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INNOVATIONS IN THE VALUE CHAIN MANAGEMENT SYSTEM IN THE AGRICULTURAL SECTOR

Ukrainian agribusiness, despite current challenges and significant risks, is actively implementing innovations aimed at enhancing efficiency, competitiveness, and sustainable development. Notwithstanding the extraordinary challenges imposed by sustained military conflict, which fundamentally disrupted conventional agricultural operations and compromised supply chain integrity, Ukraine's agrarian sector has exhibited remarkable resilience and adaptability. This demonstrated stability has catalyzed heightened investment activity among both national and international stakeholders, who acknowledge the sector's substantial long-term growth trajectory. Research findings published by Latifundist in partnership with Crédit Agricole Bank [1] indicate that cumulative foreign direct investment flows into Ukraine's agricultural sector totaled USD 1.9 billion over the 2019–2023 timeframe.

The agricultural sector value chain represents a sophisticated, integrated framework of interconnected business processes that spans the

entire continuum of agricultural product transformation – from initial cultivation through final consumption. The primary phase – production – encompasses agrotechnological planning, soil preparation, seeding, crop husbandry, and harvest operations. The produce subsequently transitions to the primary processing phase, incorporating sorting, purification, packaging, and controlled storage under optimal conditions. During the ensuing secondary processing stage, agricultural commodities undergo transformation into consumer-ready products, thereby augmenting their value-added content. This is succeeded by the distribution phase, which incorporates logistics, transportation, and warehousing operations within established storage networks. The terminal stage involves product commercialization through both wholesale and retail distribution channels, in addition to export market penetration. Optimal management throughout these sequential stages constitutes a fundamental determinant of agricultural product competitiveness and the economic viability of agribusiness operations.

In Ukraine, agricultural sector digitalization assumes strategic importance as a fundamental mechanism for augmenting operational efficiency, transparency, and sustainability within value chain production and logistics processes. A principal development trajectory involves precision agriculture technologies, incorporating GPS navigation systems, autonomous agricultural equipment, satellite-based monitoring, drone technology, and sensor networks for comprehensive soil, crop, and environmental condition assessment, complemented by automated irrigation and precision nutrient management systems [2].

Simultaneously, digital Farm Management Systems (FMS) are undergoing extensive deployment, facilitating the integration of operational planning, expenditure tracking, yield prediction, and profitability analysis for optimal resource allocation. These innovations establish the foundation for adaptive, data-driven agricultural production frameworks.

Internet of Things (IoT) technology implementation in agriculture enables the establishment of “intelligent farming systems,” wherein sensor networks conduct microclimatic monitoring across greenhouse facilities, storage infrastructure, and field environments, while managing irrigation protocols and enabling livestock surveillance with proactive disease and pest threat identification.

The integration of artificial intelligence (AI) and machine learning methodologies fundamentally restructures decision-making paradigms within the agricultural domain. AI facilitates predictive analytics

encompassing yield forecasting, market price dynamics, logistics optimization, and optimal harvest timing determination. Computer vision applications specifically address automated phytopathological diagnosis, quality-based product classification, and real-time yield quantification.

Equally critical is the deployment of blockchain technologies, ensuring decentralized oversight, comprehensive product provenance tracking, and elevated transparency standards throughout agri-food supply chains. Smart contract protocols automate financial transactions, minimize transactional overhead, and enhance inter-stakeholder confidence within agricultural markets.

According to comprehensive analytical research conducted by Aggeek, investigation of operational practices across 50 premier innovative agricultural enterprises in Ukraine revealed extensive digital technology deployment as a fundamental determinant of production efficiency enhancement and agribusiness competitive advantage. The study cohort comprised both small-scale agricultural operations (specifically "Halytska Yahoda" Farm Enterprise, "Dymitrenko V.Yu." Individual Entrepreneur, and "Moya Zemlya 2015" Farm Enterprise) and major agro-industrial conglomerates ("ASTARTA-Kyiv," "Kernel," and "Continental Farmers Group"), establishing a representative cross-sectional sample for evaluating sectoral digitalization trends [3].

Specialized agricultural software platforms integrated with GPS navigation technologies have achieved widespread adoption throughout Ukraine, including My John Deere, X-Farm, CLAAS, Xarvio, and OneSoil systems, which deliver comprehensive field cartography, continuous crop status monitoring, and real-time decision support functionality for agricultural production management.The deployment of these technological instruments facilitates enhanced precision in farm management operations, optimized resource allocation, and mitigation of production-related risks.

Research findings demonstrate that autonomous machinery guidance systems constitute the predominant technological adoption, implemented across 80% of innovative enterprises. Variable rate application nozzle control systems for precision plant protection represent the second-most prevalent technology, deployed by 78% of participating organizations. Drone-based application systems for crop protection products and micronutrients occupy the tertiary position, actively utilized by 59% of survey participants. Considerable penetration is similarly evident within telematics applications – encompassing real-time monitoring of equipment, resource utilization, and field operations – with 70% of

innovative agricultural enterprises having integrated these technological solutions.

Innovative value chain management paradigms within the agricultural sector represent strategic responses to operational efficiency, transparency, and sustainability imperatives. A principal development trajectory involves the platform economy, fundamentally transforming stakeholder interactions throughout agri-food value networks. Digital marketplace platforms establish direct linkages between producers, processing entities, and end consumers, thereby reducing intermediary dependencies and minimizing transactional overhead. Business-to-business (B2B) platforms facilitate access to specialized agricultural services – encompassing agronomic advisory services, machinery leasing arrangements, and collective procurement initiatives – consequently augmenting operational efficiency across farming operations [4].

Correspondingly significant is the circular economy framework, emphasizing waste stream minimization and comprehensive resource recovery. This approach encompasses the biotransformation of organic waste streams into biogas or composted materials, alongside the adoption of regenerative agricultural methodologies incorporating ecologically sustainable production practices.

The systematic integration of innovative technologies within agricultural value chain management frameworks yields measurable economic efficiency enhancements. Through the strategic implementation of GPS-guided navigation systems, precision fertilizer application protocols, and real-time crop monitoring technologies, agricultural enterprises achieve quantifiable benefits including fuel consumption reduction of up to 15%, fertilizer cost optimization of up to 20%, and yield loss minimization of up to 25%. These technological interventions concurrently generate productivity increases ranging from 10–30%, operational efficiency improvements in field operations, and qualitative enhancements in agricultural output, thereby strengthening market positioning and value proposition.

Ukraine's agricultural sector manifests pronounced investment attractiveness, corroborated by enhanced capital investment flows in 2024, comprehensive governmental support for sectoral digitalization initiatives, and strategic participation in international agricultural modernization programs. Moreover, these technological innovations exhibit significant multiplier effects across the broader economy: catalyzing IT sector development, advancing logistics infrastructure

modernization, and expanding the agricultural sector's export competitiveness.

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