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ACCESSIBILITY OF BLOCK CHAIN IN AGRICULTURAL SECTOR TOWARDS SUPPLY CHAIN MANAGEMENT

Dr. M. SOUNDARYA
Assistant Professor
School of Management studies
Sathyabama Institute of Science and Technology, Chennai

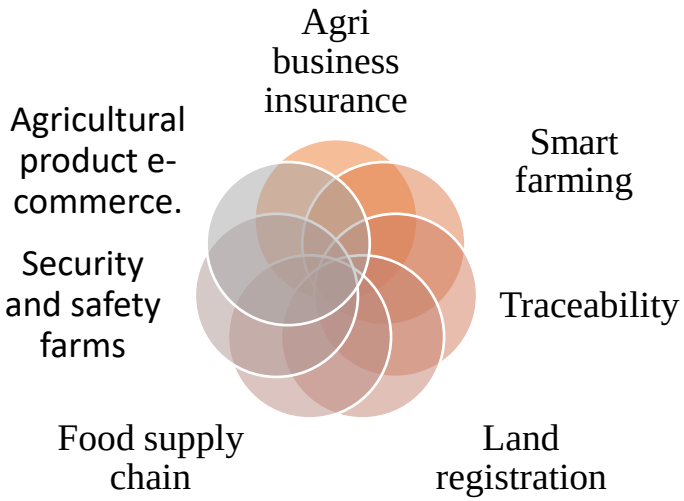
ABSTRACT

The agricultural sector is a vital contributor to the economy of Tamil Nadu, with a significant portion of the population engaged in agricultural activities. However, the supply chain management of agricultural products in Tamil Nadu is faced with challenges such as in efficiencies, lack of transparency, and low profitability for farmers. To address these issues, there is a need to leverage modern technologies to enhance traceability and transparency in the supply chain management of agricultural products. According to Statistics, the global market value of block chain in the food and agriculture market which was about 32.2 million U.S. dollars in 2017 is projected to grow to about 1.4 billion U.S. dollars by 2028.Both Primary and Secondary data has been used for the study. Primary data has been collected from the 514farmers by using simple random sampling method in Coimbatore cluster. The findings of the study shows that the farmers opinion towards agricultural sector towards supply chain management in high mean score values is participating in supply chains enables farmers to have better contact with the govt. officials.

KEYWORDS: Agricultural sector, Block Chain, Modern Technology, Supply chain Management.

INTRODUCTION

Farmers are the most potent stakeholder of fruits supply chains. Hena and Peeyush (2014) described Supply chain management as a wide business process encompassing planning, implementing and controlling the operations of the supply chain which aims at providing the consumers with desirable goods and commodities. Agriculture is a big part of the economy of any country because it helps feed the entire population. It connects and communicates with all of the related industries. If the agriculture base is strong, it is generally regarded as a socially and politically stable society. Many modern farms make use of cutting-edge technology and scientific and technological ideas.[1] Following are some of the most common blockchain applications [2].To make agricultural applications more efficient and reliable, we can divide blockchain applications into four categories. The first is the provenance of traceability and food authenticity[**3**].The second category is smart agricultural data management. The third category is trading finance in supply chain management. The last is the category of other information management systems. In agriculture, collecting data is frequently prohibitively expensive. The blockchain provides a dependable source of truth about the state of crops, inventories, and contracts. Food provenance is tracked using blockchain technology, which aids in the creation of trustworthy food supply chains and develops trust between producers and consumers. It also enables timely payments among stakeholders generated by data changes when used conjointly with smart contracts **[4].**



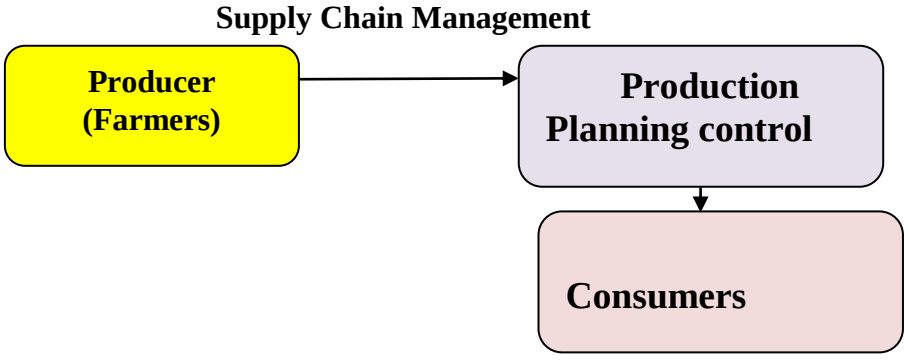
Many characteristics of the blockchain make it unique and promising for future industrial applications. For example, blockchain is decentralized, transparent, immutable, irreversible, autonomous, open-source, ownership, provenance (authenticity and origin), and task automation.Contract automation (smart contracting) eliminates the need for a traditional contract while improving security and lowering transaction costs. Smart contracts are designed with rules and actions that applied to all parties participating in the transaction **[5].**

