

**STRATEGIC FRAMEWORK FOR RUSSIAN-MALAGASY
AGRICULTURAL COOPERATION: A CONSORTIUM-BASED JOINT
VENTURE APPROACH**

Abstract: This article develops a strategic framework for Russian-Malagasy cooperation in the agricultural sector through the establishment of a consortium-based joint venture. The study examines the structural constraints of Madagascar's agro-industrial sector, including low agricultural productivity, soil degradation, limited mechanization, inadequate infrastructure, weak supply chains, restricted access to finance, land tenure insecurity, and political and climate-related risks. Based on an analysis of the competitive environment and existing foreign investment models, the article identifies contract farming and integrated value-chain development as more sustainable approaches than large-scale direct land acquisition. A consortium of Russian organizations is proposed to combine complementary competencies in export support, agricultural financing, fertilizers, mechanization, production, processing, and risk mitigation. The proposed framework involves the Russian Export Centre, PhosAgro, Rostselmash, Rusagro, and Rosselkhozbank, together with Malagasy partners such as Lecofruit, SAHANALA, Habibo Group, FIFATA, and relevant government institutions. The study also develops an institutional stakeholder framework and a 5×5 risk matrix covering political, climate, land, social, economic, currency, and infrastructure risks. Scenario-based financial analysis demonstrates that project profitability is highly sensitive to yield, operating costs, and climate conditions, with the estimated internal rate of return ranging from 9–10% under adverse conditions to 20–22% under an optimistic scenario. The findings suggest that a contract farming model supported by blended financing, localized technology transfer, and strong institutional partnerships can

provide a commercially viable and socially sustainable basis for Russian-Malagasy agricultural cooperation.

Keywords: Russian-Malagasy cooperation; agricultural cooperation; Madagascar; joint venture; consortium; contract farming; agricultural investment; agro-industrial development; technology transfer; agricultural mechanization; fertilizer technology; value chain integration; blended financing; risk management; agricultural productivity.

0. Introduction

In November 2025, a Malagasy parliamentary mission led by National Assembly Chairman Sitene Thierry Randrianasolonaiko held discussion with Rossotrudnichestvo in Moscow, resulting in an agreement to establish a Russian House in Antananarivo and arrange a Russian humanitarian business delegation to Madagascar in 2026 (Rossotrudnichestvo, 2025). The Malagasy delegation emphasized the need for enhanced business ties, while Russia pledged technological expertise to bolster Madagascar's economic independence (Rossotrudnichestvo, 2025). These mutual interests position the agro-industrial sector as a particularly suitable avenue for Russian involvement.

1. Analytical Overview: The Malagasy Agro-Industrial Sector

Agriculture employs 80% of Madagascar's population, contributes over 28% of GDP, and directly influences national poverty, which affects nearly 80% of citizens (International Initiative for Impact Evaluation [3ie], 2019; U.S. Department of State, 2025). Despite abundant arable land—only 3.5 of 41 million hectares are cultivated—productivity remains low (GTZ, 2009; Wikipedia contributors, 2025). Rice, grown on 1.34 million hectares, yields 2.7 tons per hectare, well below the Asian average of 4.3 tons, a gap exacerbated by soil erosion rates of 5–20 Mg per hectare annually (GTZ, 2009; FAO, n.d.).

Structural constraints include smallholder operations averaging 1.2–1.3 hectares with traditional practices, limited mechanization, and weak extension

services, fragmented supply chains, and constrained credit access (GTZ, 2009; Minten et al., 2009). Government initiatives such as the Plan Émergence Madagascar, the National Rice Development Strategy, and the Master Plan for the Livestock Sector underscore the scale of these challenges rather than indicating near-term transformation (Afrexim Trin Solutions, 2025; International Livestock Research Institute, 2024).

Analysis of Market Entry Barriers

Foreign investors in Madagascar's agricultural sector face interconnected barriers. Inadequate infrastructure—including limited, poorly maintained roads and rail vulnerable to cyclones—renders transportation costly and unreliable (U.S. Department of State, 2025; UNOPS, 2024). Unreliable electricity and water supply force firms to internalize utility provision, raising capital requirements (International Trade Administration, 2025; U.S. Department of State, 2025).

