RESEARCH ARTICLE

Dynamics of agriculture value chain finance: A systematic literature review

Sapna Arora*

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Purpose: The study assesses the dynamics and effectiveness of value chain financing in the agricultural sector.

Methodology: The study investigates the potential and pitfalls of using value chain finance in agricultural systems. Following PRISMA principles, a thorough literature analysis found 152 relevant papers after a quality review published from 2007 to 2023, which revealed information about the validity and rigor of studies and methods.

Results: This study emphasizes the critical role of agricultural value chain financing in increasing credit availability, reducing risk and strengthening farmer market links. Value chain financing favors the agricultural industry, increasing production, profitability and farmers' livelihoods. It accelerates growth and helps stakeholder access credit, working capital and investment opportunities. Challenges include limited financial availability, illiteracy, debt, contractual flexibility and governance. Capacity building programs and supportive policies are critical for long-term agricultural development and inclusive growth.

Originality: This study stands out by finding valuable solutions for farmers, policymakers and financial entities aiming to foster inclusive and enduring agricultural progress. It delves into influential elements and presents diverse agricultural remedies for farmers and policymakers.

Key Words: *Agriculture value chain finance; Financial models; Inclusive growth PRISMA; Revitalizing agricultural prosperity*

INTRODUCTION

The world recognizes agriculture's potential as a market-driven engine for economic growth, enhancing regional and international agricultural value chains. The financial system is crucial in meeting global demand and expanding the agricultural value chain. Encouraging agro-based businesses can create economic diversification and employment opportunities, especially for rural youth. Agricultural Value Chain Finance (AVCF) resolves financial restrictions for increased agricultural production, economic expansion and food security. Value chain finance is value-added and marketing processes in a chain to determine financial needs and how to best provide financing to those involved.

As we approach the area of AVCF, numerous crucial questions emerge. First, what problems do farmers encounter in securing cost-effective financing? Farmers face challenges accessing financial benefits due to financial illiteracy, inadequate infrastructure and perceived risk, lack of collateral, high-interest rates and complex agricultural value chains. Limited awareness of value chain finance hinders small producers, who face obstacles in obtaining financial investment compared to larger counterparts. Value Chain Finance (VCF) addresses these challenges in the agricultural sector, providing increased market connections, lower risk, inclusive growth, technology adoption, capacity building and policy assistance [1]. Farmers can diversify by creating value-added products such as dried mushrooms, mushroom powder, pickles, cookies, noodles and extracts for longer shelf life and higher value. Secondly, how financial institutes customized their services to satisfy the different actors within the value chain? Flexible finance, such as tailored repayment schedules or crop linked choices, fits with farmers' income patterns, resulting in increased financial flexibility. AVCF consists of self-sustaining finance, informal finance inside the direct value chain and formal finance that indirectly supports the value chain. Self-financing allows farmers to use their savings, personal loans or profits for production and marketing. Informal finance in the direct value chain occurs when farmers obtain credit from value chain participants without formal agreements or collateral [2]. Farmers involved mainly in indirect formal financing. Understanding such finance is critical to supporting farmers and agribusiness players across the agricultural value chain. Lastly, how has technology improved the financial chain? Digitization streamlines the financing procedure for farmers utilizing online platforms, smartphone apps and digital documents. It eliminates the administrative effort and promotes rapid access to financing. Cooperation between farmers, agribusinesses and buyers via contract farming agreements gives secured markets, access to credit and technical assistance [3]. The research identifies gaps in existing studies: Limited exploration of VCF's impact on agricultural sector growth, insufficient understanding of financial dynamics within value chains and inadequate financial support. Addressing these requires insights into stakeholder roles, efficient supply chains and technology integration. Opportunities like adopting new technologies, entering certification programs and expanding export markets can enhance agricultural profitability and sustainability. This paper explores factors, constraints, financing models of AVCF, revealing challenges, opportunities and best practices.

