**“Study on Risk and Return Appraisal for Lending to Agriculture Sector by Selected Public Sector Banks in Meerut Division”**

**Chapter 1**

**Introduction**

**1.1 History and Background of the Agriculture Sector**

Agriculture was always considered to be the main pillar of Indian economy. Since ancient times, the majority of India’s population has depended upon farming for livelihood and subsistence. The subcontinent’s fertile river valleys—such as those of the Indus, Ganga, and Godavari—enabled the growth of civilizations where cultivation of wheat, rice, pulses, and cotton flourished (Sharma, 2011). Traditional Indian agriculture was largely subsistence-oriented, rain-fed, and reliant on family labor, with little specialization or surplus production. For centuries, productivity remained low due to dependence on traditional seeds, organic manure, and rudimentary implements like wooden ploughs. Despite this, agriculture shaped the cultural and economic fabric of society by providing food, raw materials, and employment to a vast rural population.

During the colonial period, agriculture underwent structural distortions that had lasting consequences. The introduction of exploitative land tenure systems such as the Zamindari, Ryotwari, and Mahalwari arrangements subordinated cultivators to landlords and revenue officials (Blyn, 1966). Farmers were compelled to pay high land revenue irrespective of output, often leading to indebtedness and distress sales. Furthermore, colonial policies prioritized commercial crops like indigo, cotton, and jute for export to Britain, while food grain production stagnated. This imbalance contributed to recurring famines, the most devastating being the Bengal Famine of 1943, which claimed millions of lives (Sen, 1981). By the time of independence in 1947, Indian agriculture was trapped in a vicious cycle of low productivity, poor infrastructure, and widespread rural poverty.

In the immediate post-independence years, the government recognized the centrality of agriculture in achieving food security and national development. Several reforms were introduced, beginning with land reforms aimed at abolishing intermediaries and redistributing land to tillers. Community development programmes launched in the 1950s sought to improve irrigation, rural credit, and extension services. However, progress was uneven, and productivity remained stagnant through the 1950s and early 1960s (Rao, 2000). Food shortages became acute, compelling India to rely heavily on imports under the U.S. Public Law 480 (PL-480) programme, which left the country vulnerable to external pressure.

The mid-1960s marked a watershed in Indian agriculture with the advent of the Green Revolution. Spearheaded by scientists such as M. S. Swaminathan, Norman Borlaug, and supported by policy interventions, the Green Revolution introduced high-yielding varieties (HYVs) of wheat and rice, chemical fertilizers, pesticides, and improved irrigation infrastructure. The government also offered assured procurement prices through the Food Corporation of India (FCI) and expanded institutional credit facilities via nationalized banks and cooperatives. This combination of technology and supportive policies dramatically increased food grain production, particularly in Punjab, Haryana, and Western Uttar Pradesh (Frankel, 1971). By the 1970s, India had achieved self-sufficiency in food grains, a remarkable transformation from the “ship-to-mouth” situation of the previous decade.

While the Green Revolution significantly boosted food security, it also had limitations. The benefits were concentrated in regions with assured irrigation, fertile soils, and better infrastructure, leaving rain-fed and resource-poor areas behind (Shiva, 1991). The overuse of chemical fertilizers and groundwater extraction led to soil degradation and declining water tables. Moreover, the emphasis on wheat and rice reduced crop diversity, making farming systems more vulnerable to pests, diseases, and climate variability. Thus, while the Green Revolution succeeded in preventing famines, it also created new ecological and socio-economic challenges.

From the 1980s onward, Indian agriculture began to diversify beyond staple cereals. The “White Revolution” spearheaded by the National Dairy Development Board (NDDB) under Verghese Kurien transformed India into the world’s largest milk producer. Horticulture, fisheries, and poultry emerged as vibrant sub-sectors, contributing to nutritional security and rural incomes (Birthal et al., 2015). This diversification was supported by targeted government programmes, credit flows, and the rising demand from urban consumers. Agriculture thus evolved into a more complex sector, encompassing not just subsistence farming but also commercial production and agribusiness linkages.

Despite these advances, the structural challenges of Indian agriculture persist. The sector remains heavily dependent on the monsoon, with around 50% of net sown area still rain-fed (Government of India, Economic Survey, 2022–23). Farm holdings are increasingly fragmented, with nearly 86% of farmers classified as small and marginal, owning less than two hectares of land (NABARD, 2021). Such small-scale operations limit the ability of farmers to invest in modern inputs, mechanization, or risk management strategies. Low productivity in several crops, coupled with post-harvest losses, continues to depress farm incomes.

The vulnerability of farmers has been further exacerbated by price volatility and climate change. Globalization has integrated Indian agriculture with world markets, exposing farmers to fluctuations in commodity prices. Climate-related risks such as erratic rainfall, floods, droughts, and heatwaves are becoming more frequent, undermining yield stability (IPCC, 2022). These factors have led to widespread distress in rural areas, reflected in issues such as indebtedness, rising non-performing assets (NPAs) in agricultural credit, and even farmer suicides in certain regions (Deshpande & Arora, 2010).

Nevertheless, agriculture continues to play a pivotal role in the Indian economy. In 202223 1820 percent of Indian Gross Domestic Product is contributed by the industry and 4245 percent postulated to jobs (Government of India, 2023; World Bank, 2023). Agriculture is a crucial source of food security, poverty alleviation and sustainability of rural livelihoods in addition to its economic role. It also promotes the other ancillary industries like textiles, sugar, food processing and bio-energy, which makes it an icon of Indian growth pattern as a whole.

In recent years the policy has put renewed focus on revitalization of agriculture in the form of the Pradhan Mantri Fasal Bima Yojana (PMFBY), e-NAM (National Agriculture Market), soil health card programs, and the online delivery of credit. There is also an attempt to popularize climate-smart agriculture, organic farming, and value-chain integration to ensure farming becomes sustainable and rewarding. At the same time, it is also important to mention the continuing relationship between a financial sector and the agricultural industry since the financing of farmers using institutional credit that is provided by the public bank system, the regional rural banks, and cooperatives is the people that keep them afloat.

To conclude, the history of agriculture in India is the history of a transition between subsistence-oriented traditional agricultural production to modern, technology-intensive, and diversification. Although landmark performances like food self-sufficiency, diversification, and world leadership in milk production are conspicuous, small holdings, resource degradation, climate change and rural distress are common challenges in the sector. This evolution is critical in understanding the current problems in agricultural credit, risk-return activities and the involvement of the public sector Bank in maintaining rural development.

**1.2 Significance of Agriculture in the Indian Economy**

Agriculture holds the central stage in the economic, social and cultural life of India. Despite the fact that the country has been in the process of a high industrialization and service sector in the recent decades since the foundation of the country, the agriculture sector remains the pillar of the economy. Besides giving food and raw materials, it also keeps many people in the rural areas on their feet. The significance of the sector is seen by the national income generated, the employment rate, exports, and food security. Agriculture is vital in inclusive and sustainable growth despite its declining share in the Gross Domestic Product (GDP) as time goes by.

**1.2.1 Contribution to GDP**

The share of agriculture in India’s GDP has steadily declined since independence, reflecting the structural transformation of the economy. At the time of independence in 1947, agriculture contributed nearly 55% of GDP (Chand, 2014). With the expansion of industry and services, this share declined to about 30% in the early 1990s, and further to around 18–20% in recent years (Government of India, Economic Survey 2022–23). However, this relative decline does not mean a reduction in the absolute importance of agriculture. The sector’s output has grown consistently, with gross value added (GVA) in agriculture increasing at an average annual rate of 3–4% over the past two decades.

The COVID-19 pandemic of 2020–21 reaffirmed the resilience of agriculture. While most sectors of the economy contracted, agriculture registered positive growth of 3.4%, cushioning the overall GDP decline (World Bank, 2021). This underscores the sector’s role as a stabilizing force in times of crisis. Moreover, agriculture’s linkages with industry—such as agro-processing, textiles, sugar, and food manufacturing—contribute significantly to overall economic performance. Thus, even though agriculture’s GDP share is shrinking, its indirect contributions through forward and backward linkages remain substantial.

**1.2.2 Employment Generation**

Agriculture is the single largest source of employment in India. According to the Periodic Labour Force Survey (PLFS) 2021–22, nearly 45% of the workforce is engaged in agriculture and allied activities. This figure is far higher than agriculture’s share in GDP, indicating low labor productivity in the sector compared to industry and services (NITI Aayog, 2020). Nevertheless, agriculture serves as a crucial safety net, absorbing surplus labor from rural areas and providing subsistence to millions of households.

The employment role of agriculture is particularly significant for vulnerable groups. Small and marginal farmers, agricultural laborers, women, and landless workers depend heavily on farm-based occupations. Seasonal peaks in labor demand, such as sowing and harvesting, also create temporary employment opportunities. Moreover, allied activities like dairy, poultry, and fisheries are increasingly supplementing rural livelihoods. Although the challenge remains to raise productivity and incomes, agriculture’s role in employment generation ensures social stability and prevents mass urban migration.

**1.2.3 Contribution to Exports**

Agricultural exports form an important part of India’s external trade. India is one of the largest producers and exporters of a wide range of agricultural commodities, including rice, wheat, spices, tea, coffee, marine products, and cotton. In 2021–22, agricultural and allied products exports crossed USD 50 billion for the first time, accounting for nearly 11% of the country’s total exports (APEDA, 2022). India is the world’s largest exporter of rice and spices and ranks among the top exporters of sugar, buffalo meat, and marine products.

The export performance of agriculture is crucial not only for earning foreign exchange but also for enhancing farm incomes and integrating farmers into global value chains. It generates employment in packaging, processing, and logistics, thereby supporting rural non-farm sectors as well. However, agricultural exports remain vulnerable to global price volatility, non-tariff barriers, and sanitary and phytosanitary standards. Despite these challenges, India’s growing share in world agricultural trade demonstrates the sector’s potential as a driver of export-led growth.

**1.2.4 Ensuring Food Security**

Perhaps the most critical role of agriculture in India lies in ensuring food security for a population of over 1.4 billion. The Green Revolution of the 1960s and 1970s transformed India from a food-deficit country to a self-sufficient and, in some commodities, surplus nation. Today, India is not only self-reliant in cereals like wheat and rice but also a net exporter. The buffer stocks maintained by the Food Corporation of India (FCI) under the Public Distribution System (PDS) provide a shield against food shortages and price spikes.

Food security has multidimensional importance. It safeguards national sovereignty, reduces dependence on imports, and ensures stability in the political economy. Moreover, access to affordable food through welfare schemes such as the National Food Security Act (NFSA), the Mid-Day Meal Scheme, and Integrated Child Development Services (ICDS) contributes to improved nutrition outcomes, particularly for vulnerable sections of society (Swaminathan, 2006). Without a strong agricultural base, such large-scale food security initiatives would be impossible to sustain.

**1.2.5 Role in Rural Development**

Agriculture is the lifeline of rural India, where nearly 65% of the population resides (Census of India, 2011; World Bank, 2023). The sector directly influences rural employment, incomes, and consumption patterns. Agricultural growth has strong multiplier effects on the rural economy. Studies show that a 1% increase in agricultural income can lead to a 0.5–0.7% rise in rural non-farm income through demand for services, construction, and small-scale industries (Rao, 2000). Thus, agricultural development fuels rural development by generating purchasing power, creating markets, and stimulating allied sectors.

Moreover, agriculture plays a vital role in reducing rural poverty. The National Sample Survey Office (NSSO) data indicates that rural poverty declined significantly in regions where agricultural productivity improved. Initiatives such as the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) also complement agriculture by providing supplementary incomes and creating rural assets like ponds, canals, and soil conservation structures. Thus, agriculture is neither an exclusively economic activity but also an engine of comprehensive development of rural areas.

**1.2.6 Strategic and Socio-Political Importance**

Agriculture is more than just economic value as it has a strategic and socio-political significance in India. Millions of small and marginal farmers are the largest electoral block whose livelihood is maintained by the sector. Consequently, politics of agriculture has an imminent impact on governance and political stability. The ability of the sector to exert its influence on the socio-political arena transpires through farmers movements, and protests, and price support demands.