The institutional environment amplifies these physical hurdles. The legal system suffers from backlogs and inconsistent enforcement, while corruption is pervasive in tax, customs, and land administration (International Trade Administration, 2025; U.S. Department of State, 2025). Foreign entrants without local partners face unexplained administrative disadvantages (U.S. Department of State, 2025).

Land tenure insecurity represents a critical risk. Although foreigners may obtain 99-year leases, the system remains complex and poorly documented; approximately 80% of land lacks formal title, exposing investors to customary claims (GTZ, 2009; U.S. Department of State, 2025). Lease acquisition is lengthy, requires high-level approval for areas exceeding 500 hectares, and lacks transparency (Clayton et al., 2011). The 2008 Daewoo Logistics bid to lease 1.3 million hectares—which triggered a political crisis—illustrates the volatility surrounding land acquisitions (Clayton et al., 2011).

With an 80.7% poverty rate, the domestic market for mass-consumption agricultural products is limited, favoring export-oriented strategies (International

Trade Administration, 2025). High transaction costs arise from low human capital, restricted credit access, and fragmented supply chains (Minten et al., 2009). Lecofruit, a successful exporter managing over 9,000 smallholder contract farmers, internalized extension services, input provision, and quality control—demonstrating both the feasibility of engaging smallholders and the substantial operational burden it entails (Minten et al., 2009).

Analysis of the Competitive Landscape

Despite formidable barriers, a diverse range of international competitors have established a presence in Madagascar. Chinese firms pursue large-scale, vertically integrated models: Hunan Agri/Chengsheng operates in hybrid rice and cassava via contract farming; SUCOMA, a major sugar producer, has faced labor disputes; Tianli Agri links cotton production to textile processing in Mauritius; and Longfei has diversified from cement into aquaculture (Chen & Landry, 2016). European firms, particularly French, dominate high-value exports; Lecofruit manages over 9,000 contract farmers producing vegetables for European supermarkets, demonstrating vertical integration under stringent phytosanitary standards (Minten et al., 2009). Indian firms have encountered significant challenges: VARUN International's leases for over 170,000 hectares generated political controversy, while Munja and Penja faced land tenure conflicts and compliance issues (Clayton et al., 2011).

Several strategic insights emerge. Contract farming integrating smallholders (Hunan Agri, Lecofruit) has proven more sustainable than direct land acquisition (Daewoo, VARUN) (Chen & Landry, 2016; Clayton et al., 2011; GTZ, 2009; Minten et al., 2009). Successful entrants internalize functions—extension services, quality control, infrastructure—absent in the public sector (Chen & Landry, 2016; Minten et al., 2009). Political and reputational risk management is paramount, as land-related controversies have derailed investments (Clayton et al., 2011; GTZ, 2009). Vertical integration linking Madagascar to regional value chains (Tianli Agri) offers a compelling model (Chen & Landry, 2016).

The sector holds vast untapped potential constrained by systemic deficits in productivity, infrastructure, and institutional capacity. Madagascar's need for modern irrigation, agricultural machinery, and agro-processing creates opportunities for international partners (Afrexim Trin Solutions, 2025). Success depends on engagement models that integrate smallholders, manage risk, and internalize essential support functions. For Russia, which has committed to sharing technological expertise to strengthen Madagascar's economic sovereignty (Rossotrudnichestvo, 2025), this alignment represents a strategic opportunity requiring proven experience in foreign investment and technology transfer in developing economies.

2. Russian Companies with Expertise, Technologies, and International Project Experience in the Agriculture Sector

Establishing a successful joint venture in Madagascar's agriculture sector requires Russian partners whose competencies directly match the country's expressed needs: irrigation, fertilisers, mechanisation, seed technology, and processing infrastructure. Rather than a single company, a consortium of Russian entities—each with proven international experience, particularly in Africa—can deliver an integrated solution that spans financing, inputs, equipment, production, and processing. The following five organisations, drawn from the state and private sectors, collectively offer the complementary capabilities necessary for a large-scale agricultural modernisation project.

