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IDEATION IN AGRICULTURE

KRISHNAN UMACHANDRAN[1*]

[1]Nelcast Ltd, India.

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Short Communication

ABSTRACT

Globally every higher educational institution and mega corporate entities are in the process of Open Innovation, searching for new ideas everywhere. There are many contests and challenges being organized by institutions to motivate younger brains to think far and wide to get great ideas with potential impact that will have a chance to be made into a reality. Adding to the constraint, is the lull in employment opportunities in industry, students are channeled into entrepreneurial paths so that they can take onus of bringing their education, learning, creativity and project management skills, to make their dream of product or service become implementable as a economic livelihood activity. Bringing new ideas to make agriculture prosper requires an outsider perspective. The United Nations in its Agenda 2030 for people, planet, prosperity, peace and partnership has specified in its Sustainable Development Goal 2 that to End hunger, achieve food security and improve nutrition and promote sustainable agriculture. Taking this a vital goal, the following work aims to derive an Out-of-box elaboration, with a multi-disciplinary approach applied so as to evolve with many ideas that can profiteer the process, produce, product and service that is associated with agriculture. When the need is to make an idea become materialized, a prolonged iterative process of brainstorming with experts in the relevant field has been undergone to evolve a template for the selection criteria that can sieve the ideas and be a ready reckoner implementable in the field of agriculture. This paper attempts to go through the process of ideation in agriculture, instilling new mushrooming ideas, even as the references are still evolving with emerging technologies, and tranquil in formation. Precision agriculture is beyond modernisations that are happening in agriculture today. Telematics, Nano culture, chromosomal researches, etc., are some to be mentioned. In all means every bio system has place for plants, animals and microbial species to live and cherish its being, the scope of this paper paves wave to include and involve integrated farming in future.

Keywords: Ideas; innovation; creativity; agriculture; digital technology; idea evaluation.

1. INTRODUCTION

An Idea should convey a business plan with clear and concise words or terminology. It should provide an overview of the business and specify the target market. It can be either a product or process with specific benefits. Perceive an opportunity and strive to translate the opportunity into an idea, leading to provide value for the customer, entrepreneurial profit, and social benefit that when transformed into products or service. An idea of agricultural entrepreneurship is complex based on different stages of development which the agricultural enterprise goes through, including the skills required to develop the change and meet the management demands [1]. There is no such thing as a new idea, it only takes a lot of old ideas and churns on continuously, turning and making new combinations indefinitely. Inside the human mind, an idea is a mental spark that occurs as a response to the challenge of a train of thought. As we

**Corresponding author: Email: umachandran_k@hotmail.com;*

live in a continuously changing world, the new ideas of today will soon be the old of tomorrow. Ideas have obsolescence, hence needs to be quickly identified and used so as to reap benefits of its emergence. Daring to question the status-quo, doubt the existing, and wonder why not to move away from the comfort zone will lead to the appearance of new ideas and paradigms. Fresh ideas break away the established patterns of thought and start to see new paths ahead. Automation includes forage harvesting, with automatic guiding and navigation are certain recent technological developments that have proven that data and model computations can address uncertainties and offer more reliable nitrogen management advice to farmers through cloud based services. Entrepreneurial development among farmers is to make them more profitable, through developing ideas, and translating them into action; fed by self-driven motivation, perseverance, capacitation plan, organize farm business, seeking opportunities, conceptualizing, initiating new ideas to accomplish the business goals [1].

2. CHALLENGES AS IMPETUS TO INNOVATION

On a pragmatic approach the challenges are obtained from the field, by the way of a contest promoted among engineering students and content specific learners to join as teams and offer new solutions to existing and projected problems, which are then assorted for an organized evaluation using template. References are very few in the subject area, and hence the explorative way for need identification is challenged and motivated for further implementations as a business prospect. Challenges prompt new ideas to cope up with new technology, unanswered customer needs, production bottlenecks, and product issues or pricing. In the human mind, an idea is a spark that occurs as a response to the thought challenge. There is no difficulty in developing new ideas but from escaping the existing practices requires more push. Bureaucracy derails the ideation process, where the individual's ability to try new and innovative ideas are at complete variance with the existing policies and procedures, which insult those who want to create. Ideation is a visioning process with critical skill towards entrepreneurship, involving insight, observation, and experience; facilitated through education, training, cascaded creativity on the opportunity available in the market. This requires a detailed investigation of an idea being analyzed for feasibility when initiated could develop for an implementable sense. Imagination or dreams germinates ideas, which the individual or team nurtures them and then suitably develops them successfully to be implemented.