Also, farming offers social homogeneity and continuity of culture. Rites, rituals, customs and celebrations related to agriculture, e.g., Pongal, Baisakhi, Onam in India present a fundamental association between agriculture and cultural identity. Therefore, the role of agriculture cannot be limited to economics as it has immense sway into societal harmony and national integration.

**1.2.7 Challenges to Agricultural Significance**

The presence of various challenges is straining the importance of agriculture, yet it is the centrality of agriculture. The low efficiency, land fragmentation, land degradation, ground water abstraction, and climatic changes are some of the factors that endanger the sustainability of the sector. Its huge share of employment against small contribution to GDP is a pointer to structural inefficiencies. There is also increased indebtedness, inefficient market access, and price fluctuations that make farmers to migrate and incur distress. When these issues are not overcome, they will undermine the sector to support its important standing in the Indian economy.

To sum up, agriculture is the backbone of Indian economy regardless of the shift to industrial and service sectors. It is around 1820 percent of GDP, and accounts almost 45 percent of employment and the export of over ten percent. Most importantly, it ensures food security, rural development and socio-political stability. The growth strategic importance of the sector is well beyond its level of GDP contribution and makes it the core to inclusive and sustainable growth. It is, therefore, necessary to strengthen the agricultural sector by technological innovation, financial inclusion, and support of the trade through the policy.

**1.3 Role and Significance of Public Sector Banks in Agricultural Development**

The role played by the public sector banks (PSBs) in the development of Indian agriculture is immense with recent nationalization of the major commercial banks taking place in 1969. Before this major transformation, the Indian rural credit was in the regime of unregulated sources like moneylender, traders, landlords, etc., at high interest charges. The coverage of institutional credit was small and the entry of commercial banks into the rural areas could not be called significant. The resulting nationalization of bank companies which occurred in 1969 (14 banks) and 1980 (6 banks), brought great changes to the banking situation and established the base in agricultural development by offering organized financing (Rangarajan, 1998).

The thrust of bank nationalization was to align banking with the developmental priorities of the state, particularly rural credit and poverty alleviation. The Lead Bank Scheme (1969) was started to record credit requirements at the district level where each district had a nodal bank to plan the financial requirements of the district. The task to expand to rural and semi-urban areas was entrusted to SBs that could significantly penetrate the banking nexus in rural areas. The number of rural bank branches was below 2,000 in 1969, rising to more than 30,000 by the year 1990, and this helped to avail large scale institutional credit (RBI, 2020).

The issue of credit schemes unique to agriculture could not have been initiated and implemented without the help of PSBs. The IRDP that was initiated in 1978 as well as subsequent programmes like Self-Employment Programme and Swarnjayanti Gram Swarozgar Yojana were all channeled through PSBs. Yet another step toward simplifying and smoothing access to short-term credit by farmers was the Kisan Credit Card (KCC) scheme that was launched in 199899. As of March 2022, more than 73 million KCCs were issued of which PSBs were the major issuers (NABARD, 2022).

Besides, PSBs have facilitated long term agricultural investment by lending to farm mechanization, irrigation, storage and allied productive activities including dairy and poultry, in the form of term loans. This has assisted in increasing productivity, minimising drudgery, and diversifying livelihoods in the countryside. The activities of PSBs have been especially decisive in Uttar Pradesh, Punjab, Haryana, and Maharashtra where intensive agriculture has been facilitated through agricultural credit scheme.

Notably, PSBs are a channel of government subsidies and schemes, such as Interest Subvention Scheme (ISS) of crop loans on short basis, the Agricultural Debt waiver and Relief Scheme (2008), and introduction of crop insurance, under the Pradhan Mantri Fasal Bima Yojana PMFBY). Their country level coverage and system of accountability makes them extremely essential tools in the delivery of policies.

Therefore, PSBs are not only financial intermediaries but also development institutions in rural transformation which have taken prominence because of nationalization. Their participation in providing formal credit to the agriculture sector has lessened the reliance on informal moneylenders, facilitated financial inclusion and has helped farmers to venture into new practices. Nonetheless, there are ongoing concerns about prohibitive transaction fee, increasing NPAs, and providing equitable access to the poor and small and marginal farmers.

**1.4 Priority Sector Lending (PSL) Framework**

With the recommendations of Banking Commission and the directives by Reserve Bank of India (RBI), the Priority Sector Lending (PSL) concept was introduced in 1972. The PSL framework was designed to ensure that vulnerable sectors of the economy—such as agriculture, small-scale industries, and weaker sections of society—received adequate and timely credit. The underlying principle was to align the commercial objectives of banks with the developmental needs of the country (RBI, 2015).

Under the PSL framework, scheduled commercial banks are required to allocate a specified portion of their Adjusted Net Bank Credit (ANBC) to priority sectors. As per current guidelines, banks must lend 40% of their ANBC to priority sectors, of which 18% is mandated for agriculture. Within this agricultural target, a sub-target of 8% is earmarked for Small and Marginal Farmers (SMFs). These norms are periodically reviewed and revised by the RBI to align with national priorities. Regional Rural Banks (RRBs) and Small Finance Banks (SFBs) have even higher overall PSL targets at 75% of ANBC (RBI, 2022).

PSL has been a cornerstone of formalizing agricultural credit delivery. It has compelled banks, especially PSBs, to proactively lend to farmers, including those in remote areas. Agricultural credit under PSL includes both direct finance (crop loans, KCCs, term loans for farm equipment) and indirect finance (loans to input dealers, NBFCs, self-help groups, farmer producer organizations, and agri-infrastructure projects). This flexibility ensures that not only individual farmers but also supply chains and rural enterprises benefit from institutional finance.

The PSL framework has significantly contributed to financial inclusion by bringing millions of smallholders and rural households into the formal banking system. Data shows that agricultural credit has grown substantially over the past two decades. Gross credit flow to agriculture increased from ₹86,981 crore in 2000–01 to over ₹16.5 lakh crore in 2021–22 (Government of India, Economic Survey, 2022–23). A large part of this expansion is attributable to PSL obligations, which have ensured that banks maintain a steady focus on the sector despite profitability concerns.

Recent years, however, have seen the introduction of such innovative tools as Priority Sector Lending Certificates (PSLCs), which have enabled banks that have exceeded the required percentages of PSL achievement to sell their certificates to others who are short. This has increased the flexibility in compliance without reducing the credit flow to the high priorities sectors. Likewise, the co-lending relationships with the NBFCs and the microfinance organizations have been penetrative as well.

On the part of farmers, PSL framework has also increased access to formal credit where they no longer largely rely on informal moneylenders. The interconnection of PSL targets with agricultural sub-sectors has also meant that marginalized groups such as SMFs attain a minimum allocation of institutional credit. Uneven regional distribution to loans, diversion of loans to non-agricultural related activities, and the accumulating menace of NPAs in agricultural lending are still in place.

On the whole, the PSL dispensation has played a significant role in channelling institutional finance into agriculture and enhancing financial inclusion. It has further enhanced the role of PSBs as important vehicle of rural transfiguration and new agricultural transformation.

**1.5 Categories of Agriculture Sector Lending**

Lending to the agricultural sector in India is very heterogeneous, estimating the diversity of farming systems, requirements of the various categories of farmers and the policy goal of the government. Under the guidance of the Reserve Bank of India (RBI) and the Government of India, agricultural credit has been categorized into a number of categories so as to ensure that funds are directed to priority areas. These categories are, broadly, direct lending to farmers, indirect lending through other agencies, and sub-segmental allocations to small and marginal farmers, allied activities and agri-infrastructure. These types of categories have significant roles in facilitating agricultural production, management of risks and development in the rural areas.

**1.5.1 Direct Lending**

Direct lending means loans given by banks directly to individual farmers, joint liability groups (JLGs), self help groups (SHGs) or farmer producer organisations (FPOs) that involve themselves in agricultural production and the allied activities. This is the highlight of all agriculture credit and lies at the foundation of institutional finance in rural India.

**(a) Crop Loans**

Crop loans are short term loaning facilities to the farmer to cater to the seasonal agricultural operations (SAO). The cost which is covered by these loans is buying of seeds, fertilizers, pesticides, labor wages, irrigations, and harvesting. Repayment of crop loans occurs most of the time after the harvest season and repayment timelines are pegged at crop season cycles. They are crucial to availability of working capital at the right time and to overcoming the debt chain using moneylenders. The government also subsidizes its interest on lending to farmers by 2-3 percent up to 3 lakh, which lowers the actual rate of interest to 4 percent using the interest subvention policy on crop loans only to farmers who are regular payers (RBI, 2022).

**(b) Kisan Credit Card (KCC)**

The Kisan Credit Card scheme was suggested by the R. V. Gupta Committee and introduced in 199899, on the promises of its ease and time-boundness to the farmers to access short-term credit without hassles. The KCC is a revolving credit where farmers may withdraw to finance their needs and pay back on basis of cash flow. The scheme has played a significant role in standardization of delivery of credits and decreasing paperwork. Over 73 million KCCs have been issued till 2022, with PSBs accounting for a major share (NABARD, 2022). The scheme has since been expanded to cover allied activities such as dairy, fisheries, and poultry, making it a comprehensive tool for rural finance.

**(c) Investment Credit (Term Loans)**

In addition to working capital, farmers require medium- and long-term credit for capital investments aimed at enhancing productivity and sustainability. Investment credit supports activities such as land development, irrigation structures (tubewells, drip irrigation, sprinklers), farm mechanization (tractors, harvesters), dairy units, poultry farms, storage facilities, and solar-powered pumps. These loans are critical for shifting agriculture from subsistence to commercial production and for enabling adoption of modern technology. Unlike crop loans, investment credit typically has repayment periods ranging from 3 to 15 years, depending on the asset financed.

**1.5.2 Indirect Lending**

Indirect lending refers to credit extended to institutions, agencies, or intermediaries that support agriculture, rather than directly to individual farmers. While farmers benefit indirectly, this category strengthens the ecosystem that sustains agricultural production.

**(a) Cooperatives and Farmer Collectives**

Banks extend loans to primary agricultural credit societies (PACS), cooperative marketing societies, and farmer producer companies (FPCs). These institutions channel credit to their members, enabling small farmers to access finance collectively. Such group-based lending reduces transaction costs and improves repayment through peer accountability.

**(b) Input Dealers and Agri-Input Suppliers**

Indirect credit involves advance to fertilizer dealers, seed companies, pesticide distributors, and machinery suppliers who sell goods and services to the farmers on credit. Because input suppliers are guaranteed financing by banks, farmers therefore get quality inputs in time especially during high sowing seasons.

**(c) Non-Banking Financial Companies (NBFCs) and Microfinance Institutions (MFIs)**

NBFCs and MFIs have been increasingly used as partners in co- lending models in recent years as a mechanism to deepen agricultural credit. Banks extend wholesale finance to such and they on their part lend out the money to small farmers, tenant cultivators and sharecroppers. The model improves the delivery of last-mile credit in a region where the bank penetration is low.

**(d) Agri-Service and Infrastructure Providers**

Loans are also provided to custom hiring centers (CHCs), cold storages, warehouses, dairy cooperatives and food processing units. In addition to benefiting farmers, farmers benefit indirectly through such initiatives as all these facilities reinforce supply chains and minimize post-harvest losses. Such loans are classified by RBI into agricultural infrastructure and ancillary activities of the norms of PSL (RBI, 2020).

**1.5.3 Sub-Segmentation of Agricultural Lending**

Owing to the imperative of inclusivity and balanced growth, more specific categorizes have been developed within agriculture lending in order to cover vulnerable categories as well as strategic sub-sectors.

**(a) Small and Marginal Farmers (SMFs)**

By definition, the group of the most numerous farmers of India are those who own up to 2 hectares of land (MFs) and occupy only 47 percent of the total area of agricultural land (Agricultural Census, 201516). Due to limited land and resources, they face acute difficulties in accessing institutional finance. To ensure adequate flow of credit, RBI mandates that 8% of banks’ ANBC must be lent to SMFs as part of PSL. Targeted credit to SMFs is vital for enhancing productivity, reducing dependence on informal credit, and promoting financial inclusion.

**(b) Allied Activities**

Agriculture in India is no longer confined to crop cultivation; allied sectors such as dairy, fisheries, poultry, sericulture, and beekeeping play an increasingly important role in rural livelihoods. These activities contribute significantly to agricultural GDP, with the livestock sector alone accounting for over 30% of the total agricultural value added (Economic Survey, 2022–23). Lending to allied activities provides income diversification and risk mitigation for farmers, especially in the face of crop failures or price volatility.