A State Backed Framework: Russian Export Centre (REC)

The Russian Export Centre (REC) is the state-integrated institution responsible for coordinating non-resource exports and structuring investment projects abroad (Russian Export Centre, 2024). Through its subsidiaries EXIAR and the Russian Export Center Bank, REC provides export credits, political risk insurance, and loan guarantees (EXIAR, 2025). Between 2022 and 2025, REC led agricultural business missions to Egypt, Nigeria, Angola, and Kenya, and structured a government-backed credit line for agricultural machinery to Zimbabwe,

mobilising over US\$ 100 million. In 2024, REC supported Russian agricultural exports worth more than US\$ 6 billion, with Africa accounting for a growing share (Russian Export Centre, 2024).

Competitive advantage: Unlike purely commercial financiers (e.g., European or Chinese commercial banks) or bilateral development agencies (USAID, AFD), REC combines export credit, political risk insurance, and direct government-to-government negotiation under one roof. For Madagascar, this means a single point of contact that can de-risk the project from both political and commercial angles—an offer that no other national export agency currently matches in the Malagasy agricultural sector.

Soil Fertility and Inputs: PhosAgro

Madagascar's low agricultural productivity is rooted in severe soil degradation; fertiliser use averages only 7 kg per hectare, far below the sub-Saharan African average. PhosAgro, a leading producer of phosphate-based fertilisers, offers high-efficiency products and agronomic advisory services, including soil analysis and custom blends for tropical smallholder systems (PhosAgro, 2024). In Africa, it has partnerships in Kenya, Zambia, and Côte d'Ivoire, and in 2024 signed an MOU with the African Fertilizer and Agribusiness Partnership (AFAP) to support soil health initiatives covering an estimated 500,000 smallholder farmers (African Fertilizer and Agribusiness Partnership, 2024). Its collaboration with Brazilian agricultural cooperatives (serving over 200,000 farmers) further demonstrates its effectiveness with smallholder systems. PhosAgro's global revenue exceeded US\$ 12 billion in 2024, with a 20% share of the global phosphate fertiliser market (PhosAgro, 2024).

Competitive advantage: While major competitors like OCP (Morocco) and Mosaic (USA) also supply fertilisers, PhosAgro's unique value proposition lies in bundling product supply with intensive on-the-ground agronomic training. In Africa, it has already deployed mobile soil testing laboratories and cooperated with local universities to adapt recommendations to tropical soils. For Madagascar, this means

not just a shipment of fertiliser but a long-term partnership to rebuild soil health—a feature that OCP, focused largely on phosphate rock, does not offer at the same level of farmer engagement.

Mechanisation and Local Service Capacity: Rostselmash

The Malagasy government's plan to develop 150,000 hectares of new rice fields calls for mechanised transplanting and harvesting. Rostselmash, a global agricultural machinery manufacturer, is well-positioned to meet this demand with rice-specific combine harvesters and compact tractors (Rostselmash, 2025). Rostselmash has a strong presence in African markets such as Zimbabwe, Tanzania, and Namibia. In Zimbabwe, it established a local assembly and service centre covering 80% of the country's mechanised farming regions (Zimbabwe Ministry of Lands, Agriculture, Fisheries, Water and Rural Development, 2024). In Tanzania, it participated in a World Bank-supported mechanisation project that provided over 300 tractors to farmer cooperatives, achieving a 98% machine availability rate after two years (World Bank, 2024). The company's annual turnover exceeds US\$ 1.5 billion, with a 35% share of the combine harvester market in the CIS and African export markets (Rostselmash, 2025).

Competitive advantage: Unlike global competitors such as John Deere (USA) or Claas (Germany), which focus primarily on high-end equipment and dealer networks in established markets, Rostselmash has demonstrated a specific capability to set up local service hubs and train local technicians in challenging African environments. Its willingness to transfer technology through local assembly (as in Zimbabwe) aligns perfectly with Madagascar's goal of building domestic capacity rather than remaining dependent on imports. No other major agricultural machinery manufacturer offers a comparable model of deep localisation in Africa.