3. INNOVATIONS IN AGRICULTURE

The revolution in Information and communication Technology is available and accessible across the farming sector linking to educate and inform farmers about new ideas, technologies, overcoming the limitations of distances, transportation facilities with farmers through mobile gadgets without compromising any unique local factors [1]. Interdisciplinary approaches can tackle profound human cognition using revolutionary technologies. Two innovations in agriculture are the Organic farming and ICT implementations that are sprouting for a promising emergence and impact in agriculture, the Organic farm produces gets consumed while ICT is enabled, but both are Quality oriented, consciously as a new demand in the evolving future [2] [3]. Revolutions in the Farming Industry have picked up pace as farming is now being considered as an industry today, hence the modern industrial farming is mono cultured on a large-scale, with enough support for sustainable organic agriculture, refer Fig. 1, on the digital sustainable management parameters. The role proactively facilitates up bringing the policies on new e-business models, skills in digital transformation, support infrastructure, systems including gadgets and downloaded applications are expected to benefit the farming community by this technological wave [2]. Farming technologies include Soil and Crop sensors, Telematics, Mobile computing, Nanotechnology and micro chromosomal technology, Electric drives and Automation with IoT / IIoT requires integration of processes with sensors use computing and sharing data by bringing together people - processes and systems, through data capabilities brings richer experiences and economic opportunities across the globe.

Productivity: In agriculture is a measure of the ratio of agricultural outputs to inputs. The agricultural output is a measure of the market value of final output, excluding the intermediate products. The productivity is a numeral used to reflect the changes that happen over a particular time. It is referred to as percent changes, indexes and average changes, indicating the productivity change from one period to the next. Initially it was the farm machinery mechanizations which happened as innovations in farming practices, later with the role of digital technology revolutions the farm productivity underwent a lot of changes such as identification of fishing densities, rightly timed climatic changes, weather, fog and rain etc,. Thus the adoption of new techniques, innovation and competitiveness novel enhancements came over to increase productivity. There exists a strong demand for in-depth understanding of farmers' practices to determine the most effective, economical and sustainable options in

increasing the productivity, and to formulate approaches for adaptation, uptake and upscaling. In the sub-catchment the productivity is based on the amount of rainfall and its influence on their yields [4]. The continuous exposure of land due to short crop cycle, climate variability like high intensity rainfall, cyclonic winds lead to massive landslides and erosion leave the land barren and unfertile overtime, increasing the area of land degradation. In addition practices such as slash-and-burn system of cultivation also affect the land degradation to an alarming rate [5].

Yield: Is the measure of the desired economic output per unit area. Through innovation, intensive farming, improved farming implements, and a search for better practices leads to the development of high-yielding varieties of food crops. The expansion of irrigation infrastructure, modernization techniques, hybridized seeds, synthetic fertilizers, pesticides, microbiological facilitations along with digital technology implementations, yield gets exponentially evolved. Farmers adopt various methods to benefit from the available water, such as tillage methods, agronomic practices and crop diversification approaches to maximize the [4]. Adoption of Integrated Pest Management improves the crop yields. Rice consumes more than 50% of the total irrigation water in agriculture, with the impact of climate induced higher temperatures the crops' water requirements increase. On an average for every 10°C increase over the mean temperature, there is a 7% decline in the yield of rice crop, necessitating a need to develop water saving technologies.. System of Rice Intensification (SRI) and Directed Seeded Rice cultivation are water saving rice production technologies, which help in overcoming water shortage and make the water available for growing other crops thus promoting crop diversification. In addition to higher productivity, the available nutrient status in soil also increases marginally at the end of four seasons. SRI recorded higher grain yield, associated with reduction in the incidence of pests and the relative abundance of plant parasitic nematodes. SRI performed well and consistently reduced the requirement of inputs such as seed and water in different soil conditions [5]. Land at the head of the irrigation canal tends to get more yield than those in the tail end, in addition the water usage at the head of the canal gets used more water than that is needed for optimum crop production. More access to water leads to a high yield and not necessarily to achieve a high productivity [4].