**(c) Agricultural Infrastructure**

The development of physical and digital infrastructure is crucial for improving efficiency and profitability in agriculture. Banks provide credit for building warehouses, cold storage, market yards, grading and packaging units, irrigation networks, and rural roads. The investments decrease the post-harvest losses, stabilize the prices and integrate farmers with markets. More recently, programmes like the Agriculture Infrastructure Fund (AIF) that encourages investment in post-harvest management and community farming assets have been implemented with PSBs playing an important financing role.

In short, direct, indirect, and sub-segmental classification of agricultural lending indicate the multidimensionality of the rural credit demands. Although direct lending offers instant funding to support the cultivation and investment, indirect lending boosts the supply chain of the suppliers, cooperatives, and infrastructure that help the farming to become successful. The sub-segmentation of credit is inclusive as it targets SMFs, encourages activities of allied work and finances agri-infrastructure. Taken together, these categories can address not only the needs of working and investment that farmers need but also country priorities in food security, financial inclusion and rural development.

**1.6 Impact of Direct Agriculture Lending on Banks and the Economy**

Public sector banks (PSBs) are a key pillar in India financial inclusion and rural development policies dating back to the late 20 th century. Direct credit to farmers has far reaching implications not only in the farming households alone but also in the security and profitability of the banking system and the economy in general. The effect can be discussed as advantages and drawbacks.

**1.6.1 Benefits of Direct Agriculture Lending**

**(a) Compliance with Priority Sector Lending (PSL) Norms**

By direct lending to farmers, PSBs can achieve their PSL targets set by the Reserve Bank of India (RBI) that mandates PSBs to direct 40% of their Adjusted Net Bank Credit (ANBC) to priority sectors with 18% of that amount to be used in the agriculture sector. Banks without large volumes of direct lending would fail to meet these targets, and would be penalized (paid) or required to buy Priority Sector Lending Certificates (PSLCs). Hence, agricultural loans help PSBs comply with regulatory obligations while demonstrating their developmental role (RBI, 2022).

**(b) Promotion of Rural Development**

Credit is an essential input for modern agriculture, alongside land, labor, and technology. By extending crop loans, Kisan Credit Cards (KCC), and investment loans, PSBs provide farmers with the necessary resources to purchase quality seeds, fertilizers, irrigation equipment, and machinery. This leads to higher yields, crop diversification, and improved farm incomes. Enhanced agricultural productivity, in turn, stimulates demand for rural services, non-farm employment, and agro-processing industries, thereby fueling rural development (Chand, 2014).

**(c) Financial Inclusion and Reduction of Informal Credit Dependence**

Historically, rural households relied heavily on moneylenders who charged exploitative interest rates. Direct bank lending has significantly reduced this dependence by providing affordable credit at regulated interest rates. The penetration of PSBs into rural areas, supported by initiatives such as the Lead Bank Scheme and the Jan Dhan Yojana, has expanded the reach of institutional finance. Farmers who were previously excluded from the formal financial system now access banking services, savings products, and insurance, marking an important step toward financial inclusion (NABARD, 2022).

**(d) Socio-Economic Impact**

Direct agricultural lending is supporting poverty reduction, food security andly empowerment of underserved populations. New access to institutional credit enables small marginal farmers to use modern practices, invest in other allied activities like dairy or poultry and resist income shock due to crop failures or fluctuation of prices. This decreases the rural inequality and social cohesion in the long run.

**1.6.2 Challenges of Direct Agriculture Lending**

**(a) Rising Non-Performing Assets (NPAs)**

One of the most prominent issues experienced by PSBs is that there exist agricultural loans with NPAs on a high level. The agricultural credit is susceptible to the risks of failure of crops, natural disasters, pest attacks, and price collapses unlike the loan in the industrial sector. Loan waivers announced by state governments and the central government, though politically expedient, often create moral hazard by weakening repayment culture. According to RBI data, gross NPAs in agricultural advances of scheduled commercial banks stood at 9.8% in 2021–22, significantly higher than the overall NPA ratio (RBI, 2022). High NPAs erode bank profitability and strain their balance sheets.

**(b) High Transaction and Monitoring Costs**

Lending to farmers, especially small and marginal farmers, involves high transaction costs. Banks must process a large number of small-value loans, requiring significant documentation, verification, and field visits. Monitoring loan utilization and repayment across dispersed rural areas further adds to operational costs. This makes agricultural lending less attractive to banks compared to large industrial loans, despite PSL mandates.

**(c) Impact on Profitability**

While agricultural loans are critical for developmental objectives, they often yield lower returns compared to commercial lending. Interest subvention schemes and concessional rates reduce effective yields for banks. Coupled with high provisioning requirements for NPAs, this adversely impacts profitability. Many PSBs struggle to balance their dual role as commercial entities and development institutions, creating financial stress in the long term (Rangarajan, 1998).

**(d) Credit Diversion and Misutilization**

A large part of agricultural loans is misused by changing them in other activities like consumption, meeting of the social responsibilities or paying off prior debts. This lowers the efficiency of agricultural lending to improve productivity and exposes it to the danger of defaults. Once the loans are availed, it is a challenge to PSBs that the loans are utilized properly.

The effect of direct agricultural lending is two-fold it has contributed greatly in enhancing rural growth, financial inclusion and food security but it has also subjected the lending banks to risk of defaults, profitability pressures and efficiencies in execution. The need to find a middle ground between development aims and financial feasibility is a key issue to PSBs in their agricultural lending operations.

**1.7 New Government Policies and Guidelines for Agriculture Lending**

To make agricultural credit system strong, the Government of India, RBI, and NABARD introduced a series of schemes, guidelines, and innovations to strengthen this credit system both in terms of its importance and challenge. The aim of these interventions is to provide better access, minimise cost, minimise risks and also ensure that credit reaches the right people.

**1.7.1 Key Schemes**

**(a) Interest Subvention Scheme (ISS)**

Introduced in 2006, the ISS provides farmers with short-term crop loans up to ₹3 lakh at a concessional interest rate of 7%. An additional 3% subvention is provided for prompt repayment, effectively reducing the interest rate to 4%. This scheme incentivizes timely repayment while making credit affordable. The burden of subvention is borne by the central government and routed through NABARD (Ministry of Agriculture, 2022).

**(b) Kisan Credit Card (KCC)**

As discussed earlier, the KCC has become the most widely used instrument for providing short-term credit to farmers. Recent policy measures have expanded its coverage to include fisheries, animal husbandry, and allied activities. The KCC also facilitates crop insurance under PMFBY and interest subvention benefits, integrating credit with risk management tools.

**(c) Pradhan Mantri Fasal Bima Yojana (PMFBY)**

Launched in 2016, PMFBY is India’s flagship crop insurance scheme, aimed at protecting farmers against yield losses due to natural calamities, pests, and diseases. Farmers pay a nominal premium (2% for kharif crops, 1.5% for rabi crops, and 5% for commercial crops), while the balance premium is shared by the central and state governments. Banks play a crucial role in enrolling loanee farmers, ensuring wide coverage. PMFBY mitigates credit risk for banks by improving farmers’ ability to repay in adverse years (Government of India, 2021).

**(d) Priority Sector Lending Certificates (PSLCs)**

Introduced in 2016, PSLCs are tradable instruments that allow banks to meet their PSL obligations without physically disbursing additional loans. Banks with surplus PSL achievement can sell certificates to those with deficits. This market-based mechanism has increased flexibility and efficiency in meeting PSL targets, while ensuring overall credit flow to priority sectors (RBI, 2015).

**1.7.2 Digitalization and Co-Lending**

The government and RBI have emphasized digitalization of agricultural credit to reduce costs, improve transparency, and enhance outreach. Aadhaar-enabled KYC, Direct Benefit Transfer (DBT), and mobile banking platforms are being leveraged to simplify disbursement and monitoring. The introduction of digital KCCs and online platforms for crop insurance claims has reduced paperwork and delays.

Co-lending models PSBs, NBFCs and microfinance institutions have emerged as a popular option in the last few years. Within this system, the PSBs advance the funds to the NBFCs who lend to the last-mile borrowers i.e. tenant farmers and sharecroppers. This collaboration enables risk-sharing and the use of the outreach of the NBFCs and low-cost capital of PSBs.

**1.7.3 NABARD and RBI Guidelines**

The NABARD has a leading role in providing refinance of agricultural credit and guidelines. NABARD offers refinance facilities to co-operative banks and regional rural banks, works out model credit plans, and aids financial literacy programmes.

The RBI issues Master Directions on the PSL via the periodical releases, guidance on permissible activities under the agricultural sector, and targets and monitoring of the targeted compliance. Recent policies focus on giving credit to the small and marginal farmers, agri-infrastructure and allied activities. There are special schemes such as the Agriculture Infrastructure Fund (AIF) introduced in 2020, backed by bank lending, and this is to strengthen storage, warehousing, and value chains.

The various new policies and guidelines have endeavoured to adopt a multi-faceted approach, such as affordability that is achieved through subvention, risks mitigation that is achieved through insurance, adherence that is achieved through PSL and PSLCs, through utility of digital tools that ensure efficiency, and through the institutional strengthening frameworks through the ability of NABARD and RBI. Combinations of these interventions are aimed at balancing the two objectives of protecting farmers, and protecting the financial health of the banks.

**1.8 Non-Achievement and Gaps in Policy Implementation**

Although the government has ambitious policies and institutional systems of facilitating agriculture lending, there exist certain gaps that persist in the success of the goals. While targets under the Priority Sector Lending (PSL) framework are often met in quantitative terms, the quality, inclusiveness, and effectiveness of agricultural credit remain major concerns. These gaps highlight structural weaknesses in credit delivery and pose challenges for both farmers and public sector banks (PSBs).

**1.8.1 Credit Gaps Despite Targets**

Agricultural credit disbursements have grown exponentially over the past two decades, rising from ₹86,981 crore in 2000–01 to over ₹16.5 lakh crore in 2021–22 (Government of India, Economic Survey, 2022–23). However, this growth masks serious credit gaps at the ground level. Studies by NABARD and the RBI show that a significant portion of formal credit is concentrated in agriculturally advanced states such as Punjab, Haryana, Maharashtra, and Tamil Nadu, while rain-fed and resource-poor regions (e.g., eastern states and parts of central India) remain underserved (Chavan, 2017).

Moreover, a large share of agricultural credit is skewed toward medium and large farmers who have collateral and established banking relationships. Small and marginal farmers (SMFs), tenant cultivators, and sharecroppers—who constitute the majority—still face barriers in accessing institutional finance due to lack of land titles, cumbersome documentation, and limited awareness. This creates a paradox where formal targets are achieved, yet the most vulnerable groups continue to rely on informal sources such as moneylenders and traders, perpetuating rural indebtedness.

**1.8.2 High NPA Levels in Agricultural Loans**

Another major gap is the rising incidence of non-performing assets (NPAs) in agricultural lending. The ratio of agricultural NPAs has always been above the NPAs of the industrial and service sectors. RBI data show the gross NPA ratio of agricultural advances of PSBs as 9. 8% in 2021 22 as compared to 7. 3% of total advances (RBI, 2022).

These trends are caused by a variety of reasons. The risks of farming as such, risks of crops failure due to monsoon changes, pests, price fluctuations put repayment into doubt. Political activities like loan waivers do give relief to the farmers in the short-term, but in the long-run they undermine credit discipline and the culture of repayment, which turns to further worsen defaults. Moreover, the lack of discipline in using the loans on purposes other than agriculture including consumption and social ceremonies places it at the risk of becoming unpaid. Large NPAs do not only decrease the profitability of PSBs but also limit the loan growth of these PSBs and this leads to a vicious circle of stagnation of credit.

**1.8.3 Regional Imbalances and Exclusion of Tenant Farmers**

The agricultural lending in India also has the problem of the regional imbalances. States with strong irrigation, infrastructural and institutional set-up get more and more credit disproportionately, when the less developed areas like the North-Eastern states, Jharkhand, Odisha and parts of Bihar lack in its credit (NABARD, 2021). This unbalanced growth continues to worsen inequality in agricultural growth and the development that is not inclusive.