In order to extend credit in agri-business, identifying and managing risk is crucial. The study fills the research gap in value chain finance and introduces a value chain framework Strategies such as interdependent financing, contractual financing and cascade financing are recommended to help smallholder farmers reduce their financial risk [3]. The importance of financial operators providing innovative and reasonably priced services is also emphasized by the report. There are policy recommendations for improving the agricultural value chain's efficacy and inclusivity [4]. Training and capacity building for farmers can mitigate risks for financial institutions, requiring a solid risk appetite and supportive skills for AVCF. Challenges like information asymmetry, infrastructural limitations and underutilization of technology persist. The study advocates an ecosystem approach, emphasizing social and trade capital to lower transaction costs and risk [5]. It recommends inclusive AVCF ecosystems with balanced participation and support from governments and development agencies measures include the facilitation of AVCF, the establishment of a credit information bureau, capacity building of financial institutions and promotion of digital financial services. The study highlights credit matching technology, the mix of digital and analog tools, extension services, marketing linkages and the role of AVCF digital equipment in incentives, customer value, business models, barriers and technological advancements [6]. Key barriers in agriculture

Department of Food Business Management and Entrepreneurship Development (FBMED), National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Sonipat, India

***Correspondence:** Sapna Arora, Department of Food Business Management and Entrepreneurship Development (FBMED), National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Sonipat, India; E-mail: drsapna.niftem@gmail.com*

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include limited rural internet access, farmers' digital unfamiliarity and financing gaps for agri-fintech. Current research focuses on Information and Communication Technology (ICT), trust, governance, flexibility and innovation in value chain finance to enhance smallholders' creditworthiness. It emphasizes using ICT for strong linkages, governance structures and efficient financial products. The study stresses value chain financing institutions supporting farmers to boost food production and incomes with favorable interest rates. It also highlights engaging stakeholders beyond the supply chain for successful financing model implementation, sustainability and capacity building [7].

MATERIALS AND METHODS

This study employed a systematic review method to examine the existing literature on AVCF, following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) statement. The primary goal of this review was to analyze financial access enhancement and investment optimization strategies across different regions [8]. This research study utilized a systematic search approach to evaluate relevant literature on financial accessibility and investment levels. Scopus and Google Scholar were the sources and databases used. To achieve this, an extensive search was conducted encompassing papers published between 2007 and 2023, 16 years window due to the scarcity of literature on the subject. Various search terms were utilized, encompassing key aspects of agricultural finance such as "value chain finance," "agricultural supply chain finance," "agricultural credit" and "financial inclusion in agriculture, “Models of value chain finance in agriculture”, “challenges to value chain finance”. In addition, the review acknowledges the challenges within the agricultural finance sector. The approach highlights diversity by considering various sources, including case studies, conference proceedings, reports and indexed journals. With a comprehensive review using databases and scholarly journals, 152 articles were carefully selected for final analysis through the PRISMA method. The researchers employed a systematic data mining approach to explore key aspects related to AVCF and agricultural financial evaluation. By investigating different models, financial constraints, influencing factors and innovative approaches aimed at revitalizing agricultural productivity through value chain financing, this study not only contributes valuable insights but also enhances our understanding of AVCF and related fields (Figure 1) [9].

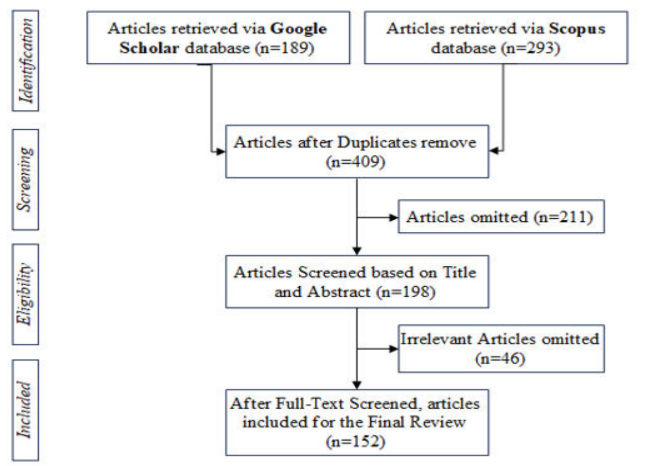

Figure 1) *Visual representation of article selection using PRISMA methodology*

RESULTS AND DISCUSSION

Comparative analysis of different models of agricultural value chain finance

The comparative analysis presented in Table 1 provides insights into the different models of agricultural value chain finance. Each model has its distinct features, benefits, limitations and impacts on the agricultural sector [10]. The discussion below provides a detailed analysis of the findings.