Integrated Production and Processing: Rusagro Group

Rusagro, one of Russia's largest vertically integrated agricultural holdings, manages over 650,000 hectares using modern precision agriculture techniques (Rusagro Group, 2023). Its expertise spans irrigation management, seed selection,

post-harvest handling, and large-scale processing facilities, including sugar refineries, oil extraction plants, and meat processing. In 2023, Rusagro launched a joint venture in Serbia, constructing a 100,000-tonne-per-year vegetable oil processing plant and building a supply chain with 2,500 local farmers—a blueprint transferable to Madagascar (Rusagro Group, 2023). The group's 2024 consolidated revenue was approximately US\$ 2.3 billion, ranking it among the top three sugar producers and top five oilseed processors in Russia.

Competitive advantage: While Chinese agricultural firms (e.g., COFCO) focus on land acquisition and large-scale farming with less emphasis on processing, and European firms (e.g., Louis Dreyfus) concentrate on trading and logistics, Rusagro offers an end-to-end integrated model—from seed to processed product—proven in a greenfield setting (Serbia). For Madagascar, where no modern rice milling or value-addition infrastructure exists, Rusagro's ability to design, finance, and operate a complete agro-industrial cluster in a new market is a unique selling point that distinguishes it from competitors who would rely on existing infrastructure or simple off-take agreements.

Financing and Risk Mitigation: Russian Agricultural Bank (Rosselkhozbank)

No large-scale agricultural project can succeed without access to affordable, long-term finance. Rosselkhozbank is a specialised financial institution with extensive experience in agricultural project finance, leasing, and trade finance (Rosselkhozbank, 2024). It has participated in cross-border syndicated loans for agricultural modernisation in Zimbabwe and Mozambique, working alongside the African Development Bank, with total disbursements exceeding US\$ 400 million in African agribusiness projects since 2020 (Rosselkhozbank, 2024). The bank also structures leasing arrangements for agricultural machinery exports to Africa, providing a flexible mechanism for acquiring equipment without placing excessive upfront burdens on the joint venture. Rosselkhozbank's total assets exceed US\$ 50 billion, and it maintains a specialised Africa-focused desk.

Competitive advantage: Unlike commercial banks (e.g., Standard Bank, BNP Paribas) that require extensive local collateral and offer only short-term working capital, Rosselkhozbank provides long-tenor project finance (up to 10–15 years) combined with leasing products tailored to agricultural cycles. Moreover, its close coordination with REC and Russian state export agencies allows it to structure sovereign-backed financing that de-risks the project for both Malagasy and Russian stakeholders. This combination of specialised agricultural expertise, long maturities, and state backing is not readily available from any other international financier operating in Madagascar.

3. The Structure of Governance in Madagascar in the Context of the Agricultural Sector

The agro-industrial sector is examined as an export-oriented system—the most realistic model given Madagascar’s institutional and infrastructural constraints. This section analyzes key governmental bodies relevant to a Russian company across critical stages: market entry and registration, land rights, production regulation, and export procedures.

Market Entry and Registration. In Madagascar a company must register through the Trade and Companies Register and other administrative bodies (World Bank, 2017; UNCTAD, 2023). However, a Russian company primarily interacts with them indirectly, as most procedures are conducted through the Economic Development Board of Madagascar (EDBM). Acting as a one-stop shop, EDBM provides access to other bodies and facilitates processes, although it does not make binding decisions. Therefore, it demonstrates high interest, due to continuous interaction throughout operations, but low influence (World Bank, 2017).

Land Tenure. After registration, to formalize land rights for agriculture through the Land Registry Service (Madagascar Invest, 2023). It has high influence, as it formalizes landownership without which land cannot be legally used. However, it exhibits low interest, since interaction is typically limited in duration.