E-agriculture, or smart farming, refers to building innovative methods to use modern information and communication technologies (ICTs), such as the Internet of Things (IoT), cloud computing, machine learning, big data, and blockchain, to move towards more feasible agricultural and farming practices. Blockchain technology in agriculture is gaining traction because of its ability to move away from the centralized approach that now governs the farm value chain. The new technologies have produced Agriculture 4.0 or smart farming **[6].**

Smart contracts help manage the challenges in implementing the revenue sharing algorithm and improve productivity, transparency, security, traceability, and full integration between supply chain levels.

Smart contracts are considered a flexible type of planning because they provide cost metrics that get used to accomplishing high productivity within plans for producing and delivering products in the context of current market restrictions and then executing the established programs **[7].**All innovation results from an attempt to solve a problem, and blockchain technology is no exception. After learning about the origins of blockchain technology, it is evident that blockchain solves a flaw in existing centralized agricultural systems.

CONCEPTUAL FRAMEWORK



Block Chain technology has the potential to revolutionize the agricultural sector by enhancing supply chain management in several ways. The transparency, security and traceability features of block chain can help address many of the challenges faced by the agricultural supply chain. Here's how block chain can be applied in the agricultural sector.

Traceability

Block chain can create an immutable ledger of every transaction and event in the supply chain. Farmers, processors, distributors, and retailers can record their actions on the block chain, allowing for complete traceability. This ensures that the origin and journey of a product, from farm to fork, can be tracked in real-time. Consumers can scan QR codes on products to access this information, which enhances food safety and quality control.

Reduced Fraud

Block chain's cryptographic features make it extremely secure. Invoices, contracts, and payments can be stored on the block chain, reducing the risk of fraud and ensuring that all parties receive accurate and timely payments. Smart contracts can automate payments when predefined conditions are met.

Efficient Record –Keeping

Farmers can record important data like crop yields, weather conditions, and pesticide usage on a blockchain. This data can be used for analytics and decision-making, helping to optimize agricultural practices and reduce waste.

Supply Chain Visibility

Block chain provides real time visibility into the supply chain. This allows stakeholders to identify bottlenecks, delays, or inefficiencies quickly, making supply chain management more agile and responsive.

Authentication of organic and fair trade labels

The provenance data stored on the blockchain can be used to verify the authenticity of organic, fair trade, or other certifications. This can prevent fraudulent claims and ensure that consumers are getting what they pay for.

Inventory Management

Blockchain can improve inventory management by providing accurate, real-time information about the quantity and location of products in the supply chain. This reduces the risk of overstocking or under stocking.

Smart Contracts

Smart contracts on the blockchain can automate various supply chain processes, such as payments, quality checks, and compliance verification. This reduces administrative overhead and the risk of errors.

Data Sharing and collaboration

Multiple parties in the supply chain can securely share data without the need for intermediaries. This facilitates collaboration and information sharing, leading to more efficient and transparent supply chains.

Quality Control and safety

Block chain can help identify the source of contamination or quality issues in the supply chain more quickly, allowing for targeted recalls and preventing the spread of unsafe products.