Fig. 1. Digital sustainable management parameters
Source – Umachandran [2] Information and Communication Enabled Agriculture Technology

Income: Is monetary returns earned from carrying out the farming operations and includes the returns from secondary derivatives of the original produce; after deducting land lease value, cost incurred on such others as of rental for appliances and services etc. Crop production is one of the key determinants of wealth for any famer. An improved water service will directly impact the financial capacity of farmers and also enable them to voluntarily contribute their time and effort which are more valuable than the capital alone. Most farmers produce at subsistence level, even release of high yielding varieties of crops by agricultural societies to boost agricultural productivity has not been translated into getting even close to the potential yield or to approach the optimum levels [4]. While farmers sell crops at harvest, having storage yards or warehousing would have leverage for better bargaining power, return on investments (ROI), internal rate of return (IRR) for the grain bin investment. Thus farmers can increase their net income with additional on-farm storage, to capture a better sales value on time value and also as a marketing tool to push towards higher yields. Farmers need to be frugal and constantly find new technology that can be attached to achieve maximum economic yields, with the existing equipment, thus avoiding purchase or investments on new machinery [6].

Techniques: In Farming Technologies are influenced by the digital transformation in mobile computing, 3G/4G networks. Right from portable computers, smart-phones and equipment such as farm tractors have portability options. Farmer's access high-speed Internet services and mobile cellular communications networks in rural areas for telematics, displaying GPS maps and images on crop harvest, equipment service conditions or breakdown, nitrogen utilization data for understanding of the yield mechanism or maintaining their levels. Telematics monitor herbicides tolerance traits, pest controls, virtual monitoring of productivity or yield per acre etc. through expansion of irrigation, infrastructure modernization, distribution of hybrid seeds, microbiological facilitation end nanotechnology application.

Mobile phones have spread at an unimaginable speed, their proliferation across various areas has also landed into agriculture with numerous mobile phone-enabled services (mservices). With smartphone penetration and broadband networks are progressing to deliver technologies which are voice and text based. Digital transformations in precision agriculture have tools to monitor intra-field variations and manage crop production to boost agricultural productivity. Technologies and gadgets are becoming cheaper, while the mobile network infrastructure is also getting improved, thus enabling the access to hardware and infrastructure laying the foundation for exploiting innovative applications in agriculture services, to the diverse ecosystems with interconnected devices and multiple applications through cloud computing. Mobile connectivity through gadgets such as laptops, desktop and tablets can be used to access the network, as it is easier, affordable and can be connected using external USB dongles, or built-in WiFi or by using the mobile hotspot etc., leading to continuous internet connection, switching between Ethernet, WiFi and 3G/4G mobile phone networks. Agricultural m-service has been already developed and deployed as a system providing farmers cooperatives with supply chain management tools to track production quantities, production and processing methods and delivery [7]. Nowadays soil and crop sensors are predominant in farm equipment, being fitted with smart sensors they capture everything from plant health and water needs in the crop to nitrogen levels in the soil. The sensors enable on-the-go application of inputs based on real-time field conditions. The newest area of sensor use is in irrigation where the sensors measure water needs. Sensors help optimize water use and avoid yield loss. Pervasive technologies include ICT, integration of sensors, advanced materials, biotechnology, transportation systems and sustainable clean technologies, facilitated through big data, IoT, robotics, additive manufacturing and cloud mobile computing.

Mobile technologies include Internet and cellular services for agriculture including fishing. In fishing identifying fishing densities, rightly timed climatic changes of weather, fog or rain are also part of agriculture. Electric drive systems such as tractors, sprayers and other farm vehicles can generate electric power to run auxiliaries and attachments, these features shall put conservation of energy and prolonged use of the power generated over various appliances. Automated grain off-loading -Automatic guiding & navigation systems that combine to improve continuous cart filling as part of forage-harvesting systems. These systems make a very good ROI as it is easier to fill and off load the contents automatically. Nano technology finds application in Crop Biotechnology, Recycling Agricultural Waste, and Delivery Systems for Pests, Nutrients, and Plant Hormones. Nanotechnology includes recycling of wastes, delivery systems for pests, nutrients and plant hormones. Herbicide tolerance trait technology works to develop new formulations that tackle spray drift, volatilization to non-target crops and other plants on the landscape while increasing the intended production. Weeds are the major reasons for yield loss. Based on the weed pressure and methods of control, their yields can be reduced through agricultural biotechnology to make them tolerant to a wide variety of herbicides. In-crop use of herbicides simplify the weed control and facilitates no or less-

tillage, controlling emerging weeds through post-planting herbicide application, leads to increased water retention in the soil, less soil disruption, less soil erosion, and increased organic matter in the soil [8]. Mini-chromosome technology allows to add traits faster and more precisely over the existing by looking at the complex traits like drought tolerance and nitrogen-use efficiency etc. Engineered minichromosomes produced using telomere mediated truncation cleaves chromosome arms and places the required transgenes linked to an endogenous centromere [9]. Micro chromosomal technology takes care of drought resistance, tolerance, nitrogen use efficiency.