TABLE 1
Comparative analysis of different models of agricultural value chain finance

Financing model	Features	Benefits	Limitations
Collaborative financing	Collaborative financing approach	Enhanced coordination among actors	Limited access to formal credit
	Joint liability of value chain actors	Reduced transaction costs	Lack of scalability
	Inclusion of small-scale farmers	Risk-sharing mechanism	Challenges in repayment collection
Contract-based financing	Contract-based financing	Guaranteed market access	Limited flexibility in contracts
	Long-term agreements with buyers	Stable prices and income	Dependence on buyer’s integrity
	Integrated supply chain	Lower transaction and negotiation costs	Information asymmetry
	Provision of technical assistance	Improved productivity and efficiency	Limited access to formal credit
Rural cooperative financing	Rural cooperative financing	Collective bargaining power	Governance and management challenges
	Member-owned and democratically controlled	Lower interest rates	Limited financial resources
	Shared risks and profits	Mutual support and networking	Limited capacity for scaling up
	Provision of input and output services	Enhanced marketing opportunities	Lack of professional expertise

Collaborative financing: Collaborative financing is a model that brings together various stakeholders in the agricultural value chain, including government bodies, private entities, agencies, companies and farmers. Primary goal is to enhance coordination, reduce transaction costs, strengthen market connections and ensure fair pricing for agricultural products. Collaborative financing's joint liability mechanism encourages risk-sharing, boosting productivity and profitability for farmers. It promotes inclusivity by enabling small-scale farmers to participate. However, challenges like limited financial resources, insufficient collateral and paperwork hindering scalability. Addressing these is crucial for collaborative financing's long-term viability in agriculture.

Contract-based financing: Contract based financing is a widely utilized model in agricultural value chain finance [11]. It operates through long-term agreements established between farmers and buyers, ensuring guaranteed market access and stable prices. This approach streamlines transaction processes, reducing negotiation costs. Technical assistance enhances productivity, efficiency and the adoption of sustainable practices in agriculture. Contract-based financing mitigates risks related to price fluctuations and uncertain market conditions, promoting better agricultural practices and fostering collaboration and trust between farmers and buyers. Prioritizing transparency and fairness in contract based financing arrangements is essential to safeguard farmers' interests and enable informed decisions.

Rural cooperative financing: Rural cooperative financing is a cooperative approach to agricultural value chain finance that involves farmers pooling resources and engaging in financial activities. This model offers collective bargaining power, enabling farmers to negotiate higher commodity prices and access banking services at cheaper interest rates. It fosters mutual support and networking *via* Farmer Producer Organizations (FPO) and Self-Help Groups (SHG), promoting community and collaboration. Establishing cooperatives provides a platform for farmers to voice concerns, address common challenges, reduce reliance on external financial institutions and foster self-reliance. However, scaling up the model faces challenges due to resource constraints and governance issues. Capacity-building initiatives and supportive policies are crucial for overcoming limitations.

Comparative analysis of collaborative financing, contract-based financing and rural cooperative financing models in agricultural value chain finance reveals their unique features, benefits and limitations. These models improve access to finance, market linkages and empower farmers. Policymakers and stakeholders should consider these factors when designing appropriate financing strategies to foster sustainable agricultural development, improve livelihoods and achieve inclusive growth in the agricultural sector [12].