Export and Quality Control. Agricultural activity requires navigating the process from production to export. In Madagascar, agriculture is regulated by the Ministry of Agriculture and Livestock, which oversees pesticides and seeds, ensures product quality, and addresses related issues. It thus has high influence and interest, as non-compliance with quality standards results in the loss of legal production rights (SGS Digicomply Editorial Team, 2023; World Trade Organization, 2015). To export agricultural products, a phytosanitary certificate is required, issued by the Plant Protection Directorate (DPV) (Economic Development Board of Madagascar [EDBM], n.d.). The DPV has high influence, as it grants the certification for export, and high interest, since each new product requires a separate certificate.

Customs. Export procedures must pass through the Customs Directorate General. This institution has both high influences since exports cannot occur without their approval—and high interest, as interactions are ongoing and standardized.

Informal Decision-Making Center. The President of the National Assembly—analogous to the State Duma—has publicly prioritized agricultural technology and fertilizers. Though formally a legislative body, it can serve as an informal center of influence by providing political support, raising institutional interest, and reducing administrative barriers. Compliance with legal requirements remains mandatory. Interest and influence are high, though influence is political and indirect, unlike the administrative authority of the Ministry of Agriculture.

Matrix Construction. Based on the assessed levels of institutional influence and interest, an interest–influence grid can be constructed, where the x-axis represents interest and the y-axis represents influence (Figure 1).

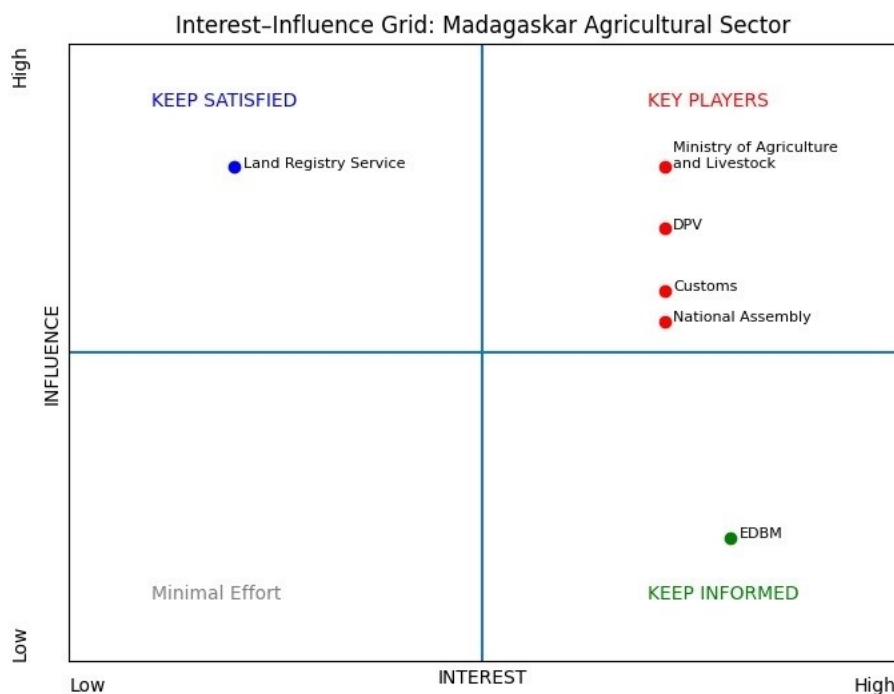


Figure 1. Interest–Influence Grid

Thus, based on Johnson et al. (2008), the identified institutions can be classified into three groups. *Key players*—those with high influence and interest, requiring active negotiation and continuous engagement—include the Ministry of Agriculture and Livestock, DPV, the National Assembly, and the Customs Directorate General. The “*keep satisfied*” category includes high influence but low interest, specifically the Land Registry Service. The “*keep informed*” category includes institutions with low influence but high interest, such as the EDBM. Key players can be identified as the primary actors in the negotiation process, requiring continuous interaction, whereas the remaining institutions participate mainly in a regulatory or supportive capacity.