Improvised Methods: Are continuously evolving based on day to day problems, and still latent. Classic example is the system for Rice Intensification to adopt seedling distance while planting. Hydroponics fodder as livestock feed is an alternative to conventional method of green fodder production taking care of the concerns such as decreasing land size for fodder cultivation, scarcity of water more labor requirement, non-availability of same quality green fodder round the year, requirement of manure/fertilizer and natural calamities. Harnessing plant, animal and human waste as effective inputs to reduce input cost on farming through integration of wastes into useful components such as vermicomposting, pest repellents and biogas. Hatchery-based fish production concentrates on Micro-algal culture and water quality management in seed, feed and farming technologies, takes care of cross border fishing and depleting fleet of ships, ensures the survival of high density stocking of ornamental & rearing juvenile fishes in hatchery. Fossil Park- To conserve fossils and the rare and endangered flora and fauna. This can prevent cross-border illegal trade and poaching in fossils, flora and fauna. The Fossil Park spread area has marine fossils such as ammonites, belemnites and has sparse vegetation, several swamps; pools in the area are home to various species of flora and fauna species found in the region.

Research: In farming processes and practices has exponentially opened up. There is a lot of research and innovations happening in farming. Some of the recent applications in the protection of environment from pollution, use of non-conventional energy sources, new farm techniques and use of natural manure and rejection of fertilizers and chemicals are Multipurpose solar pest, insect trapper and garden light - reduces the frequency of spraying pesticides to control the fruit borer and white fly pests. Avoids incidences of farmers being killed due to electric shock in the fields while switching on their agricultural pump-sets. Short duration green gram variety through micro-nutrient mixture - The crop is ideal for rain-fed conditions. Application of micronutrient mixture ensure better growth of plants with enhance pods and seed setting leads to early maturity it escapes terminal drought and ensures sustainable yield, determinate growth and synchronized maturity is amenable for single harvest saving labour and time. This variety shows resistance to mung-bean yellow mosaic and stem necrosis; field tolerance to sucking pests like aphids, stem-fly and spotted pod borer. Innovative sericulture- in Bivoltine cocoon deflossing to increase productivity using mechanized pedaling technique avoiding manual operations. Pest management in Chili Seed treatment with imidacloprid is effective; Spray with acaricides such as dicofol and utilization of indigenous materials have confirmed that garlic chili kerosene extract can effectively combat the problem of Mite infestation.

Market Expansions: Is a value chain analysis used to identify emerging economy settings, growth and poverty reduction. Analyze the factors influencing industry performance, including access to and the requirements of end markets; the legal, regulatory and policy environment; coordination between firms in the industry; and the level and quality of support services. Contract farming loans are tied to purchase to increase commitment levels appropriate for buyers and sellers of high-value, specialty products. Warehouse receipts are the mechanisms for expanding rural credit that have grown out of value chain relationships. In addition Trader credit which is the short-term or seasonal loans between buyers and sellers of inputs or products; to provide commodity-based value chains in rice or other basic grains commodities.

Livelihood Impact and **Rural Prosperity**: Depend completely on the agricultural growth options and linkages with agricultural investments are the key component of an agricultural development strategy. There needs to be a real demand for the goods produced in the local market for sustainability of the farming activity. At the same time the Export sector favorable policies should exist and support the balances of linkages between demand and supply through changes in income and productivity. Dis-aggregating to get the bigger picture for growth of the activity and future investments, enough documentation is required on Agricultural crop production on farm groups; Livestock production; and Local consumption to capitalize on existence. Identify the Community Cluster and carryout baseline survey on mapping the village resource such as local farming, collection, quality practices, etc. for identifying the relevant clusters of villages, or communities so that an optimal size of farmer or producer participation that can be optimized on geographic reference for technical and commercial viability. Convergence of basic social and community

services, available in the selected cluster, should be developed in tune to the local structures with the farmers or producers as its members, based on the local skills availability, on-the-job training required etc that could get a better engagement with the society [10].