Financial constrains

Access of finance: Access to financing in agriculture, particularly for small farmers, is limited, hampering investment in modern methods and output growth. Stringent requirements, paperwork and credit history impede small farmers' access to loans, reducing productivity and participation in higher-value activities. Although the government provides formal financial services through cooperative banks, Regional Rural Banks (RRBs) and rural commercial banks, many lack access due to insufficient collateral, reluctance to visit banks and document complexity [13]. This information gap and lack of collateral make lending to these farmers risky. Expanding bank branches in rural areas and hiring trained personnel to assist farmers in accessing lending sources are suggested. High service quality, quick loan approval and minimal paperwork are essential for increased institutional finance usage. Lower interest rates and longer payback periods may improve farmers' acceptance of institutional financing. Governments, banks and agricultural groups must collaborate to address financial constraints. Customized financial inclusion plans, literacy training, streamlined loan processes and collateral options can increase funding availability and promote active participation in the agricultural value chain.

Financial illiteracy: Limited financial literacy hinders farmers' access to finance and decision-making. Poor debt knowledge correlates with higher numerical and probability abilities. Education and financial experience improve cognitive abilities, with math proficiency linked to financial awareness and debt literacy. Risk aversion diminishes financial ability, while cash crop farmers with external inputs display greater debt awareness. The banking system enhances financial inclusion, yet farmers' limited financial awareness hampers their use of appropriate financial tools for agricultural activities. This hinders comprehensive financial planning, resource allocation and cash flow management, leading to financial instability and restricted finance access. Suboptimal choices and reluctance to access finance impede agricultural productivity and growth. Governments and banks should conduct training programs and campaigns in rural areas to enhance financial inclusion and rural development. Financial literacy empowers rural individuals to make informed decisions, access financial services and contribute to economic well-being.

Seasonality and cash flow challenges: Cash flow variability in agriculture poses significant challenges for farmers, affecting their working capital, repayment schedules and access to formal finance. Seasonal income and limited assets also hinder farmers from providing loan collateral, as financial institutions typically require it [14]. Agriculture's perceived risk, including weather-related and market fluctuations, prompts risk-averse behavior from lenders, leading to strict lending criteria, higher interest rates and limited credit availability. Innovative financial solutions and risk management strategies are needed. Flexible financing, crop-linked financing, agricultural insurance, income-smoothing mechanisms and supply chain financing can mitigate cash flow variability and enhance farmers' creditworthiness. These solutions address seasonality and cash flow challenges, improving working capital, investment opportunities and financial stability. Collaboration among policymakers, financial institutions, stakeholders and farmers is crucial for successful implementation, to develop financial products, establish regulatory frameworks and raise farmer awareness.

Weak value chain coordination: The agriculture sector faces challenges including farmer distress, slow growth, low productivity, price slumps and unsold produce wastage. Inadequate value chain coordination hampers farmers' access to finance and market linkages, affecting income and formal finance access. Uncertain demand and price fluctuations further complicate market predictions for farmers. Price volatility and uncertain demand hurt farmers' profits, affecting investment planning and financial obligations. Challenges like poor economies of scale, weak negotiation power, inadequate market connections and information asymmetry raise transaction costs for small farmers. Perishable crops face higher marketing costs due to complex frameworks and middlemen, leading to unethical practices, low prices and market inefficiency. Addressing these challenges is crucial for improving livelihoods, income and food security. Innovative products, delivery based contracts and indirect futures use can boost confidence and facilitate futures use. Policies should cut transaction costs, enhance connectivity and provide market information and infrastructure. Strengthening institutional support for contract farming and FPOs can boost farmers' participation in value chains and futures markets.

Influencing factors in the adoption of AVCF: The adoption of AVCF by firms is influenced by various factors, including operational, financial, relationship, technological and informational aspects. Policymakers, financial institutions and stakeholders must understand these factors to develop effective strategies and interventions to facilitate farmers' adoption of AVCF.

Operational factors: Operational processes are essential for the smooth flow of agricultural produce within the value chain [15,16]. Factors affecting AVCF adoption include value chain coordination, efficient supply chain management, timely disbursement and repayment, supportive infrastructure and policy and regulatory support. Value chain coordination involves various actors collaborating to minimize bottlenecks and ensure smooth flow of goods and services. Efficient supply chain management reduces wastage, improves product quality and enhances farmers' market access. Timely access to finance for working capital, input investment and production management is crucial for farmers. Financial institutions with efficient disbursement processes and flexible repayment options promote value chain finance adoption. Adequate infrastructure, like storage facilities and market linkages, enhances value chain operations, reducing post-harvest losses and providing access to better markets. Favorable legislation promotes inclusive finance, driving the adoption of value chain finance in agriculture. Stakeholders can promote successful utilization of value chain finance through coordination, supply chain optimization, financial services, infrastructure investment and favorable policies.