Negotiation Track. The sequence of interaction is as follows: EDBM → Land Registry Service → Ministry of Agriculture and Livestock → DPV → Customs Directorate General. The National Assembly is expected to be involved throughout project implementation through informal political channels. While all institutions are necessary for project realization, the most critical actors are the Land Registry Service, the Ministry of Agriculture and Livestock, and the DPV. Without their approval and involvement, it is not possible to initiate agricultural production

or, in practice, to begin export activities. EDBM plays an important facilitating role; however, its role is supportive. Similarly, engagement with customs authorities is not meaningful without first obtaining the required certification from the DPV.

4. The list of major Malagasy companies and institutional partners that could potentially act as co-founders of a joint venture on the Malagasy side.

Institutional Partner - Ministry of Agriculture and Livestock of Madagascar. The central government authority responsible for agricultural policy, rural development, irrigation systems, and livestock management. It is the primary body overseeing the planning and implementation of national agricultural development strategies. Engagement with the Ministry is essential due to its control over land access, infrastructure projects, and sectoral programs. In developing economies, large agricultural investments require alignment with public authorities to reduce regulatory risks and ensure project feasibility (World Bank, 2023).

Role: regulatory and institutional support; facilitation of approvals and land access; coordination with national programs

Lecofruit. A leading agri-export company working with thousands of farmers under a contract farming model. Lecofruit is one of the largest agricultural exporters in Madagascar, working with over 9,000 smallholder farmers and supplying fresh vegetables to European markets. The company operates a fully integrated value chain, including input provision, training, quality control, and export logistics. This scale demonstrates its capacity to manage complex supply chains in a low-infrastructure environment. According to the World Bank (2023) and Food and Agriculture Organization, such vertically integrated, export-oriented models represent the most successful form of agribusiness in Madagascar.

Role: supply chain management, export operations, and operational model for the JV.

SAHANALA. A social enterprise and network of cooperatives working with smallholder farmers and exporting niche agricultural products. SAHANALA works with several thousand producers across multiple regions and focuses on high-value

crops such as spices, essential oils, and cocoa. The organization aggregates production from dispersed smallholders and integrates them into value chains, which is critical in a country where agriculture is dominated by small-scale farms (World Bank, 2023; International Fund for Agricultural Development, 2022). Its operational scale and cooperative structure make it a key intermediary between investors and rural producers.

Role: formation of the raw material base, integration of smallholder farmers.

Habibo Group. A major national business group active in trade and the agri-food sector. Habibo Group operates multiple production facilities and a nationwide distribution network, supplying food products across Madagascar. Its scale and integration into domestic markets make it a strong partner for commercialization. In an environment characterized by administrative barriers and weak institutions, such companies play a key role in market access and regulatory navigation (U.S. Department of State, 2025).

Role: commercialization of products, access to the domestic market.

Institutional Partner - FIFATA (Federation of Malagasy Farmers). The largest federation of farmer organizations in the country. FIFATA represents tens of thousands of farmers through regional unions and cooperatives, making it one of the most influential agricultural organizations in Madagascar. Given that approximately 70-80% of the population is engaged in agriculture (World Bank, 2023), involvement of such a federation is essential for ensuring social acceptance and reducing land-related risks. It also facilitates dissemination of technologies and access to agricultural services (IFAD, 2022; U.S. Department of State, 2025).

Role: engagement with farmers, reduction of social and institutional risks.

Link between Partner Selection and Analytical Findings

Mitigation of land risks. The JV model avoids large-scale land acquisition-associated with political failures (Daewoo, VARUN) - and relies on contract farming (Lecofruit, SAHANALA) and farmer organizations (FIFATA), consistent with proven sustainable practices (Clayton et al., 2011; GTZ, 2009).

Internalization of functions. Given weak state support, key functions (training, inputs, logistics) are internalized by partners such as Lecofruit, reducing operational risks.

Political and reputational resilience. Involvement of the Ministry and FIFATA ensures legitimacy, reduces conflict risks, and aligns the project with national priorities.