Activity Management: Or Farming Management practices to prevent crop pests, weeds, and diseases including Crop rotation and soil and crop nutrient management; Sanitation measures to remove disease vectors, weed seeds, and habitat for pest organisms; and Cultural practices that enhance crop health, including selection of plant species and varieties with regard to suitability to site - specific conditions and resistance to prevalent pests, weeds, and diseases. Maintenance of crop health both for yield and quality of produce, requires long-term strategies for the minimization of pest and disease occurrence. Use of resistant cultivars, varieties, crop sequences, associations, and cultural practices that can minimize the pressure and maximize biological prevention of pests and diseases. The essentials for successful farming are to enhance natural control mechanisms that facilitate healthy cropping, controlling specific measures on disease, pest-resistance, and rotation of crops. Application of pest and disease forecasting techniques by understanding and using non-chemical pest, disease management practices, and equipment used complying with established safety and maintenance standards on the handling and application of agrochemicals can ensure maintenance of accurate agrochemical records. Data mining techniques using artificial intelligence (AI) will support in predicting and controlling of effective measures to incident handling.

Disease breaks for susceptible crops, thermic or mechanical control practices and tactical use of agrochemicals to control weeds, pests, and diseases are to be carried out with state of the art knowledge and equipment, which integrate for a consolidated benefit. Maintain regular and quantitative assessment of the balance status between pest and disease and beneficial organisms of all crops [11]. Better management is possible by virtual monitoring controls such as the drones also called Unmanned Aerial vehicles (UAV) with cloud computing. UAV does the physical surveillance, while cloud facilitates all the servers, software's, analysis and services from a remote location. Unmanned Aerial Vehicles and cloud based data management tools can be specifically designed to work with unmanned aerial Vehicles. The online tool allows to utilize data on yield, as-planted, drainage tile, soils, shape file layers and various Aerial imagery (such as Oblique Imagery, Optical Imagery, Soil Imagery and Virtual Video Imagery) for the following emergence variability, drainage analysis, hybrid placement, plant health and soil performances. Unmanned aerial vehicles (UAVs) are being increasingly used in agriculture and marine surveys due to its rapidly advancing versatility and functionality, cost-effectiveness when compared with other methods which have relatively poor sampling efficiency, accuracy and precision [12].

3.1 Idea Selection Criteria

Ideas are precious, and it doesn't strike everyone. Therefore whenever it emanates, it needs to collected and processed for the value it bears. This process of ideation is sought through contests that involve multidisciplinary teams from young engineers and content specific learners to join as a team and offer innovating ideas that are possible through including emerging technologies in the theme of water resources and environment. The teams are processed through webinars, individual counseling and pep-ups for idea evolution, then it is sieved. The Idea sieve has two stages of evaluation, with templates as specified below

Potential Sieve: This is a first stage pitching, were the idea is evaluated on the parameters such as following for it worthiness in terms of novelty, originality, technology, resource requirements, adaptability, benefit, business viability and scalability options on the impact areas such as human life, livelihood and comfort. The parameters and its impact factors are obtained through brain storming with experts using Delphi technic and then derived.

Parameter	**Impact**		
	Human Life	***Livelihood***	***Comfort***
Novelty			
1. Conceptual			
2. Reality			
3. Immediate Requirement			
4. Futuristic			
Originality			
1. New Product / Process			
2. New Class / Variant			
Technology			

1.	Existing
2.	Emerging
Resource Requirement	
1.	Low (Limits needed)
2.	Affordable (Limits needed)
3.	High (Limits needed)
Adaptability	
1.	Into the same Product/ Process
2.	Standalone / Separate
3.	Customisable
Benefit	
1.	Social
2.	Cost
Business viability	
1.	Low
2.	Medium
3.	High
Scalability option	
1.	Yes
2.	No
3.	Can be tried

Professional Sieve: This is a second stage of pitching where the actionable to feasibility relevance to the subject area is evaluated.

Problem	**Approach**	**Idea (Solution)**	**Phases of Implementation**	**Time line**	**Resource**	**Skills**
	Improvisation Radically new					

4. CONCLUSION

This paper envisages gathering more of ideas, building a big canvas of opportunities in agriculture, and sieved for fruitful implementations that can turn out to be a business. Hence of course, the idea for incubating or surrogating should have a business plan and include an executive summary, describing the company and its operational features, with a mission statement, market and audience, opportunities, competitors, cutting edge over the competition, roadmap, KPIs and financial plan. Creativity is imagination, while innovation is implementation. Culture of innovation fosters new ideas, by promoting participation and trust, trying new things, adapting and learning happens. In all practicality, it is better to have enough ideas which can also be mixed with some which can be wrong, than to be always right with no ideas at all.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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