Access to Finance

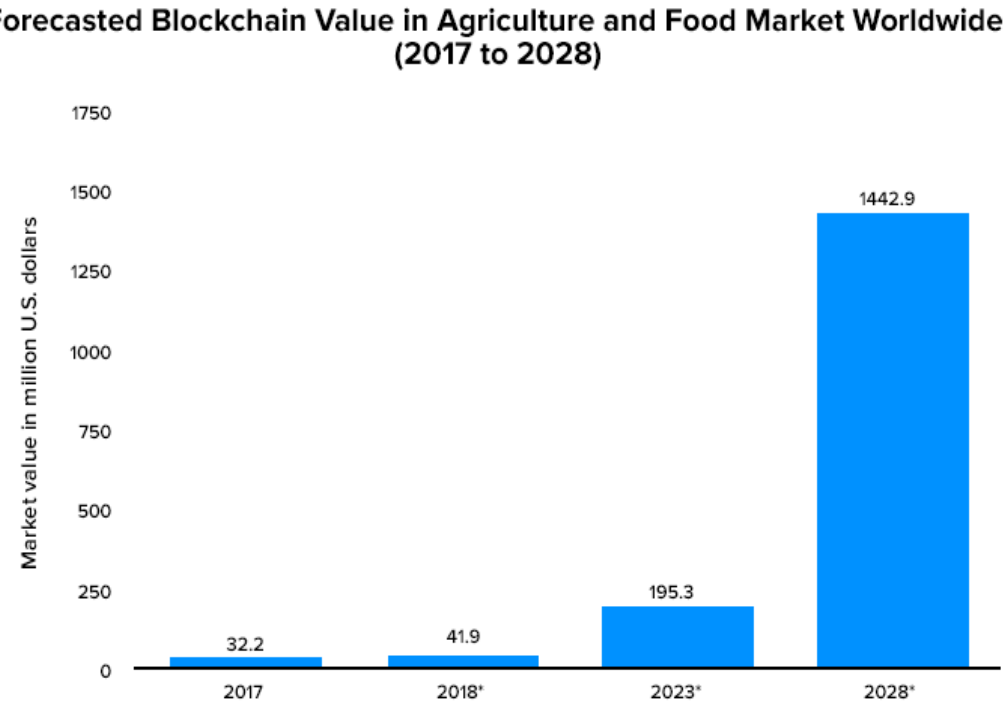
Blockchain can make it easier for small-scale farmers and agricultural businesses to access financing by providing transparent records of their operations and transactions, which can be used as collateral.

Implementing blockchain in the agricultural sector does come with challenges, such as the need for standardization, scalability, and ensuring that all participants in the supply chain are on board. However, as the technology matures and more stakeholders adopt it, it has the potential to greatly improve supply chain management in agriculture, leading to more efficient, transparent, and sustainable practices.

The blockchain for supply chain can transform the agricultural industry by

- Simplifying all stages of the agricultural supply chain.
- Tracking a product along its entire path from farmland to store shelf
- Improving food safety and eliminating counterfeit items

- Reducing financial risks and promoting inclusive trade
- Providing farmers and businesses with access to agricultural financial services
- Generating smarter market data for better decision-making with data science in agriculture
- Legally proving certifications to relevant authorities.



REVIEW OF LITERATURE

Adil El Mane et.al (2022)[1]in their article observed that agriculture supply chain management based on block chain. In this research paper the researcher discussed various smart contracts i.e Smart contracts are composed of codes that analyze collected data and display to members if the sensor results are on the optimum values. These contracts help track the product supply chain by keeping eyes on product identification and detecting the member that holds the product. Furthermore, the block cannot store the data until it is verified and validated by control members, so the case in which an entity can be malicious is significantly minimized compared to other centralized systems. The researcher concluded that block chain and IOT technologies can aid in developing a secure, transparent, open, and innovative ecological agriculture system that involves all participants. This work aims to provide a possible technique to build practical blockchain-based applications and change the agriculture industry, even though the evolution of blockchain and agriculture research studies is still in its infancy.

Nikhil et.al (2021)[2]in their article discussed the review on supply chain management in agriculture empowered byEthereum and IPFS.The researcher discussed various aspects related toIndian agriculture, Traceability, Reliability, BlockChain, and IPFS. The researcher concluded that the current Indian Agro-Food industry is not well organized under any hood. This is an attempt to put things together in an orderly fashion. The concepts that BlockChain brings to the table adds valuable meaning and organization to this distorted Indian Market and agricultural sector. Using the concepts and ideas learned from the referred papers, we conclude that creating a DApp(Decentralized Application) will solve most of the problems we discussed and create an application which acts as a platform for all the stakeholders in the Agro-Food industry to come together and create a better flow of goods and services to people.

XiaonanWanget.al(2020)[3]in their article stated that block chain technology for agriculture towards applications and rationale. The researcher discuss four classes of applications in agricultural and food sectors: agricultural insurance, smart farming, food supply chain, and

transactions of agricultural products. The researcher concluded that the applications of blockchain technology in food supply chains, agricultural insurance, smart farming, and transactions of agricultural products for both theoretical and practical perspectives.