Financial factors: Research identifies financial factors influencing VCF adoption in agriculture, like working capital, credit availability, interest rates, collateral requirements, loan terms, supportive institutions and government schemes. Access to credit bridges funding gaps and facilitates value chain activities. Financial institutions offering tailored solutions are more likely to encourage VCF adoption. Competitive interest rates and transparent pricing are crucial for farmers.

Traditional collateral requirements, like land ownership, can hinder smallholder farmers' access to VCF. Inclusive approaches, such as crop inventories or farmer association guarantees, can broaden access. Loan repayment terms are crucial for farmers and financial institutions with agricultural expertise, tailored products and personalized support gain farmers' trust and acceptance. Collaboration between financial institutions and other value chain stakeholders fosters VCF adoption. Government initiatives offering incentives stimulate VCF adoption. Addressing financial factors through targeted interventions encourages farmers to adopt VCF.

Relationship factors: Trust, support, collaboration, responsiveness, long-term partnerships and value chain networks are crucial for facilitating finance flow. Trust is built upon transparent practices and reliable financial services [17]. Collaborative efforts among growers, suppliers, manufacturers, sellers and financial institutions enhance coordination and reduce transaction costs. Responsiveness is a key relationship factor, as financial institutions that demonstrate responsiveness to farmers' needs are more likely to attract their interest and participation. Long-term partnerships facilitate knowledge sharing, joint investments and continuous support, enabling farmers to access finance at different stages of the value chain. Farmer cooperatives and collective action platforms pool resources negotiate better terms and access value chain finance collectively, enhancing farmers' bargaining power and fostering shared responsibility and mutual support. A well-connected value chain network offers farmers increased market access, information flow and business opportunities. Fostering positive and collaborative relationships among participants can create an environment conducive to the adoption and utilization of value chain finance by farmers.

Technological factors: The adoption of AVCF is driven by technological factors, including digital infrastructure and fintech innovations like block chain and IoT which revolutionize financial services delivery and access for farmers, enabling seamless transactions, information sharing and communication within the value chain. Robust digital infrastructure reduces geographical barriers, improves transaction speed and accuracy and enables real-time information exchange [18]. Fintech innovations, like block chain and IoT, have greatly influenced AVCF adoption, addressing farmer challenges by providing secure, transparent record-keeping and reducing fraud risk, fostering trust among value chain participants. These technologies have the potential to revolutionize supply chain finance by providing transparency, accountability and efficiency in financial transactions. IoT devices and sensors generate real-time data on agricultural production and processes, enabling data-driven decision making and enhancing financial inclusion, streamlining processes and enhancing transparency within the agricultural sector.

Informational factors: Within the realm of agricultural finance, several informational factors have been widely discussed in the literature. These factors include financial literacy and awareness, reliable market information, transparent pricing and fair-trade practices, financial advisory services and capacity building and training. Understanding and addressing these factors are crucial for promoting the effective adoption of value chain finance by farmers. Financial literacy and awareness are key for empowering farmers to make informed financial decisions. It involves equipping farmers with the knowledge and skills to understand financial products, manage their finances effectively and evaluate the benefits and risks associated with value chain finance. Access to reliable market information is crucial for farmers to adopt value chain finance effectively [19]. They need up-to-date data on market trends, pricing and quality standards to make informed decisions about their production, marketing and financial strategies. Transparent pricing and fair trade practices are essential elements that build trust and confidence among farmers in value chain finance. Access to financial advisory services is vital for farmers to navigate value chain finance complexities. Advisors offer personalized guidance on financial planning and risk management. Capacity building programs cover financial management, risk assessment and business planning. By addressing these factors, stakeholders empower farmers to utilize value chain finance effectively, enhancing agricultural productivity and profitability. The literature explores factors influencing AVCF acceptance and adoption. Categorizing these factors into broader groups helps understand and analyze them, identifying common themes and identifying overlaps. Table 2 presents five distinct categories, providing a structured approach to comprehensively examine these factors in a systematic manner.