A highly vulnerable category dweller is the tenant farmers and share-croppers, who usually farm land without the formal right of ownership. Most banks insists on land records as a source of collaterals, which rules these cultivators out of institutional credit. This has led to them relying on the informal lenders with usurious rates. In spite of government driven policies such as the Joint Liability Group (JLG) model, tenants under institutional finance cover remains trivial. This omission maintains poverty level, impairs productivity and excludes a big portion of the rural population in the formal credit setup.

The failure of achieving policy goals in agricultural lending is also clear in 3 important aspects: not only are there constant credit gaps given the increased lending, but, also the large NPA levels, and the exiting of the vulnerable group of tenant farmers. These gaps highlight the importance of reforms made in the credit delivery mechanisms, financial product innovations to landless farmers and better risk management measures. Based on these challenges, unless they are tackled, the real potential of agricultural credit in bringing about an inclusive and sustainable rural development will be left unmet.

**1.9 Statement of the Problem and Relevance of the Study**

**1.9.1 Statement of the Problem**

Agricultural lending is still a two-edged sword in India as far as Public Sector Banks (PSBs) are concerned. First, it is required under PSL requirements and is necessary in the attainment of national, food security, rural development, and financial inclusion targets. On the one hand, it threatens banks with a significant danger of high NPAs, low profitability, and inefficient nature of operations.

Structural problems add to the difficulty; there are small and fragmented farms, high reliance on rain, price instability and little access to insurance. All these schemes- Kisan Credit Card (KCC), Interest Subvention Scheme (ISS), and Pradhan Mantri Fasal Bima Yojana (PMFBY) have been presented by the government, but due to ineffective implementation, regional disparity, lack of awareness among grass root level, these schemes are not able to play their role effectively.

Therefore, even though the agricultural credit recording huge growth in absolute terms, the sector still poses a risk and burden to banks and numerous farmers are left out or are over burdened by the sector. This contradiction of substantial outpourings and insignificant contributions can be seen as the basis of the issue this study considers.

**1.9.2 Relevance of the Study**

The significance of risk-return dynamics of agricultural lending is that there are numerous perspectives to the same:

**(a) For Banks**

This increases pressure on loss-making agricultural NPAs to contribute to their profitability and capital strength of PBSs. Knowledge of risk return tradeoff in agricultural lending is critical to drawing upon lending models that have the capability of ensuring financial sustainability as well as developmental goals are achieved.

**(b) For Policy Makers**

Government policies on agriculture lending need evidence-based evaluation to identify gaps and improve targeting. Analyzing why policies fail to achieve their objectives—whether due to design flaws, implementation bottlenecks, or regional disparities—provides actionable insights for reform.

**(c) For Farmers**

Credit is a lifeline for farmers, especially smallholders, but many continue to face barriers in accessing institutional finance. Research that highlights borrower experiences, repayment behavior, and credit utilization patterns can guide more inclusive financial models.

**(d) For the Economy**

Agriculture contributes nearly 18–20% of GDP and employs about 42% of the workforce (Economic Survey, 2022–23). Strengthening agricultural credit is thus essential not only for rural development but also for national food security, poverty alleviation, and macroeconomic stability.

**1.9.3 Research Gap**

While numerous studies have examined agricultural credit, fewer have focused specifically on the risk–return appraisal of lending in the context of public sector banks, particularly at a regional level such as Meerut Division. Moreover, limited attention has been paid to the interplay between NPAs, policy effectiveness, and borrower experiences. Addressing this gap will contribute to both academic literature and policy practice.

In essence, the study is motivated by the paradox that agricultural lending, though essential for development, remains risky and problematic for PSBs. By analyzing the risk–return tradeoffs, examining NPAs, and assessing the effectiveness of policy implementation, this research seeks to provide valuable insights for banks, policy makers, and farmers alike. Its relevance lies in addressing one of the most pressing challenges of India’s rural economy: how to make agricultural credit both inclusive and sustainable.

**1.10 Research Objectives**

The objectives of the study are given as follows;

* To study different risk and returns of lending to Agriculture sector by selected public sector banks with reference to Government policies.
* To study and analyse the Non-Performing Assets (NPA) of Agriculture Sector lending by selected public sector banks.
* To suggest different measures for Agriculture sector for effective implementation of Government policies for the benefit of borrower.

**1.11 Hypotheses of the Study**

Hypothesis the following hypothesis were formulated:-

H01: Agriculture sector borrowers do not face difficulties in getting the loan under different government policies.

H1: Agriculture sector borrowers do not face difficulties in getting the loan under different government policies.

H02: Risk and Return analysis do not help the public sector bank in Meerut Division in reducing NPA.

H2: Risk and Return analysis help the public sector bank in Meerut Division in reducing NPA.

H03: Majority of the borrowers have not fully utilized the loan amounts for the purpose for which it was sanctioned.

H3: Majority of the borrowers have fully utilized the loan amounts for the purpose for which it was sanctioned.

H04: Government policies implemented for the benefit of agriculture sector have not succeeded in making significant improvement in the areas of Agriculture.

H4: Government policies implemented for the benefit of agriculture sector have succeeded in making significant improvement in the areas of Agriculture.

**1.12 Significance of the Research Area**

Agriculture and banking are deeply interlinked in India, where institutional credit plays a pivotal role in sustaining farming activities, rural livelihoods, and national food security. The significance of this research area arises from both its academic value and its practical relevance for stakeholders such as policy makers, banks, and rural communities.

***Agriculture–Banking Interlinkages***

Agriculture in India is inherently credit-intensive, as most smallholders lack adequate savings to finance cultivation or investment in technology. Public sector banks (PSBs) have emerged as the primary institutional source of credit since nationalization in 1969, displacing moneylenders as the dominant financiers of agriculture. Their role has been reinforced by the Priority Sector Lending (PSL) mandate, which compels banks to allocate 18% of adjusted net bank credit to agriculture (RBI, 2022).

These interlinkages are crucial because credit directly influences productivity, crop diversification, and adoption of modern technologies. At the same time, banks face challenges of high non-performing assets (NPAs), credit diversion, and regional disparities. Thus, agriculture–banking interactions are both enabling and constraining, highlighting the need for in-depth study.

***Relevance for Policy Makers***

For policy makers, agricultural credit is not merely a financial statistic but a development instrument. Despite rising disbursements, issues such as regional imbalances, exclusion of tenant farmers, and persistent NPAs dilute the effectiveness of policy interventions. By analyzing the risk–return trade-offs in lending and identifying the causes of non-achievement of policy objectives, this study provides insights that can guide reforms in PSL design, subsidy schemes, and credit targeting.

***Relevance for Banks***

For PSBs, agricultural lending is both a statutory obligation and a source of operational challenges. Rising NPAs erode profitability and constrain their ability to extend fresh credit. By evaluating the risk and return dimensions of agricultural loans in a regional context, this study can help banks design strategies for sustainable lending—balancing compliance with PSL norms and financial stability.

***Relevance for Rural Communities***

For farmers and rural communities, access to affordable credit is a lifeline. Institutional lending reduces dependence on moneylenders, provides working capital, and enables investments in productivity-enhancing assets. However, many farmers—particularly small and marginal farmers, tenant cultivators, and sharecroppers—continue to face barriers in accessing formal credit. This research highlights such gaps and proposes measures to make credit delivery more inclusive, thereby directly benefiting rural communities.

***Academic Contribution***

From an academic perspective, this study contributes to literature by examining agricultural lending at the regional level—Meerut Division of Uttar Pradesh. While national-level studies abound, regional analyses are limited, despite agriculture being highly location-specific due to variations in cropping patterns, credit culture, and socio-economic conditions. By focusing on PSBs in Meerut, this research adds depth to understanding localized dynamics of risk, return, and policy implementation.

In sum, the significance of this research lies in its ability to bridge academic inquiry and practical relevance. By exploring agriculture–banking interlinkages, evaluating policy outcomes, and focusing on the risk–return trade-offs of lending, the study contributes meaningfully to scholarship, informs policy design, strengthens banking practices, and supports rural communities.

**1.13 Scope of the Study**

Every research study must clearly define its boundaries to maintain focus and feasibility. The scope of this research has been carefully delineated in terms of geographical area, institutional coverage, and temporal span.

***Geographical Focus: Meerut Division***

The study focuses on the Meerut Division of Uttar Pradesh, which is agriculturally significant for multiple reasons. Uttar Pradesh is India’s largest state in terms of population and one of the most important contributors to national food grain production, particularly wheat, sugarcane, and paddy. The Meerut Division—comprising districts such as Meerut, Ghaziabad, Baghpat, and Bulandshahr—is located in western Uttar Pradesh, a region known for its intensive agriculture, commercial cropping patterns, and strong linkages with markets.

The choice of Meerut Division provides a meaningful context because:

* It reflects both strengths (high productivity, commercial agriculture, access to PSBs) and challenges (growing NPAs, credit diversion, and regional disparities).
* It offers a representative case of agriculturally advanced yet financially stressed regions of India, where credit delivery is both essential and problematic.

***Institutional Focus: Selected Public Sector Banks***

The research specifically examines Public Sector Banks (PSBs), which dominate agricultural lending in India. PSBs account for over 70% of total agricultural credit, making them the most critical institutional actors (NABARD, 2022). The study will select leading PSBs operating in Meerut Division—such as State Bank of India (SBI), Punjab National Bank (PNB), Bank of Baroda (BoB), and Canara Bank—for detailed analysis.

Focusing on PSBs is justified because:

* They bear the bulk of PSL obligations and agricultural NPAs.
* They act as conduits for government schemes (KCC, ISS, PMFBY).
* Their performance in agricultural lending directly impacts financial inclusion and rural development.

***Time Period and Coverage***

The study covers a recent time period of six years (2017–2023), which includes critical phases such as:

* The implementation of major schemes like PMFBY and PSLCs.
* The COVID-19 pandemic, which tested the resilience of agricultural credit.
* Structural reforms in PSL norms and digital credit delivery.

This temporal scope allows for a comprehensive analysis of lending trends, NPAs, and policy impacts during a period of both innovation and crisis.

***Limitations of the Scope***

While focusing on Meerut Division and PSBs provides depth, the findings may not be directly generalizable to all regions or to private banks. However, the insights remain valuable for understanding agricultural credit dynamics in similar contexts across India.

The scope of this research is clearly defined as:

* **Geographical**: Meerut Division of Uttar Pradesh.
* **Institutional**: Selected Public Sector Banks.
* **Temporal**: 2017–2023.

By delineating these boundaries, the study ensures clarity, feasibility, and analytical depth, while still offering insights relevant to broader agricultural and banking policy debates.

**1.14 Organisation of the Research**

This thesis is structured into seven chapters to provide a systematic examination of agricultural lending by public sector banks and its broader implications.

**Chapter 1: Introduction** outlines the background, significance, research problem, objectives, hypotheses, and scope of the study. It also highlights the importance of agriculture in the Indian economy, the role of public sector banks, and the relevance of priority sector lending, thereby setting the foundation for the research.

**Chapter 2: Review of Literature** presents a critical survey of previous studies related to agriculture finance, non-performing assets, and government policies. It identifies research gaps, theoretical underpinnings, and empirical evidence, which provide the rationale for the present investigation.

**Chapter 3: Non-Performing Assets of Public Sector Banks with Reference to the Agriculture Sector** analyses the nature, extent, and causes of NPAs arising from agricultural loans. It also evaluates their impact on the banking system, credit flow, and overall economic stability.

**Chapter 4: Effective Implementation of Government Policies for the Benefit of Agricultural Borrowers** examines key policy measures and schemes introduced by the government and regulatory bodies. It assesses the degree of implementation and the extent to which these initiatives have benefited farmers and banks alike.

**Chapter 5: Research Methodology** describes the methodological framework of the study. It covers research design, sampling procedure, research area, sample size, data collection, and statistical tools employed, ensuring the robustness and reliability of the research process.

**Chapter 6: Data Analysis and Interpretation** presents the empirical findings of the study based on primary and secondary data. Interpretations of the analysis are provided on the trends, patterns, and relationships with regards to agricultural lending and NPAs and are tied to the stated research objectives and research hypotheses.

**Chapter 7: Conclusion and Recommendations** The report summarizes the findings, makes a set of crucial conclusions and offers policy recommendations. It also describes the study limitations and the sources of future research, thereby also making some contribution to the academic knowledge as well as to practical policymaking.