5. Project Financing Sources and Risk Analysis

To implement a joint agricultural project in Madagascar, it is advisable to use a mixed financing model: a combination of equity capital from JV participants and debt funds from both Russian and international institutions. Bank loans and concessional loans can be attracted as financing sources. In particular, Rosselkhozbank (a 100% state-owned bank focusing on the agricultural sector) serves as a key institution supporting domestic agricultural enterprises (Russian Agricultural Bank, n.d.). Due to its public sector status and specialized focus, it can provide long-term conversion loans at low interest rates (partially subsidized by the state). Similarly, major international financial institutions (MFIs), such as the World Bank/IDA and the African Development Bank, can provide concessional financing (e.g., IDA recently financed an agricultural project in Madagascar for approximately \$105 million) (World Bank, 2025). Furthermore, the IFAD fund has historically invested hundreds of millions of dollars in Madagascar's rural programs (IFAD, n.d.).

Additionally, bilateral and subnational guarantees/loans can be considered. For instance, the French Development Agency (AFD), through Proparco, has already allocated over €44 million in the form of concessional credit lines and guarantees to support SMEs on the island (Choose Africa, n.d.). Russian export guarantees (REC) and PPP mechanisms can also provide partial co-financing for the import of machinery (e.g., from Rostselmash) and technologies. The equity capital will come from shares held by Russian companies (e.g., Rusagro) and Malagasy partners. Thus, the financing portfolio may include: direct investments from JV

participants, credit lines from Rosselkhozbank (or VEB/REC), loans from MFIs (World Bank/IDA, AfDB), as well as programs from AFD/Proparco and IFAD. Such diversification reduces the risk of funding shortages during project implementation.

Risk Matrix

A semi-quantitative L-Type Matrix (5x5) method, compliant with MIL-STD-882D and ISO 31000:2018 standards, is used to develop the risk management system (SafetyCulture, n.d.). Each risk is assessed along two axes: probability of occurrence and degree of impact on project objectives.

The probability assessment is based on time series analysis. For example, for climate risks, statistics from the last 23 years are used, according to which 47 cyclones have hit Madagascar, yielding a mathematical probability of $P = 47 / 23 = 2$ events per year (ACAPS, 2024). At the same time, storm intensity is increasing: while from 1980 to 1993 only one cyclone had wind speeds exceeding 200 km/h, such events have become more frequent in the current decade (ReliefWeb, 2024). According to the World Bank's risk profile, Madagascar's average annual direct losses from natural disasters are about \$100 million, or approximately 1% of its GDP (World Bank, n.d.).

Analysis and Justification of Key Risk Categories (Table 1)

Political and Institutional Risk. Madagascar is characterized by a highly fragmented political landscape. In October 2025, another regime change occurred, leading to the establishment of a two-year transitional period. Despite the current calm, the risk of concession agreement renegotiation remains "possible" with "catastrophic" impact. The historical precedent with Daewoo Logistics (an attempt to lease 1.3 million hectares), which led to the overthrow of the government, dictates the need to avoid direct land ownership.

Climate and Production Risk. Madagascar's agricultural sector is critically dependent on rainfall. The drought in the south of the country in 2020–2021 led to a 60% drop in production in some areas.

Land and Social Risk. Approximately 80% of land lacks formal titles, creating fertile ground for conflicts with local communities when attempting large-scale development.

Economic and Currency Risk. Inflation in Madagascar is forecast at 7.5% in 2026. The risk of depreciation of the ariary poses a threat to the repayment of loans denominated in hard currency.

Probability \ Impact	1–2 (Low)	3 (Medium)	4–5 (High)
5 (Almost Certain)	Soil Erosion	Price Volatility	Infrastructure Deficit
4 (Likely)	Logistics Delays	Currency Risk	Cyclones / Floods
3 (Possible)	Changing Norms	Land Disputes	Political Crisis
1–2 (Rare)	Technological Failures	Epidemics	War / Expropriation

Table 1. Risk Matrix

Econometric Analysis: Methodology and Calculations

To assess the model's resilience, a scenario analysis was conducted based on three key variables: yield, price, and costs .

1. To assess the financial impact (I), the Expected Monetary Value (EMV) formula is applied (EMV):

$$EMV = \sum_{i=1}^n P_i * L_i,$$

where L_i — potential losses.