Malaya Dutta Borah et.al (2019)[4] in their article examined that supply chain management in agriculture using block chain and IOT. The researcher described the experimental setup and tools used in the block chain. The researcher concluded that this work implements a user-friendly web-based platform in Agricultural Supply Chain Management using blockchain technology, which is a decentralized secured system to get transparency, enhanced product quality. The producers (farmers) will get fair prices for their produce, and their chances of getting duped by unscrupulous middlemen on account of their illiteracy are greatly reduced. Use of blockchain enables traceability of the asset. From the farmer to the consumer, throughout the supply chain, we can keep trace the asset. We can ensure that the asset has not been tampered with. Also, the whole supply chain will become more accountable. Artificial inflation of prices for the dishonest profit of intermediaries can be curbed. The consumers will also be benefitted as they will not be paying inflated prices for the goods they buy. This, in turn, will improve the overall standard of living of the society.

Bogomolov et.al (2019)[5] observed that block chain technology as efficiency improvement tool for the agricultural sector. Block chain technology is primarily associated with crypto currency, but the potential of this technology is enormous and can be a base not only in finance, but also in other sectors of the economy. The researcher discusses application prospects of block chain technologies in agricultural production. Particular attention is paid to the possibility of the formation of new, more efficient business models at the farm level. Given seven possible areas of using block chain technology in agricultural production, affecting both small farmers and international relations in the field of food security of the member countries of the Eurasian Economic Community.

STATEMENT OF THE PROBLEM

The agricultural sector is a vital contributor to the economy of Tamil Nadu, with a significant portion of the population engaged in agricultural activities. However, the supply chain management of agricultural products in Tamil Nadu is faced with challenges such as inefficiencies, lack of transparency, and low profitability for farmers. To address these issues, there is a need to leverage modern technologies to enhance traceability and transparency in the supply chain management of agricultural products. The integrating blockchain technology into the supply chain management of agricultural products in Tamil Nadu, stakeholders such as farmers, suppliers, processors, distributors, and consumers can have real-time visibility into the entire supply chain process, including the origin, quality, and movement of agricultural products. Blockchain technology can also facilitate the automation of processes such as payments, quality control, and inventory management through the use of smart contracts, reducing the involvement of intermediaries and improving efficiency in the supply chain.

Block chain technology can help address these challenges by providing an immutable and transparent ledger that can be accessed by all parties in the supply chain. This can improve traceability and transparency, allowing consumers to have greater confidence in the quality of the products they purchase. However, several technical and organizational challenges need to be addressed to successfully leverage blockchain technology in supply chain management.

OBJECTIVE OF THE STUDY

The main objective of the study is to analyze the accessibility of block chain in agricultural sector towards supply chain Management in Coimbatore district.

RESEARCH METHODOLOGY

Both primary and secondary data has been collected for the study. The primary data has been collected from the farmers. Coimbatore is a major city in the Indian state of Tamil Nadu. Coimbatore is the second largest city in Tamil Nadu after Chennai. The major production of fruits in Coimbatore district such as Mango, banana, guava, sapota, Amla papaya. The area of fruit crops

is 8201 hectare and 277691 production of fruits metric tons. For collecting the samples the researcher selected the production planning control centres area farmers.

Table 1: Sample Size drawn from various farmers

S.No	Clusters	Samples
1	Anaimalai	100
2	Pichanur	100
3	Pollachi	100
4	Sulur	100
5	Vadakipalayam	100
Total		500

Source: Primary Data

The above sample size for the study is 500 to get adequate samples and error free results 14 samples were added therefore the sample size for the study is 514.

Analysis and Interpretation

Demographic Profile of the farmers

In order to understand the demographic profile of the farmers, percentage analysis was used to identify the personal information like gender, age, marital status, residential status, education, monthly income, monthly savings, years of experience in the field of agriculture and family members engaged in the agriculture work. The Table 1.2 shows the demographic profile of the farmers.

Table 2: Demographic profile of the farmers

Demographic Profile of the farmers	Options	Frequency	Percent
Gender	Male	320	62.3
	Female	194	37.7
	Total	514	100
Age	Less than 30 years	113	22
	31 to 40 years	183	35.6
	41 to 50 years	167	32.5
	51 to 60 years	37	7.2
	Above 60 years	14	2.7
	Total	514	100
Marital status	Married	426	82.9
	Unmarried	45	8.8
	Widowed	43	8.3
	Total	514	100
Educational Qualification	Master Degree	61	11.9
	Degree	95	18.5
	Diploma/ ITI	118	23.0
	Illiterate	215	41.8
	Others	25	4.8
	Total	514	100
Residence	Rural	276	53.6
	Urban	81	15.7
	Semi – Urban	157	30.5
	Total	514	100
Monthly Income	Less than Rs.20,000	265	51.6
	Rs.20,001 to Rs.30,000	119	23.2
	Rs.30,001 to Rs.40,000	65	12.6