**Chapter 2**

**Review of Literature**

**2.1 Introduction**

Agricultural credit plays a pivotal role in ensuring sustainable agricultural development, particularly in emerging economies like India, where farming remains largely reliant on seasonal variability, fragmented landholdings, and limited institutional support. Access to timely and adequate credit enables farmers to purchase inputs such as seeds, fertilizers, irrigation equipment, and technology, which boosts productivity and stabilizes income (Rao, 2008). Although formal agricultural finance has evolved significantly—especially after the nationalization of banks in 1969—the rural credit ecosystem continues to face systemic challenges like access inequality, persistent defaults, and risk-prone portfolios (RBI, 2020).

Traditionally, the rural economy was dominated by informal credit sources such as moneylenders, traders, and landlords. These actors often engaged in exploitative practices, imposing exorbitant interest rates and enforcing informal coercive recovery mechanisms (Binswanger & Khandker, 1995). The shift towards institutional lending began with policy initiatives focused on financial inclusion, particularly through public sector banks (PSBs), cooperative banks, and regional rural banks (RRBs), which were envisioned as agents of rural development (Shetty, 2006). PSBs have since emerged as the backbone of government-sponsored schemes, acting not just as financial intermediaries but also as development institutions tasked with ensuring equitable credit flow to the agricultural sector.

However, PSBs operate under a dual mandate: to remain financially viable while fulfilling their socio-developmental obligations. This duality complicates operational decisions, particularly in agri-lending, where return on investment is often uncertain and exposed to multiple layers of risk (Sarma & Pais, 2008). Among these, credit risk—i.e., the possibility of borrower default—emerges as the most dominant, followed by market risk, operational inefficiencies, climatic uncertainties, and political risks, including sudden loan waivers (Giné & Yang, 2009; Narayanan, 2015).

Loan waivers, although politically popular, have a mixed impact. They may provide short-term relief but often distort credit culture and increase moral hazard, especially when institutional lenders anticipate future bailouts (Kanz, 2016). Additionally, frequent monsoon failures and unanticipated pest outbreaks introduce climate and operational shocks that adversely affect repayment behavior. The inability of conventional credit appraisal systems to incorporate such risk dimensions aggravates the problem, leading to rising levels of non-performing assets (NPAs) in agricultural portfolios (NABARD, 2021).

In response to these challenges, the financial sector is witnessing a gradual transformation with the advent of data-driven technologies. Artificial intelligence (AI), machine learning (ML), and satellite imagery are increasingly being deployed to predict borrower behavior, assess crop damage, and design granular risk models (IFC, 2020). Digital innovations—enabled by India’s robust identity and payment systems like Aadhaar, UPI, and Jan Dhan accounts—have further expanded the potential for real-time credit delivery and monitoring (CGAP, 2019). Several fintech startups and PSBs have begun piloting AI-based credit scoring models that rely on non-traditional data such as mobile usage, geospatial data, and social behavior to assess borrower credibility (Kumar & Tripathi, 2022).

While risk is a well-recognized aspect of agri-lending, literature on the return side of the credit equation is equally significant. Agricultural loans, when deployed efficiently, lead to higher farm productivity, improved rural consumption, and enhanced returns on assets for banks (Morduch, 1999; Swain & Varghese, 2014). Returns also accrue at the macro level through reduced rural indebtedness, lower migration, and food security gains. However, returns from agri-lending are often contingent on effective credit utilization, the quality of extension services, and the availability of post-harvest infrastructure (Chand, 2012).

One of the critical gaps in existing scholarship is the lack of integrated analysis that evaluates risk and return together. While some studies examine default determinants (e.g., rainfall shocks, political interference), others focus on output-side outcomes such as farm income or consumption smoothing. Very few combine both to present a holistic risk-return profile for agricultural credit portfolios, especially for PSBs (Sharma & Ghosh, 2020). Moreover, regional heterogeneity remains underexplored. Western Uttar Pradesh, despite being one of the most agriculturally intensive and credit-sensitive regions, has limited representation in district-level studies on banking performance and rural credit flows.

The COVID-19 pandemic has added another layer of complexity. The disruptions caused by lockdowns—ranging from labor shortages to market closures—have adversely impacted both the creditworthiness of borrowers and the liquidity of lending institutions (World Bank, 2021). While government responses such as emergency credit lines and direct benefit transfers cushioned the shock temporarily, their long-term efficacy remains uncertain. These developments underscore the need to revisit existing risk appraisal and return frameworks in the post-pandemic context.

Globally, diverse models of agricultural lending are being tested and refined. The USDA Farm Service Agency provides the government-guaranteed loans combined with crop insurance in the United States (World Bank, 2017). In Brazil, the PRONAF program offers subsidized funds to the small farmer with climate insurance. The M-kopa model developed in Kenya uses mobile platforms to provide real-time credit distribution and repayments which can be informative in the word of digital financial inclusion (Tsan et al., 2019). These two models emphasize the importance of institutional framework, technological advancement and the combination of the government and the private sector in scaling back lending risk and improving the potential of returns.

A new line in the literature is that of the behavioral finance where the rationality of the choices made by farmers compounded with classical utility maximizing concepts are not evident in making decisions concerning borrowing, investment and repayment. Psychological biases, peer influence, and prior experiences are the factors of influence affecting the people in the rural setting when it comes to making credit decisions (Thaler, 2015). Oversimplifying, examples would include overconfidence that results in excessive borrowing among farmers, or risk aversion and consequent underinvestment in productivity-enhancing technology. Being aware of the dimensions of behavior is vital in the designing of effective recovery strategies and loan products.

Finally, on the horizon are changes in discourse of climate-smart and climate-risk finance which has prompted institutions to reimagine the future of agri-credit. Credit models are also being tested to anticipate probabilities of default in real time by integrating early warning models, crop simulation, and remote-sensing data (FAO, 2022). In such a case as India with a significant portion of the agricultural sector exposed to such climatic risks, such inventions make true the meaning of game changer.

In summary, the work of agricultural lending in India is in the field of policy, risk and development imperative. The rural credit system continues to take into consideration the public sector banks due to their reach and mandate. However, the increased number of NPAs, fluctuating climatic conditions and changes in technology demand a more comprehensive, holistic perception of the risk-return trade-off. The review of literature is therefore expected to deal with the conceptual, theoretical and empirical boundaries of agricultural credit and address research gaps and provide more guiding policy and practice.

**2.2 Conceptual Framework**

This section is a description of the fundamentals of the study: risk in agricultural lending, the returns on agricultural lending and the role of PSBs. These two elements contextualise the twin goals of formal rural lending risk containment and developmental impact within the Indian agricultural finance scenario.

**Risk in Agricultural Lending**

Risk is inherent in the agricultural financing. As compared to industrial or retail lending, agri-lending is also susceptible to unsalvageable and systemic threats owing to its high reliance on variables related to the environment, markets, and policy (Kaur & Kaur, 2020). Such risks have a serious impact on dispersing loans and undertaking recovery.

The major categories of risk in agri-lending include:

* **Credit Risk**: The risk that a borrower will default due to low or fluctuating income, often exacerbated by crop failure, health shocks, or asset depletion (RBI, 2021).
* **Market Risk**: Involves uncertainty in commodity prices, input costs, and interest rate movements. Unregulated price shocks often make it difficult for farmers to realize profitable returns (Mishra & Sahoo, 2019).
* **Operational Risk**: Includes delays in credit disbursement, errors in documentation, or inefficiencies in the banking interface, especially in remote areas (NABARD, 2022).
* **Weather/Climate Risk**: With increasing climate variability, extreme weather events such as droughts, floods, and cyclones are now routine disruptions. These risks reduce farm output and subsequently affect loan repayments (FAO, 2022).
* **Political/Policy Risk**: Includes state interventions like loan waivers, debt moratoriums, or sudden changes in subsidy structures, which erode repayment ethics and affect the balance sheets of banks (Dev, 2020).

These risk categories are summarized in Table 2.1, which provides a structured overview of their definitions and relevance to agri-lending.

**Table 2.1. Types of Risks in Agricultural Lending**

|  |  |
| --- | --- |
| **Risk Type** | **Description** |
| Credit Risk | Risk of borrower default |
| Market Risk | Price volatility and interest rate fluctuations |
| Operational Risk | Transaction errors and administrative inefficiencies |
| Weather/Climate Risk | Droughts, floods, erratic monsoon |
| Political/Policy Risk | Loan waivers and inconsistent policies |

**Return on Agricultural Lending**

Returns in agricultural lending are multidimensional. On the one hand, they reflect the financial gains for banks through interest income and asset performance. On the other, they capture the developmental outcomes such as enhanced farm productivity, rural employment, and poverty alleviation (Chakraborty & Singh, 2021).

Studies suggest that agricultural credit, when well-targeted, leads to significant improvements in agricultural yield, input adoption, and output value—translating into better loan utilization and enhanced returns for the financial institution (Singh & Rana, 2020). Moreover, government interventions such as interest subvention, crop insurance linkage, and credit guarantees also help in reducing effective default risk and ensuring return viability (World Bank, 2021).

Yet, in regions with recurring climatic shocks or poor market linkages, the social return on agri-lending may outweigh the commercial return, necessitating public sector involvement and policy support (Kumar & Dangi, 2022). Therefore, evaluating return must account for both monetary metrics and long-term developmental impact.

**Public Sector Banks (PSBs)**

PSBs are central to India's agricultural credit system, with a mandate to serve both developmental and commercial objectives. Since bank nationalization in 1969, PSBs have expanded into rural and semi-urban areas, offering credit through schemes such as Priority Sector Lending (PSL), the Kisan Credit Card (KCC), and Agri-Infra Fund-backed loans (RBI, 2022).

Their structural presence, supported by regulatory frameworks and financial inclusion mandates, has enabled outreach to vulnerable populations, including smallholder and marginal farmers. PSBs contribute over 60% of total institutional agricultural credit and are pivotal in implementing central government schemes (GoI, 2023).

However, PSBs face increasing challenges—such as high NPA ratios, pressure to fulfill political mandates, and limited technological adoption compared to private sector counterparts (Bhatt & Sharma, 2019). To mitigate risk and improve return, many banks are adopting AI-based credit analytics, geo-tagging of farm assets, and integration with crop insurance platforms to de-risk their agri-lending portfolios (NABARD, 2023).

Despite operational constraints, PSBs remain indispensable to the agricultural finance ecosystem due to their policy alignment, deep rural network, and commitment to financial inclusion.

The conceptual framework for this study situates agricultural lending within a risk-return paradigm governed by the institutional functioning of PSBs. Being aware of the nature of risk and return and the ways that mitigate them are the key factors in long-term and sustainable development of balanced and inclusive credit architecture. It is against this frame that theoretical models and empirical patterns will be addressed in the following chapters.

**2.3 Theoretical Background**

There is need to have a sound theoretical framework to evaluate the interaction of risk and returns in the agricultural lending. In this section (Table 2.2), interdisciplinary theories used and referenced to conceptualize the way institutions, particularly the Public Sector Banks (PSBs) perceive, evaluate, and manage risk and returns include those of economics, finance, behavioral science, and the field of study of the development. The theories also assist in justification of the methodological decisions taken in this research.

**1. Modern Portfolio Theory (MPT)**

**Proponent:** Harry Markowitz (1952)

According to PPT, one can maximize his or her returns at a certain amount of risk with diversification. In agricultural lending, this idea becomes applicable when the banks distribute their loan book across crops, geographies and borrowers hence limiting the exposure to the impact of local disasters like crop failure or drought (Markowitz, 1952). On the cash side, rural finance applications through MPT have been justified through research that establishes that a regionally diversified agri-loan portfolio reduces the default level (Kumar & Mishra, 2021).

**2. Information Asymmetry Theory**

**Proponent: George Akerlof (1970)**

In a seminal theory Akerlof points the problem of lenders in the situation when borrowers have more information regarding risk profile of the latter than the to the former. In rural lending this gives us moral hazard, adverse selection, and unwillingness by banks to lend to unknown or informal borrowers (Akerlof, 1970). This is the reason why loans in some areas perform badly despite the subsidized interest rates and gives reasons why there must be an improvement on the mechanism of the appraisal.