TABLE 2
Classification of factors

Operational factors	Financial factors	Relationship factors	Technological factors	Informational factors
Value chain coordination	Availability of working capital and credit	Trust and support	Digital infrastructure	Financial literacy and awareness
Efficient supply chain management	Interest rates and cost of finance	Collaboration	Fintech innovations	Reliable market information
Timely disbursement and repayment	Collateral requirements	Responsiveness		Transparent pricing and fair trade practices
Supportive infrastructure	Loan repayment terms	Long-term partnerships		Financial advisory services
Policy and regulatory support	Supportive financial institutions	Cooperative and collective action		Capacity building and training
	Government schemes and support	Value chain network		

Revitalizing agricultural prosperity through innovative value chain finance approaches

Agriculture is essential for economic development and food security globally. Yet, many farmers and value chain actors struggle to access affordable financing, hindering sustainable prosperity. After studying relevant literature, several solutions and approaches have been identified:

The literature review highlights innovative Value Chain Finance (VCF) solutions that can contribute to sustainable and eco-friendly rural development. Agricultural credit is the most widely discussed solution, emphasizing its significance in providing farmers with access to necessary funds. Trade credit, interlinked credit and green credit are explored as value chain finance approaches aimed at promoting sustainable agricultural practices. Supply chain financing is crucial, offering tailored financial solutions such as micro-financing, integrated financing, rural financing, structured financing, smart financing, informal financing, institutional financing, purchase order financing and accounts receivables financing. Factoring, reverse factoring and working capital management are essential techniques for efficient capital utilization and smooth functioning [20]. Bank guarantees are financial instruments provided by banks to secure farmers' obligations and reduce risks. Promoting financial literacy and inclusion among farmers is crucial for this. Improving their financial knowledge and access to services fosters inclusive agricultural value chain development. Risk identification and mitigation strategies, value stream mapping and risk aversion techniques help identify risks and opportunities for improvement. Technology integration in agriculture connects farmers with markets and financial institutions through online platforms. Government initiatives, like subsidies and crop insurance, support value chain development and resilience. Social investments in agricultural value chain finance foster long-term prosperity by integrating environmental and social factors into financial decisions. Contract farming mitigates production, price and marketing risks, offering farmers secure market outlets. Side selling encourages entrepreneurial thinking, diversifying income streams and unlocking new opportunities. Revitalizing agricultural prosperity involves innovative VCF methods like financial solutions, tech advancements, policy interventions and risk management. These empower farmers, drive rural development and foster positive change.

CONCLUSION

Agricultural value chain finance has transformative effects by addressing financial constraints, enhancing productivity and improving market access for farmers. The research highlights the significance of value chain finance in driving agricultural development and supporting agriculture finance.

The findings underscore the positive effects of value chain finance on the agricultural sector, emphasizing increased productivity, profitability and improved livelihoods for farmers. Value chain finance addresses financial needs at each stage, enabling stakeholders to access credit, working capital and investment opportunities, while improving market linkages for farmers. The research emphasizes collaborative, contract based and rural cooperative financing within the agricultural value chain. It highlights addressing challenges like limited credit access, repayment collection, contract flexibility, information asymmetry, resource constraints, governance and scaling to maximize these financing models' benefits. Capacity building and supportive policies drive sustainable agricultural development, improve livelihoods and foster inclusive growth. Addressing challenges and leveraging value chain finance models promote sustainable agricultural development, improved livelihoods and inclusive growth.

The findings stress understanding financial dynamics and challenges at each stage for appropriate farmer support. Improving access to affordable energy, credit and inputs, along with fostering market linkages, benefits the industry. Addressing financial challenges through rural banking, financial literacy and innovative solutions empowers farmers. Strengthening value chain coordination and supporting initiatives like contract farming and Farmer Producer Organizations (FPOs) enables market access. Collaboration among stakeholders and institutions is crucial for driving positive change and promoting sustainable rural development in the value chain.

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