	Rs.40,001 to Rs.50,000	57	11.1
	Above Rs. 50,001	8	1.6
	Total	514	100
Monthly Savings	Less than Rs.1,000	265	51.6
	Rs.1,001 to Rs.2,000	119	23.2
	Rs.2,001 to Rs.3000	65	12.6
	Rs.3,001 to Rs.4,000	57	11.1
	Above Rs.4,001	8	1.6
	Total	514	100
Years of experience in the field of Agriculture	Less than 5 years	36	7
	5-10 years	228	44.4
	11-15 years	86	16.7
	16-20 years	129	25.1
	More than 20 years	35	6.8
	Total	514	100
Members of family engaged in agricultural work	Self	192	37.4
	With spouse	254	49.4
	With spouse and children	68	13.2
	Total	514	100

Source: Primary Data

- **Gender:** Among 514 respondents considered for the study, 320 respondents (62.3%) are male and 197 respondents (37.7%) are females. It is observed that majority of the male respondents have borrowed agriculture credit from the financial institutions.
- **Age**: Age of the farmers plays a major role in getting agricultural credit. An Agricultural credit can be given to the farmers by various banks only after the completion of 18 years. Age is one of the most important factors for a human being and age also serves as a yard stick to participate or discontinue in any occupation or profession. Among 514 respondents considered for the study; 113 respondents (22%) were less than 30 years, 183 respondents (35.6%) were in the age group of 31 to 40 years, 167 respondents (32.%)were in the age group of 41 to 50 years, 37 respondents (7.2%) belongs to the age group between 51 to 60 years and 14 respondents (2.7%) were above 60 years. Thus, majority of the farmers contacted are in the age group of 30 to 40 years. Due to the availability of more credit facilities and government subsidies, the middle aged people are motivated to engage themselves in agricultural activities.
- **Marital status:** Marital status gives a person social recognition. It increases the responsibility of a person in the society and in his family. At the same time, a married person gets psychological support and motivation from his life partner while involving in the agricultural business more than an unmarried person. Among 514 respondents considered for the study, 426 respondents (82.9%) are married, 45 respondents (8.8%) are not married and 43 respondents (8.3%) are divorced. Hence, majority of the respondents contacted for the study are married.
- **Educational Qualification:** Education is one of the most important factors that influences a person in the society to a large extent. So an attempt is made to analyze the level of education of farmers. Among 514 respondents considered for the study, 61 respondents (11.9%) are qualified with Master Degree, 95 respondents (18.5%) have completed their degree, 118 respondents (23%) are qualified with diploma/ ITI, 215 respondents (41.8%) are illiterates and 25 respondents (4.8%) are categorized as belonging to other group. The

other category includes Secondary school leaving certificate or Higher secondary certificate. Therefore, majority of the farmers are not formally educated.

- **Residence:** Residence is significant factor to be considered in agriculture. Among 514 respondents considered for the study, 276 respondents (53.6%) belong to rural area, 157 respondents (30.5%) belong to semi-urban area and 81 respondents (15.7%) belong to urban area. Therefore, majority of the respondents are doing agricultural activities in rural area.
- **Monthly Income:** Among 514 respondents considered for the study, 265 respondents (51.6%) have a monthly income of less than Rs.20,000, 119 respondents'(23.2%) monthly income is between Rs.20,001 to Rs.30,000, 65 respondents'(12.6%) monthly income is between Rs.30,001to Rs.40,000, 57 respondents'(11.1%) monthly income is between Rs.40,001 to Rs.50,000 and only 8 respondents'(1.6%) monthly income is above Rs. 50,001. It shows that majority of the farmers' monthly income is less than Rs. 20,000.
- **Monthly Savings:** Among 514 respondents considered for the study, 265 respondents' (51.6%) monthly savings is less than Rs.1000, 119 respondents' (23.2%)monthly savings is between Rs.1001 to Rs.2000, 65 respondents'(12.6%) monthly savings is between Rs.2001 to Rs.3000, 57 respondents' (11.1%) monthly savings is between Rs.3001 to Rs.4,000 and only 8 respondents '(1.6%) monthly savings is above Rs.5,001. It shows that majority of the farmers save less than Rs.1000 per month.
- **Years of experience in the field of agriculture:** Farming experience indicates how long the farmers are engaged in agricultural activities. The period of experience leads to knowledge and patience which give them morale strength to face problems. Experience in the field of agricultural activities is the most important factor for cultivating different crops. Among 514 respondents considered for the study 36 respondents (7%) have less than 5 years of experience, 228 respondents (44.4%) have 5-10 years of experience in the field of agriculture, 86 respondents (16.7%) have 11-15 years of experience in the field of agriculture, 129 respondents (25.1%) have 16-20 years of experience and 35 respondents (6.8%) have more than 20 years of experience in the field of agriculture. Therefore, majority of the respondents are having a high proportion of well experience (5-10 years) in the field of agriculture.
- **Members of family engaged in agricultural work:** The role of family members' is significant in any business. They are the driving force to expand the business to high level. In agricultural activities, family members can involve themselves and support the farmer in the agricultural business by offering financial aids. The researcher has classified the agricultural work into three categories such as self, with spouse and with spouse and children. Among 514 respondents considered for the study, 192 respondents (37.4) have involved themselves in agricultural activities, 254 respondents along with their spouse (49.4) involved in agricultural activities and the remaining 68 respondents (13.2) are engaged in agricultural activities with their spouse and children. Therefore, majority of the respondents are doing agriculture activities with their spouse.