**3. Credit Scoring and Machine Learning Models**

**Proponents:** Banks and AI/ML researchers and fintech firms (2000s2020s)

Use of data science in credit scoring has become popular in recent years. Real time credit decisions are now possible based on transactional history, mobile phone usage, and remote sensing data being used as algorithms assess credit worthiness (IFC, 2021). These models tackle problems of asymmetric information and improves accuracy of risk profiling, particularly to the smallholders who have no formal credit history.

**4. Development Banking Theory**

**Proponents:** Multiple (1940s onwards)

The theory of development banking states that state-owned financial agencies have to pursue the broader social aim of inclusive growth, poverty reduction, and sector development (Chandrasekhar & Ghosh, 2020). It is the justification used in the area of agri-lending of priority lending sector (PSL), interest subvention, rural credit targets.

**5. Behavioral Finance**

**Proponents:** Daniel Kahneman, Richard Thaler (1980s–2017)

Behavioral finance questions the fact that the borrowers are completely rational. In general, the farmers are characterized by loss aversion, optimism bias, herd behavior, and thus can be more prone to borrow, invest or repay funds (Kahneman, 2011). This lens can be used to understand such phenomena as over-borrowing or deliberately defaulting when there was a possibility to repay the debt.

**6. Climate Risk Finance Models**

**Proponents:** IPCC, FAO, World Bank (2010s–2020s)

The climate modeling used in these models combines the science of climate with credit modeling to predict agro-climate shocks and their implication on the repayment capacity. Arguably the most effective of these tools is agro-climatic zoning, early warning systems, and weather-based insurance that help mitigate the uncertainty of lending to climatic-sensitive areas (FAO, 2022).

**7. Digital Financial Inclusion Framework**

**Proponents:** CGAP, World Bank (2015+)

This framework focuses on on technology-enabled access to finance via mobile banks, Aadhaar-based eKYC and digital wallets. This has created the capacity to deliver low-cost credits, a quicker verification of KYC and monitoring particularly in rural areas less serviced by mainstream banks (CGAP, 2020; World Bank, 2021).

**Table 2.2. Theoretical Approaches and Their Relevance**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Theory / Model** | **Proponent(s)** | **Year** | **Core Idea** | **Relevance to Study** |
| **Modern Portfolio Theory (MPT)** | Harry Markowitz | 1952 | Diversification to manage return-risk trade-off | Agri-lending across regions and crop types to mitigate portfolio risk |
| **Information Asymmetry** | George Akerlof | 1970 | Borrowers have more information than lenders | Explains poor loan performance, moral hazard, and challenges in rural lending |
| **Credit Scoring / ML Models** | Logistic/AI/ML scholars | 2000s–2020s | Use of AI/ML to predict creditworthiness | Advanced risk appraisal using data-driven scoring in PSBs and fintech-enabled credit |
| **Development Banking Theory** | Multiple | 1940s+ | Banks as instruments of inclusive growth | Justifies PSL norms and rural penetration by PSBs |
| **Behavioral Finance** | Kahneman, Thaler | 1980s–2017 | Economic decisions are emotionally and cognitively biased | Farmers’ irrational credit use or risk aversion impacts repayment behavior |
| **Climate Risk Finance Models** | IPCC, FAO | 2010s–2020s | Integrates climate models with credit risk | Vital in drought/flood-prone areas for forecasting default probability in agri-loans |
| **Digital Financial Inclusion** | CGAP, World Bank | 2015+ | Technology-led credit access through mobile, Aadhaar, UPI | Enabled scalable, low-cost credit delivery and risk monitoring |

**2.4 Historical Review of Agricultural Lending**

The history of agricultural financing in India shows us that there is a shift in informal, unregulated credit markets to a formal institutional framework under the supervision of Reserve Bank of India (RBI), National Bank for Agriculture and Rural Development (NABARD) and the Public Sector Banks (PSBs). The history can be segregated into three following major stages: pre-nationalization (before 1969), post-nationalization era (1969 onwards), and liberalization and digital reform phase (2000s onwards).

**2.4.1 Pre-1969: Dominance of Informal Credit Channels**

Prior to 1969, the rural credit system in India was largely dependent on moneylenders, landlords, traders, and indigenous bankers (Desai & Mellor, 1969). These informal agents supplied over 90% of agricultural credit, often at usurious interest rates and under exploitative conditions. The lack of formal institutions in rural areas created a power imbalance that entrenched poverty and indebtedness among small and marginal farmers.

Although cooperative credit institutions were introduced in the early 20th century (through the Co-operative Societies Act of 1904), they were largely ineffective due to poor governance, politicization, and inadequate capital. By the 1950s and 60s, the All India Rural Credit Survey (1954) revealed that institutional credit contributed less than 7% of total rural borrowing. This prompted early interventions, including the setting up of State Land Development Banks and Agricultural Refinance and Development Corporation (ARDC). However, coverage remained insufficient and spatially skewed (RBI, 1965).

Farmers were often compelled to pledge land or future harvests to access credit, leading to a vicious cycle of debt and land alienation. The inadequacy of affordable and timely institutional credit was seen as a major bottleneck to agricultural productivity, mechanization, and food security.

**2.4.2 Post-1969: Bank Nationalization and Expansion of Institutional Credit**

The nationalization of 14 major commercial banks in 1969 marked a watershed moment in India’s rural credit landscape. The primary goal was to ensure a wider geographical spread and functional reach of banking services, particularly to the neglected agricultural and rural sectors (Chavan, 2005). Subsequent nationalization in 1980 brought more banks under public ownership.

This phase witnessed rapid institutional reforms:

* Branch Expansion: Rural bank branches increased from 1,443 in 1969 to over 35,000 by the early 1990s, significantly improving outreach (RBI, 2020).
* Priority Sector Lending (PSL): Mandated banks to allocate 18% of their Adjusted Net Bank Credit (ANBC) to agriculture. PSL norms institutionalized the developmental role of banks.
* Lead Bank Scheme (1970): Allocated specific districts to banks for coordinated credit planning and monitoring.
* Regional Rural Banks (RRBs): Established in 1975 to bridge the gap between cooperatives and commercial banks, offering localized credit solutions at low cost.

Refinance and supervisory functions were consolidated with the formation of NABARD in 1982, which became the apex development financial institution for rural credit. It funded cooperative banks, RRBs, and commercial banks for agriculture and rural infrastructure.

This era also saw the introduction of seasonal agricultural operation (SAO) loans, and efforts to link credit with agricultural extension services, fertilizer distribution, and marketing support.

However, the system was plagued by growing non-performing assets (NPAs), poor recovery rates, and rising political interference, especially in the form of loan waivers and interest subventions. Despite this, the share of institutional credit in agriculture rose to over 60% by the late 1990s, indicating a substantial shift in rural finance dynamics (Mohan, 2006).

**2.4.3 Post-2000s: Liberalization, Digitization, and Targeted Schemes**

Following economic liberalization, agricultural lending was influenced by market reforms, financial sector restructuring, and technological modernization. The emphasis shifted toward efficiency, outreach, and credit quality, with notable policy and institutional innovations:

**a) Kisan Credit Card (KCC) Scheme (1998)**

The scheme of KCC introduced by NABARD and RBI had an objective of providing revolving and flexible credit to the farmers not only to sustain their consumption requirements but also input purchases. It revolutionised loan management and formed the basis block of agri-credit, a short-term form of credit, where an active number of cards exceed 26 crores as of 2023 (GoI, 2023).

**b) Crop Insurance and Credit Risk Mitigation**

Programmes like National Agricultural Insurance Scheme (NAIS), Pradhan Mantri Fasal Bima Yojana (PMFBY) and Weather-Based Crop Insurance Scheme (WBCIS) were designed to safeguard the farmers and the lenders against the dangers of climate. The instruments also tied the insurance with credit hence lowering the effects of default risks (FAO, 2022).

**c) Digital Credit and JAM Trinity**

The Jan Dhan-Aadhaar-Mobile (JAM) system transformed delivery of credit and introduced direct benefit transfer (DBT), e-KYC and digital credit scoring. UPI, AEPS and BHIM enabled easy credits dispensation and tracking.

**d) PM-KISAN and Agri-Infra Fund (2019 onward)**

The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) provides unconditional cash transfers to farmers, helping them meet credit repayment schedules and invest in farm operations. Similarly, the Agri-Infra Fund offers long-term, low-interest loans for post-harvest and infrastructure development.

**e) Priority Sector Lending (Revised)**

The RBI revised PSL guidelines to recognize start-ups, FPOs (Farmer Producer Organizations), and agri-tech ventures as eligible borrowers. This broadened the scope of agricultural lending beyond traditional production loans.

**2.4.4 Key Achievements and Continuing Challenges**

While India’s agricultural credit system has made remarkable strides in institutionalization and outreach, several challenges persist:

* Regional disparities remain, with states like Bihar, Odisha, and Jharkhand having low per capita credit disbursement.
* Credit is skewed toward input-intensive and irrigated farming, sidelining rain-fed and tribal agriculture.
* PSBs struggle with rising NPAs, especially post-loan waivers and during climate disasters.
* Informal credit still accounts for over 30% in some rural pockets, due to procedural complexities in formal lending (NSSO, 2019).

Despite these challenges, India’s experience provides a unique case study in state-supported rural credit evolution, balancing between social obligations and financial sustainability.

**2.5 Global Perspective on Agri-Lending**

Agricultural credit systems around the world reflect a diverse range of institutional designs, policy priorities, and technological advancements. While the underlying objective remains to empower farmers, especially smallholders, with timely and affordable finance, the mechanisms vary across developed and developing economies. A comparative analysis (Table 2.3) provides key insights for strengthening India’s agricultural lending framework by integrating best practices suited to local conditions.

**United States – USDA Farm Service Agency**

The United States Department of Agriculture (USDA), through its Farm Service Agency (FSA), plays a pivotal role in supporting farmers who are unable to obtain commercial credit. It provides direct and guaranteed loans; has lower interest rates and is much interconnected with federal crop insurance system to alleviate risks of losses arising out of poor yields or price volatility. It is a robust example of a public-private partnership in which government takes a partial portion of the credit risk off and motivates the market-based loaning (USDA, 2022). In the case of India, these assurances would increase the appetite to take risks among the banks, especially in the underserved region.

**Brazil – PRONAF**

Brazil BRAZIL PRONAF (National Program to Strengthen Family Farming) A government supported rural credit program with progressive interest rates, insurance based on seasonal impacts, and low interest loans to farmers that are small and marginal. It combines the technical assistance, credit access through gender sensitive approaches, as well as green financing. PRONAF has been instrumental in enhancing the livelihoods of the rural poor people and is commonly used as a point of reference when it comes to inclusive rural finance (Silva et al., 2021). The layered targeting process and weather protection provided by PRONAF can have a positive impact on India in connection to its own attempts at world class production as through PSL and KCC.

**Kenya – M-Pesa and M-Kopa**

Kenya is and has been known the world over when it comes to financial inclusions through mobile technology. The combination of M-Pesa (mobile money platform) and M-Kopa (solar and agri-lending) provides instant credit, real-time KYC, and bundled insurance, even in remote regions. These models eliminate the need for physical banking infrastructure and reduce operational costs (Jack & Suri, 2016). India’s Aadhaar-enabled payment systems (AEPS) and UPI can be further utilized to replicate Kenya’s success in mobile-first lending for smallholder farmers.

**Bangladesh – Grameen Bank**

Grameen Bank, founded by Muhammad Yunus, pioneered group lending and joint liability, enabling poor and landless farmers, particularly women, to access credit without collateral. Its model emphasizes social capital over physical assets and boasts high repayment rates (Yunus, 2007). In India, similar models are seen in Self-Help Groups (SHGs) and Joint Liability Groups (JLGs) supported by NABARD, but Grameen’s peer-monitoring mechanism and empowerment focus could be more deeply institutionalized.

**Philippines – Land Bank of the Philippines**

A government-owned financial institution, the Land Bank of the Philippines targets credit to rural cooperatives, smallholder farmers, and agrarian reform beneficiaries. It combines commercial banking with developmental mandates, ensuring targeted delivery of subsidies and inputs. The Land Bank’s hybrid identity, balancing profitability and social obligation, offers lessons for Indian Public Sector Banks (PSBs) navigating similar dual mandates (ADB, 2019).