2. The investment efficiency of this project is evaluated based on a comprehensive analysis of the Internal Rate of Return (IRR) and Net Present Value (NPV). The calculations are based on the basic net present value formula:

$$NPV = \sum_{t=0}^T \frac{CF_t}{(1+r)^t},$$

where the variable CF_t denotes the cash flow in a specific period t , r corresponds to the discount rate (WACC), and T defines the project planning horizon, which averages 10 to 15 years.

3. The formation of cash flows (CF) in the model is described by the equation:

$$CF = \text{Revenue} - \text{OPEX} - \text{CAPEX} - \text{Taxes}$$

4. The key revenue indicator is calculated as the product of yield, price, and area:

$$\text{Revenue} = \text{Yield} * \text{Price} * \text{Area}$$

At the current stage of analysis, a low base yield of 2.7 t/ha was identified, but there is potential for its growth through the active use of fertilizers and mechanization processes. Operating expenses (OPEX), including labor, resources, logistics, and energy costs, take into account regional specifics, namely expensive logistics due to weak infrastructure and the need to perform a number of functions independently in the absence of state support. Capital expenditures (CAPEX) cover the purchase of machinery and irrigation systems, while part of these costs is optimized through the use of leasing programs (e.g., Rostselmash), which allows transferring part of the financial burden to the operating expense category.

5. Within the framework of the study, the Internal Rate of Return (IRR) is calculated, defined as the rate r at which the net present value of the project equals zero:

$$\sum \frac{CF_t}{(1 + IRR)^t} = 0$$

The mathematical sensitivity of the model is expressed through the partial derivatives $\frac{\partial IRR}{\partial \text{Yield}} > 0$ and $\frac{\partial IRR}{\partial \text{OPEX}} < 0$, which confirms the status of yield as the main driver of profitability and costs as the main risk factor. In the baseline scenario (A), assuming a yield of 3.5 t/ha, a price of \$300/t, and an area of 10,000 ha, revenue is \$10.5 million. With operating expenses of \$6 million and depreciation charges of \$2 million, the cash flow is approximately \$2.5 million, which, with a WACC of $\approx 10\%$, provides an IRR of 14-16%.

The negative scenario (B) considers possible shocks such as poor infrastructure (+20% OPEX) and climate risks (-15% Yield). In this case, the new yield decreases to 2.975 t/ha, resulting in revenue of \$8.925 million. With OPEX

increased to \$7.2 million, the cash flow becomes negative (-\$0.275 million), and the IRR decreases by approximately 5–6 percentage points, reaching the 9-10% mark.

The optimistic scenario (C) assumes a 25% increase in yield due to the technologies of partners PhosAgro and Rostselmash, as well as a 10% reduction in costs. Here, yield reaches 4.375 t/ha, generating revenue of \$13.125 million. With OPEX reduced to \$5.4 million, cash flow increases to \$5.725 million, bringing the IRR to 20-22%.

In conclusion, econometric modeling demonstrates the project's high sensitivity to operational parameters. Despite a significant decrease in IRR under unfavorable conditions, the use of an export-oriented model and modern technologies ensures a return exceeding 20% in the optimistic forecast, confirming the project's sustainability with effective risk management.

6. Recommendations and Conclusion

To mitigate Madagascar's high land tenure and political risks, Russian investors should avoid direct land acquisition and instead pursue a contract farming model. A consortium led by the Russian Export Centre (REC) for risk mitigation, Rusagro for integrated value-chain management, and Rostselmash for localized mechanization is recommended, partnering with Malagasy entities such as Lecofruit and FIFATA to ensure social legitimacy and operational sustainability.

The negotiation track should prioritize the Ministry of Agriculture and the National Assembly to maintain political momentum, while routine approvals are handled through EDBM. A blended financing structure combining Rosselkhozbank project finance with concessional loans from the World Bank/IDA is advised to hedge against currency and infrastructure risks. With yield intensification as the core driver, the project is aimed to achieve an IRR of 14–22%, balancing commercial viability with the bilateral diplomatic objectives established by Rossotrudnichestvo.

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