Farmers opinion towards Accessibility of agricultural sector towards supply chain Management – Rank Analysis:

Supply chain management includes movement and storage of raw materials, inventory and finished goods from producers to consumers. Supply chain management can be explained as the flow of plans, materials and services from the supplier to the consumer including the close cooperation between the various entities in supply chain. Supply chain management offers options for improving the efficiency of farmers. There exist variations in the aspirations and expectations of farmers. Their varying degrees of attitude decide their expectations and aspirations. The

successful involvement of farmers in supply chain activities rests on their attitudinal dispositions. Hence understanding their attitude is a prime factor**.** Table 1.3 shows that farmers opinion towards Accessibility of agricultural sector towards supply chain Management.

Table 3: Farmers opinion towards Accessibility of agricultural sector towards supply chain Management – Rank Analysis

S.No	Factors	Mean	Rank
1	Farmers have to sell at low price due to high perishability of the fruits	4.747	2
2	Participating in supply chains helps farmers to have strong research and extension linkages	3.734	9
3	Crop planning and time management are followed by farmers participating in the supply chain	4.145	4
4	Lack of coordination among farmers to increase their bargaining power in the supply chain	3.241	10
5	Participating in supply chains enables farmers to have better contact with the govt. officials	4.891	1
6	Supply chain also enables procurement of frits even in small quantities from farmers	3.863	5
7	Transparency is lacking in supply chain management approach	4.229	3
8	Supply of packaging materials in the supply chain is not regular	3.725	8
9	Supply chain makes post-harvest losses	3.737	7
10	Supply chain management ensures to provide technical guidance to farmers	3.850	6

Source: Primary Data

From the rank analysis performed using the overall mean score on factors, the following factors are found to be important in influencing the farmers to accessibility of agricultural sector towards supply chain Management; it is inferred from the table that out of 10 variables the high mean scored variables are participating in supply chains enables farmers to have better contact with the govt. officials (4.891), Farmers have to sell at low price due to high perishability of the fruits (4.747),Transparency is lacking in supply chain management approach (4.229). The above variables are farmers' opinion towards Accessibility of agricultural sector towards supply chain Management. It is concluded that the farmers opinion towards agricultural sector towards supply chain management in high mean score values is participating in supply chains enables farmers to have better contact with the govt. officials.

CONCLUSION

Indian agriculture is unique in many ways. With abundant arable land, water and bio-diversity and a large population accustomed to agriculture as a way of life, no country is better placed than India in bringing about agriculture-led prosperity. But agriculture in India needs some critical management inputs, particularly that of supply chain management (SCM). Agri-business can realise its full potential by applying the principles of SCM- collaboration among various stake-holders, non-exploitative vertical and horizontal integration, market reforms, precision farming, contract farming, demand-led diversification and the extensive and intensive use of information technology for real-time communication across the chain. The supply chain concept is still nascent in Indian agriculture. However the need for the same, at this stage, is more than ever before because of the challenges unleashed on the competitiveness of the Indian agribusiness by deregulation and globalization. An essential first step in the process is to assess the current supply chain capability. A beginning has been made and large number of Indian agri based organizations today are realizing the importance of developing and implementing a comprehensive supply chain strategy - and then linking that strategy to deliver bottom line results.

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