**China – Agricultural Bank of China**

The Agricultural Bank of China (ABC) is using big data analytics, satellite monitoring and online digital credit scoring in managing large-scale agri-lending. It provides subsidized interest rates and policy-directed loans to the rural households and cooperatives. The digitalization process undertaken by the bank combined with land registries, weather information, and payment histories acts as a futuristic model of risk-adjusted lending (Chen et al., 2020). The current digitization process in India such as JanSamarth has potential to copy these technologies

**Ethiopia – Digital Warehouse Receipt System**

The Digital Warehouse Receipt System (DWRS) of Ethiopia allows farmers to borrow by using pledges of stored grain with digital warehouse receipts linked to a blockchain. This cuts the requirement of land covering collateral and encourages post-harvest liquidity. The model concerns itself with storage, price realisation and market timing. The same could be true of India whose PACS and e-NAM can replicate the model using smallholders with little in fixed assets (FAO, 2022).

**India – Kisan Credit Card (KCC)**

India has worked on rural credit by establishing Kisan credit card scheme since 1998. It offers a line of credit on a revolving basis, interest subsidy and access to crop insurance. KCCs are now being tied to RuPay cards, Aadhar and UPI, to collectively form an end-to-end credit, subsidy and savings platform. In comparison, there is also room to improve in regional balance as well as differentiation across crop or risk profile (RBI, 2022).

**Table 2.3. International Models of Agricultural Lending**

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Model/Institution** | **Key Features** | **Relevance to Study** |
| **United States** | USDA Farm Service Agency | Government-guaranteed loans, low interest rates, crop insurance integration | Model of public-private credit sharing and risk mitigation |
| **Brazil** | PRONAF (National Program for Strengthening Family Farming) | Tiered interest rates, climate risk coverage, subsidized rural credit | Holistic support for small/marginal farmers |
| **Kenya** | M-Pesa + M-Kopa Agri Lending | Mobile-based microcredit, real-time KYC, bundled insurance | Use of digital platforms for inclusive agri-finance |
| **Bangladesh** | Grameen Bank | Group lending, joint liability, no collateral | Credit access for landless/small farmers |
| **Philippines** | Land Bank of the Philippines | Targeted credit to rural cooperatives and small farmers | Institutional focus on inclusive agri-lending |
| **China** | Agricultural Bank of China | Tech-enabled rural outreach, subsidized credit packages | Use of big data for credit scoring and regional allocation |
| **Ethiopia** | Digital Warehouse Receipt System | Input-linked loans secured by digital grain storage receipts | Innovative collateral substitute for smallholder farmers |
| **India** | Kisan Credit Card Scheme (KCC) | Revolving credit facility, interest subvention, crop insurance | Foundational scheme for Indian agri-credit system |

**2.6 Empirical Studies on Risk Appraisal**

Empirical studies on the subject of risk in agricultural lending developed from a very flavoured social-economic analysis to climate-risk modeling and AI-based credit score. Considering that agriculture is a vulnerable industry susceptible to environmental, market, and political vagaries, the credit risk assessment now plays a significant role in sustenance of rural financial systems. The pretentiousness of the literature is that different approaches can be used-including field surveys to algorithmic estimations-to illustrate how credit risk gets manipulated, recognised, and buffered.

**2.6.1 Traditional Risk Determinants and Socioeconomic Factors**

Initial work related to the relationship between borrower characteristics, land ownership, and cropping decisions and credit risk. According to Basu and Srivastava (2005) households that had smaller landholdings and abnormal income fluctuation patterns were found to be at a high risk of loan defaults. Likewise, Sharma and Zeller (2007) also conducted primary data analysis of the Indian and Bangladesh districts, and reached the conclusion that risk aversion and the unavailability of collaterals contributed to the high credit rationing in banks.

A more recent study by Kumari and Patel (2021) reaffirmed these findings using household survey data from Bihar and Jharkhand, establishing that repayment default correlated strongly with variables such as land fragmentation, lack of irrigation, and low access to extension services.

**2.6.2 Climatic and Weather-Induced Risk**

Several empirical works have concentrated on climate-induced risks. Mishra and Sahoo (2012) found that rainfall deviation beyond ±15% from historical averages led to an increase in NPAs among cooperative banks in Odisha. Later, Rao and Singh (2021) integrated rainfall and soil moisture data to build regional credit risk indices. They demonstrated that such indices, when incorporated in bank appraisals, could reduce mispricing of risk.

A 2023 study by Joshi et al. using data from the Indian Meteorological Department (IMD) and farm loan waivers in Maharashtra revealed that erratic monsoons had a 32% causal impact on farm loan defaults. They proposed integrating weather-linked early warning systems with credit monitoring tools.

**2.6.3 AI/ML-Based Credit Scoring in Agricultural Lending**

The application of machine learning (ML) has marked a major shift in risk appraisal. Bera and Jain (2019) used logistic regression to predict repayment probability based on loan size, cropping cycle, borrower education, and district-level rainfall data. Their model showed an accuracy of 78%.

Reddy et al. (2023) improved upon this using Random Forest and XGBoost algorithms trained on over 50,000 loan records from PSBs across Western UP. Their model reached a prediction accuracy of 86% and identified three top predictors of default: loan disbursal delay, rainfall deviation, and crop failure reports from Fasal Bima data.

A more recent paper by Chatterjee & Sinha (2024) integrated satellite imagery, NDVI scores, and geospatial farm size data into a deep learning model. The model successfully classified borrowers into five risk categories, enabling PSBs to implement differential interest rate pricing.

**2.6.4 Institutional Responses and Risk Mitigation Schemes**

From a policy standpoint, empirical research has shown that insurance schemes, subvention, and credit guarantees play a pivotal role in reducing agri-credit risk.

Narayan and Das (2018) assessed the impact of the Pradhan Mantri Fasal Bima Yojana (PMFBY) on repayment behavior using a difference-in-difference approach. Their findings indicated a 14% drop in defaults in insured districts compared to non-insured ones.

Mukherjee and D’Souza (2020) critiqued RBI’s provisioning norms and argued that overregulation in risk-weighted asset (RWA) calculation was contributing to credit withdrawal in high-risk but high-need geographies.

In 2022, Gupta and Tyagi studied the COVID-19 loan moratorium's impact. They found that even temporary income disruption from pandemic lockdowns led to a 50% increase in overdue agricultural loans in Western UP, suggesting weak institutional contingency buffers.

**2.6.5 Post-2023 Innovations and Risk Trends**

Recent innovations reflect a shift toward predictive and preventive credit risk management. A 2024 study by Dasgupta and Krishnan evaluated fintech-bank partnerships in Andhra Pradesh that use mobile app-based credit monitoring, real-time KYC updates, and digital repayment alerts. They found that these tools reduced delinquency by 19% within the first year of adoption.

In Karnataka, a pilot by NABARD (2023) involving blockchain-based warehouse receipts for credit collateralization reduced loan fraud by 11% and improved farmer access to credit without land-based collateral.

**2.7 Empirical Studies on Return Appraisal**

While risk appraisal in agricultural lending has received substantial attention, an equally critical but comparatively under-researched domain is the appraisal of returns. Return on agricultural lending comprises not only the financial return to lenders (interest income, loan recovery, return on assets), but also the economic and social return in terms of farm output, rural livelihoods, and productivity gains. Scholars have examined how institutional credit impacts productivity, income generation, asset formation, and broader economic development in rural areas.

**2.7.1 Credit Impact on Agricultural Productivity**

Empirical studies consistently show that access to formal credit significantly enhances input adoption, productivity, and income for farm households. Binswanger and Khandker (1995), in a landmark cross-country study, found that formal credit availability was positively associated with the use of high-yielding seed varieties, fertilizers, and mechanization.

A study by Swamy and Balan (2013) in Tamil Nadu observed a 22% increase in paddy yield for credit-accessing farmers compared to non-borrowers. Similarly, Chavan and Ramakumar (2015) used panel data from rural Maharashtra to show that agricultural credit had a statistically significant impact on gross value added (GVA) in farming.

Recent work by Verma and Singh (2022), using National Sample Survey (NSS) 77th round data, concluded that timely institutional credit reduced distress sales and enabled better price realization for smallholders, ultimately increasing net farm income by 19% on average.

**2.7.2 Financial Return for Lenders (PSBs and Cooperatives)**

From a lender’s perspective, the return on agricultural lending is assessed by net interest margins (NIMs), recovery rates, and asset quality. RBI (2019) data shows that agri-loans have historically yielded lower NIMs due to interest subvention, priority sector obligations, and high transaction costs.

However, empirical studies suggest that innovations in loan product design, technology adoption, and credit monitoring can improve returns. For instance, a field study by Iyer and Narayan (2020) found that PSBs that adopted digital field verification tools experienced a 15% improvement in recovery rates, especially in KCC-linked credit.

Mukhopadhyay and Rao (2021) demonstrated that recovery performance and profitability improved when credit was bundled with crop insurance, market linkage, or input supply chains, suggesting that de-risked lending can indirectly boost returns.

**2.7.3 Return through Economic Multipliers and Livelihoods**

Multiple studies highlight the multiplier effect of agricultural credit on rural economies. Ghosh and Prasad (2016) used a CGE (Computable General Equilibrium) model to show that for every ₹1 lakh in agricultural lending, an additional ₹1.8 lakh is generated in rural output and services.

In another recent study, Das and Mehta (2023) evaluated the Madhya Pradesh Rural Credit Program and found that areas with higher institutional credit penetration saw better rural wage growth, higher input use, and greater employment diversification, contributing to inclusive growth.

**2.7.4 Social Return and Gender-Inclusive Lending**

Studies have also evaluated social and developmental returns from agri-lending, particularly when loans are extended to women farmers and SHGs. According to Ananth and Kaur (2018), the repayment rates of loans and better reinvestment of loans in productive assets in women led credit groups are higher.

Joshi and Bala (2022) evaluated the role of NABARD-assisted Joint Liability Groups (JLGs) and found that the social returns surpassed the financial returns, which is particularly true in tribal districts of Odisha and Jharkhand.

**2.7.5 Challenges in Measuring Return**

Although perceivably good, results are limited in return appraisal, literature states.

* **Data quality**: Most banks lack borrower-level profitability tracking.
* **Time lag**: Developmental returns may accrue over years, beyond loan cycles.
* **Distorted incentives**: Interest subvention may conceal actual loan performance.
* **Geographic variation**: Returns differ across agro-climatic and policy environments.

Reddy and Thomas (2024), through a meta-analysis of 58 Indian studies on agri-lending reported that economic returns on the loan are seen in irrigated and policy-supported regions, but poor in the rainfed areas.

**2.8 Regional Literature**

The regional analysis of agricultural lending in India provides key details on the spatial inequality in lending, the efficiency of the lending institution, and other socio-economic aspects that determine access to lending and their results. The nature of exports and imports has changed over the years, and is marked by huge discrepancies in agricultural productivity, the amount of irrigation coverage and rural infrastructure as well as credit penetration across regions in India. These influences define the effectiveness of agricultural lending and the risk-return profile at lower- level geographical units.

**2.8.1 Northern India: Punjab, Haryana, and Western Uttar Pradesh**

India The Green Revolution states Punjab and Haryana have long been touted as green havens of agricultural productivity and deep penetration of institutional credit. The results of studies like Singh et al. (2019) show that recently there has been a stagnant level of credit absorption caused by monocropping, soil erosion, and the unsustainable use of water.

Western Uttar Pradesh presents a more nuanced picture. While districts like Meerut, Muzaffarnagar, and Saharanpur show relatively high credit access through Kisan Credit Cards (KCC), default rates remain high, particularly post-COVID-19 (Kumar & Ali, 2022). Additionally, Bhatt and Rathi (2020) point out that political interference in loan recovery and frequent loan waivers have adversely affected repayment culture among sugarcane farmers.

**2.8.2 Eastern and North-Eastern India: Bihar, West Bengal, Assam**

In contrast to the northwestern belt, credit penetration is significantly lower in eastern India. Bihar, despite fertile soil, suffers from low institutional lending due to weak land records, fragmented holdings, and high transaction costs for banks (NCAER, 2021).

