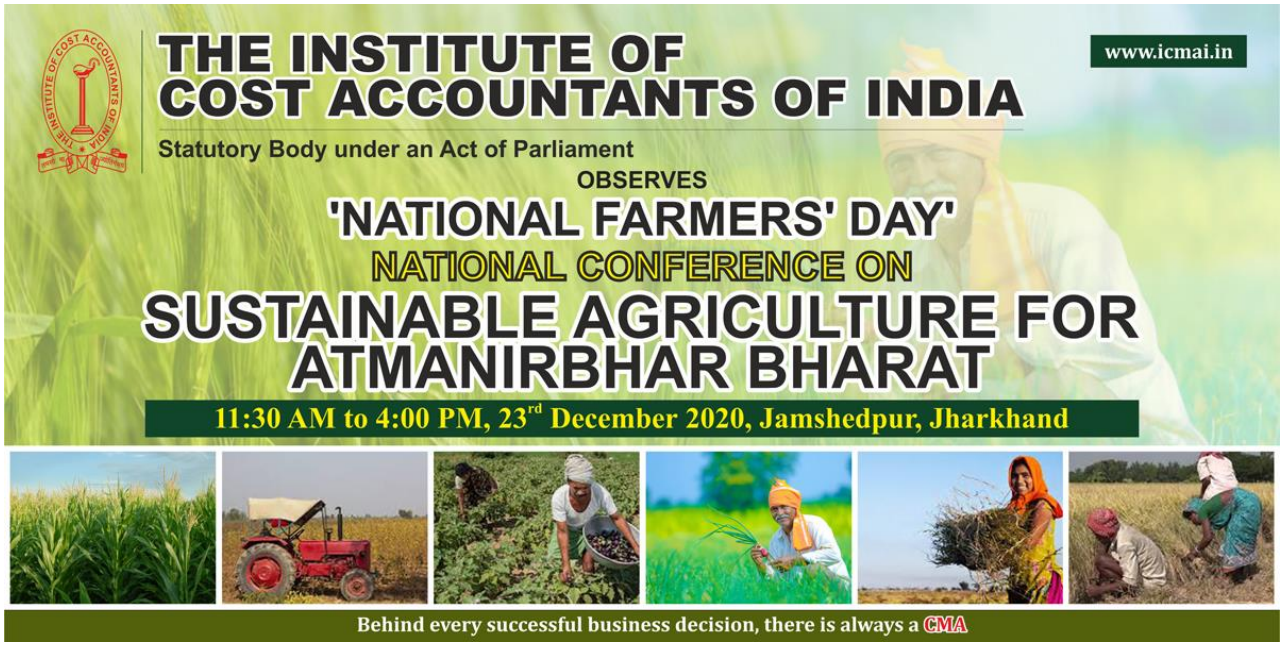
Key takeaways of the Agriculture Meet

- Upgrade farmers to Agripreneurs
- Create Smart farms around every Smart City
- Collect agri data and help farmers in taking more informed decisions
- Use a blend of Natural Intelligence and Artificial intelligence in agriculture
- Create low-cost sustainable warehouses, food processing units and other infrastructures around farms
- To build up an efficient supply chain
- Help FPO's, cooperatives and other agri organizations with Cost and management expertise
- Help government in designing policies and plans for the new age farmers
- Institute can help in Minimum Support Price (MSP) calculation
- MSP Pricing may be transformed into Compatible Support Pricing
- Role in Export Pricing Policy Mechanism
- Strategies of forward and backward integration in agriculture
- Promoting integrated and scientific farming
- Promoting quality output per rupee and per acre
- Using by-products of agriculture for different other uses like ethanol as fuel etc.

Role for CMAs in Agri Sector



- Pricing
- Revenue Management & Cost Control
- FPO Management
- Financial Services
- Agricultural Supply Chain Development
- Inventory Management
- Capacity Building
- Agricultural Value Chain Management
- Cost Benefit Analysis
- Value Added Studies
- Mechanization
- Sustainability
- Transition from Agri 4.0 to Agri 5.0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OBSERVES
'NATIONAL FARMERS' DAY'
NATIONAL CONFERENCE ON
SUSTAINABLE AGRICULTURE FOR ATMANIRBHAR BHARAT
11:30 AM to 4:00 PM, 23rd December 2020, Jamshedpur, Jharkhand
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AGRICULTURE TASK FORCE
The Institute of Cost Accountants of India
WEBINT
AGRICULTURE MEET
Tuesday, 22nd December 2020 I 6:30 pm - 8:00 pm
CEP Credit: 1 Hour
CMA Biswarup Basu
President, ICAI
CMA P. Raju Iyer
Vice President &
Chairman, Agriculture Task Force, ICAI
CMA Chittaranjan Chattopadhyay
CCM, Chairman, BFSI Committee &
Member, Agriculture Task Force, ICAI
CMA Shriram Mahankaliwar
RCM
WIRC, ICAI
CMA Anil Verma
Chairman
Nagpur Chapter, ICAI
Key Note Speakers
Shri Samay Bansod
Whole time Director
Manas Agro Industries & Infrastructure Ltd
Shri L L Raval
CGM
NABARD
Speakers
Host
CMA P V Bhattad
Past President
ICAI
CMA (Dr.) Sreehari Chava
Member
Agriculture Task Force, ICAI
CMA Jyotsna Rajpal
Coordinator Agri Cost Cell
Nagpur Chapter, ICAI
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organized by Agriculture Task Force of the Institute
on 23rd December, 2020 at Jamshedpur, Jharkhand


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Institute presented copy of Inaugural Volume of CMA Agri Bulletin to Hon'ble Minister of State for Finance and Corporate Affairs Shri Anurag Singh Thakur on 30th December 2020

CMA Biswarup Basu, President, CMA Balwinder Singh, Immediate Past President and CMA Chittaranjan Chattopadhyay, Chairman BFSI Committee & Indirect Taxation Committee of the Institute extending greetings to Shri Anurag Singh Thakur, Hon'ble Union Minister of State for Finance and Corporate Affairs on 30th December 2020.

NOTES

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