Studies in West Bengal (Roy & Dey, 2018) reveal that cooperative banks have played a more active role in recent years, though their outreach is limited by poor capitalization and risk aversion. In Assam and other northeastern states, terrain challenges, ethnic diversity, and remoteness make formal lending difficult. Baruah and Goswami (2022) observed that microfinance institutions and Self-Help Groups (SHGs) have been relatively more successful than PSBs, especially among tribal populations.

**2.8.3 Southern India: Andhra Pradesh, Tamil Nadu, Karnataka, Kerala**

Southern states display comparatively higher credit-deposit ratios, better banking infrastructure, and effective use of technology in agri-finance. Andhra Pradesh has emerged as a leader in digital land record integration with bank loan systems (Reddy & Murthy, 2021), leading to faster processing and lower NPAs.

Tamil Nadu, through its Integrated Farming System (IFS) and linkage with cooperative credit, has shown improvements in farm incomes and loan utilization (Selvaraj et al., 2020). However, issues like multiple borrowing, crop failure, and farmer suicides continue in regions like Rayalaseema and northern Karnataka.

Kerala stands out for its strong cooperative movement, but agricultural lending is challenged by the dominance of plantation crops, labour shortages, and high costs. Thomas and Joseph (2022) note that credit to women farmers in Kerala has increased significantly via Kudumbashree-linked initiatives, though repayment remains a concern due to erratic income flows.

**2.8.4 Central India: Madhya Pradesh and Chhattisgarh**

These states represent the emerging frontier in agricultural lending. A study by Sharma and Deshmukh (2023) on tribal districts of Chhattisgarh found that digital KCCs and e-KYC verification have improved access, but repayment is still irregular due to subsistence farming and weak market integration.

In Madhya Pradesh, institutional credit has been linked with agri-mechanization schemes, and districts under the Atma Nirbhar Krishi Yojana report better loan utilization and asset formation (Tiwari et al., 2021). However, loan demand is seasonal and weather-dependent, especially in Bundelkhand and Mahakaushal regions.

**2.8.5 Western India: Maharashtra, Gujarat, Rajasthan**

Maharashtra has received extensive scholarly attention due to the agrarian crisis and farmer suicides. Research by Deshpande and Kale (2019) underscores the overdependence on crop loans, lack of irrigation, and poor credit planning as key issues. The Vidarbha region, despite high institutional presence, continues to report poor loan recovery and mental health issues among indebted farmers.

Gujarat presents a more optimistic scenario. The Gujarat State Cooperative Bank has innovated in crop insurance-linked lending, especially in cotton-growing districts (Patel & Mehta, 2020). Rajasthan, on the other hand, struggles with arid zones, low land productivity, and limited branch presence, which hinders credit penetration. Singh and Rathore (2022) recommend promoting warehouse receipt finance to overcome collateral barriers.

**2.8.6 Regional Innovation in Agri-Finance**

Across states, several regional innovations have shown promise in enhancing agri-credit effectiveness:

* UPI-linked KCCs in Maharashtra and MP.
* Satellite-based crop monitoring in Andhra Pradesh.
* Agri-fintech pilots (e.g., Samunnati, Jai Kisan) in Karnataka and Telangana.
* Integration of Farmer Producer Organizations (FPOs) with credit delivery in Bihar and Odisha.

These innovations are beginning to reshape the risk-return dynamics, especially for small and marginal farmers.

**2.9 Research Gaps Identified**

The review of national and international literature on agricultural lending reveals a substantial body of work across themes such as credit delivery, risk management, financial inclusion, and development banking. However, significant research gaps persist, particularly when contextualized within India’s evolving credit architecture and the role of Public Sector Banks (PSBs). The following gaps have been identified:

**1. Lack of Integrated Risk–Return Analysis**

While numerous studies have explored risk in agricultural lending and others have separately evaluated return metrics (e.g., interest income, repayment ratios), few have attempted a combined analysis that simultaneously addresses both dimensions. Agricultural lending inherently involves balancing risk (e.g., credit, climate, policy) against return (e.g., financial yield, socio-economic benefit). However, a holistic framework capturing this risk-return trade-off, particularly in Indian PSBs, remains underdeveloped (Kaur & Kaur, 2022; Singh & Dangi, 2025).

**2. Limited District-Level and Regional Analysis (Western UP)**

There is a dearth of granular studies that examine the performance of agricultural credit at the district or sub-regional level. Western Uttar Pradesh (UP), despite being agriculturally significant and credit-intensive, remains underrepresented in academic analysis. Most available data is aggregated at the state or national level, obscuring localized patterns of loan disbursement, non-performing assets (NPAs), or scheme effectiveness. Region-specific research could provide more actionable insights for policy design and operational reforms (Kumar & Dangi, 2022).

**3. Minimal Use of Quantitative and Predictive Risk Models**

Several studies emphasize descriptive statistics and qualitative observations rather than adopting advanced quantitative techniques. Risk appraisal using predictive analytics (e.g., logistic regression, credit scoring algorithms, weather-indexed risk models) is still nascent in Indian agricultural finance literature. With the increasing availability of granular datasets through financial inclusion drives, Aadhaar, and digital land records, the academic community is yet to fully leverage these tools for robust risk assessment in agri-credit (NABARD, 2023; World Bank, 2021).

**4. Inadequate Post-COVID-19 Credit Impact Evaluation**

The COVID-19 pandemic significantly disrupted the agricultural lending ecosystem, leading to moratoriums, restructuring packages, and digital disbursement interventions. However, the medium- to long-term impact of these policy responses on loan recovery, repayment ethics, and institutional financial health is insufficiently explored in the literature. There is a pressing need for post-2020 empirical studies that examine how credit behavior, default risks, and bank performance evolved in the wake of pandemic-induced policy shifts (World Bank, 2021; RBI, 2022).

These research gaps provide both a rationale and relevance for the present study. By focusing on an integrated risk-return framework, using regional data from Western UP, and applying quantitative tools to analyze post-COVID dynamics, the current research seeks to address critical voids in the existing literature.

**2.10 Summary of Literature Review**

The review of literature over the last two decades (2005–2025) provides a panoramic view of the evolution, gaps, and thematic progression of agricultural lending research. Key themes identified span across access to rural credit, institutional delivery mechanisms, risk typologies, credit utilization efficiency, digital innovations, and post-crisis responses. Each contribution reflects not only the policy context of its time but also signals transitions in the operational and theoretical framework of agricultural finance.

A primary observation is the shift from foundational discussions on credit access and inclusion (Binswanger-Mkhize, 2005; Mohan, 2007) toward more sophisticated studies that explore risk-return calibration, technology-led credit scoring, and climate-integrated lending models (FAO, 2017; NABARD, 2023). For instance, earlier works such as that of Khandker & Faruqee (2006) and Rajeev & Mahesh (2008) highlighted microfinance and informal credit dependencies respectively, revealing structural inefficiencies despite formal expansion. These points are one more evidence of the persistence of the problem of financial deepening in agrarian economies.

At the same time, some other works (e.g., Chand et al., 2010; Kale and Patil, 2014) provide empirical arguments establishing the positive correlation between the level of credit intensity and productivity when the utilization corresponds to the crop cycles and regional resource settings. Considering risk management as a critical issue, Basu (2012) made a strong case in favour of weather-based insurance as a means of de-stigmatising lending in agri-lending. Subsequently, FAO (2017) offered credit appraisals that are climate-adjusted out of an expected rise in weather-driven defaults.

In the recent decade, the literature also captures the technological transformation in lending. CGAP (2015) and NABARD (2023) documented the deployment of digital interfaces, Aadhaar-seeded authentication, GPS-based land mapping, and AI-driven credit scoring to improve credit delivery efficiency. These innovations not only enhance creditworthiness assessment but also expand outreach to remote and previously excluded farmer segments.

From a policy and governance lens, scholars such as Dev (2016) and Bhatt & Rathi (2020) raise concerns over loan waivers and political interference, which compromise repayment ethics and skew PSB asset quality. World Bank (2021) and Singh & Dangi (2025) provide post-COVID and future-oriented models that blend financial return analysis with social impact metrics, signaling a more holistic approach to agri-credit assessment.

Importantly, Table 2.4 synthesizes these landmark contributions in chronological order, allowing thematic grouping of studies across five key clusters:

1. Access and Inclusion (2005–2011),
2. Credit Risk and Utilization (2012–2014),
3. Digital Financial Architecture (2015–2017),
4. Systemic Crisis and Political Economy (2018–2021),
5. Integrated Risk-Return Innovation (2022–2025).

This classification allows a longitudinal understanding of how agricultural credit literature has evolved—moving from supply-side access and institutional gaps toward risk optimization, climate resilience, and digital transformation.

Despite the wealth of contributions, several research gaps persist:

* There is a limited integration of risk and return appraisal in most studies, which tend to treat them as separate constructs.
* District-level micro-studies, especially in fertile yet policy-neglected regions like Western Uttar Pradesh, are rare.
* Advanced credit scoring tools such as AI/ML, while discussed, remain under-evaluated in rural institutional contexts.
* Lastly, post-COVID empirical insights are still emerging and require further longitudinal analysis to measure recovery outcomes and policy effectiveness.

In conclusion, the literature points toward the urgency of a holistic, integrated, and region-specific study of agri-lending—one that accounts for risk, return, technology, and institutional structure in unison. This study intends to bridge these gaps by applying a dual-lens framework supported by district-level empirical validation.

**Table 2.4 Literature Themes and Observations**

|  |  |  |
| --- | --- | --- |
| **Author(s) & Year** | **Theme/Focus Area** | **Key Observation/Contribution** |
| Binswanger-Mkhize (2005) | Rural Credit Access | Highlighted structural barriers in accessing formal credit among smallholder farmers. |
| Khandker & Faruqee (2006) | Microfinance & Agri Lending | Demonstrated long-term benefits of microcredit in increasing input use and yields. |
| Mohan, R. (2007) | Financial Inclusion & PSL | Emphasized the need to restructure Priority Sector Lending for rural development. |
| Rajeev & Mahesh (2008) | Informal vs Formal Credit | Revealed continued farmer dependence on informal credit despite formal availability. |
| Reserve Bank of India (2009) | NPA Trends in Agri Lending | Noted rising NPAs in agri-credit portfolio post-loan waiver schemes. |
| Chand et al. (2010) | Credit Intensity & Productivity | Found strong correlation between credit availability and agricultural productivity. |
| NABARD (2011) | SHG-Bank Linkage Model | Documented growth and repayment discipline in SHG-linked rural credit. |
| Basu, P. (2012) | Risk Management in Rural Lending | Proposed integration of weather-indexed insurance with loans to manage risk. |
| Das, A. (2013) | Agri-Credit Allocation | Found skewed credit allocation toward irrigated and resource-rich regions. |
| Kale & Patil (2014) | Credit Utilization Efficiency | Low loan utilization in non-irrigated areas led to poor loan performance. |
| CGAP (2015) | Digital Financial Inclusion | Introduced Aadhaar and mobile tech as tools for expanding rural financial access. |
| Dev, S.M. (2016) | Crop Loan vs Term Loan Dynamics | Found that term lending was declining while short-term crop loans dominated credit delivery. |
| FAO (2017) | Climate Change & Agri Credit | Advocated climate-adjusted credit appraisal models for resilience in farming. |
| Kumar et al. (2018) | KCC Effectiveness | Identified operational inefficiencies and gaps in access within the KCC scheme. |
| Deshpande & Kale (2019) | Agrarian Crisis & Credit Defaults | Linked rising farmer distress and suicides to debt overhang and poor credit design. |
| Bhatt & Rathi (2020) | Political Interference in Lending | Demonstrated how loan waivers eroded repayment culture and impaired PSB asset quality. |
| World Bank (2021) | Post-COVID Credit & Recovery | Emphasized the role of restructuring and moratoriums for resilience in farm lending. |
| Kaur & Kaur (2022) | Risk Typology in Agri Lending | Categorized emerging risks including digital, policy, and climate-linked risks. |
| NABARD (2023) | Tech-Enabled Lending | Documented adoption of AI/ML models, GPS tagging, and mobile interfaces in PSBs. |
| NCAER (2024) | Land Records & Lending | Showed how digitized land records enhance collateral verification and loan disbursal. |
| Singh & Dangi (2025) | Integrated Risk-Return Model for PSBs | Proposed a comprehensive appraisal model integrating financial and social returns. |