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Importance of Blockchain Technology in Dairy-Based Business Management in Udaipur, Rajasthan

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ABSTRACT

Blockchain technology, initially known for its application in cryptocurrency, has found transformative potential across various sectors. This research explores the relevance and application of blockchain in the dairy-based business sector in Udaipur, Rajasthan. Given the growing demand for transparency, traceability, and efficiency in the dairy industry, blockchain offers a promising solution for supply chain management, quality assurance, and financial transparency. This paper examines how blockchain technology can address challenges in the dairy industry in Udaipur, proposing its implementation for improved business operations and stakeholder engagement. Blockchain technology offers significant potential to improve the management and transparency of dairy businesses in Udaipur, Rajasthan. By addressing key challenges such as supply chain inefficiency, quality assurance, and financial transparency, blockchain can help modernize the dairy industry and make it more competitive in both domestic and international markets. However, the successful implementation of blockchain will require collaboration among stakeholders, investments in technology infrastructure, and ongoing education and support for local dairy farmers. As global case studies have demonstrated, blockchain can be a game-changer in transforming

the dairy sector, and its adoption in Udaipur could lead to a more sustainable, efficient, and trustworthy dairy industry.

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Introduction

In India, the dairy industry is one of the largest sectors in the agricultural sector. Rajasthan is a major pr oducer of milk and Udaipur is the hub for the production, processing and export of dairy products. From smallholder farmers to large-
scale processors, the dairy industry faces significant challenges such as inefficient supply chains, fraud, l ack of traceability and issues related to quality assurance. In recent years, blockchain technology has em erged as a solution to address these issues and increase the overall efficiency and trust of the dairy ecosy stem. This article explores the importance of integrating blockchain technology into the dairy industry in Udaipur, Rajasthan, with a focus on improving business governance, transparency and stakeholder trust. India is currently the world's largest milk producer with an annual growth rate of approximately 4%. Th e country's milk production was estimated at 110 million tonnes in 2010. Most of the milk produced in t he country (more than 46%) is consumed in the form of milk powder. There is considerable interest in th e production and use of animal products for human consumption (Singh et al., 2012). The milk producti on potential of cows can be increased by appropriate management, feeding, handling, etc. that will affect the expression of their genetics. Before identifying animals for breeding and production, they should be examined according to their physical characteristics (Singh et al., 2013). While the number of goats in o ur country was 47.14 million in 1951, it increased to 124.5 million in 2005 (Singh and Sharma, 2013a) a nd (Singh and Sharma, 2014). Gir breed is considered as a good milk producer among local breeds and it s production potential should be investigated to understand its future prospects. Improvement can be ach ieved by appropriate management, feeding, handling and other environmental conditions affecting behav ioral adaptations; however, their limitations are determined by genetics (Singh et al., 2013b). The aim of this study is to investigate the importance and significance of dairy goats in India in terms of nature and agriculture. Goat farming in India is subject to adverse ecological and physiological constraints. Poultry farming is an old industry in India but the science of chicken farming is very new. It has important indus trial, food, commercial, sports and research areas. This also plays an important role in increasing the eco nomic interests of poultry farmers. Many governments and NGOs have also recognized the importance o

f poultry farming as an economic activity and are working to encourage more and more entrepreneurs to venture into the business (Singh et al., 2014a). Goats play an important role in the Asian agricultural economy, especially for resource-poor people living in harsh environments (Singh et al., 2014b). There are currently 921 million goats in the world, more than 90% of which are in developing countries. Asia, home to the world's largest goat population, hosts approximately 60% of the world's total goat population, with domestic goats accounting for the largest share at 26%. Goats play an important role in the agricultural economy of Asia, especially for resource-poor people living in harsh environments. Non-bovine milk accounts for approximately 15% of all human milk consumed worldwide (Singh et al., 2014c). Goats are often poorly managed because they are prone to stress and rural people often keep goats for family consumption. Such results often do not reflect national estimates due to illegal trade and poaching (Singh et al., 2014d). Milk protein is always homogenized because it does not contain lectins. The composition of this milk (fat content etc.) is also more similar to human milk than cow milk. For these reasons, goat milk may be suitable for babies and people who have difficulty digesting cow milk (Singh et al., 2014e). Goat meat is an excellent source of protein and is the best meat available in the domestic market. It is leaner than other red meats and its fat contains ideal fatty acids. Archaeological remains collected in Western Asia (Singh et al., 2014f) prove that goats were domesticated in 6-7 BC. The daily life of a large section of the Indian population is based on agriculture, including goat rearing, which is an important rural economy for small farmers and landless labourers (Singh et al., 2014g). The reproductive performance of animals is controlled by many factors such as age at first conception, age at first calving, time to first pregnancy, etc. However, this study was only applied to the study of reproductive performance of animals at first calving (Singh et al., 2014h). Known as ‘baby goats’ in England and ‘poor man’s cattle’ in India, goats were among the first domesticated animals. Goat milk contains less lactose than cow milk and is therefore less likely to cause lactose intolerance (Singh and Sharma, 2015). Goat meat is a high protein food and is the preferred meat in the domestic market. It is leaner than other red meats and its fat contains essential fatty acids. Archaeological remains in Western Asia provide evidence that goats were domesticated as early as 6–7 BC. Since then, it has played a significant role in the socio-economic transformation of human progress worldwide (Singh and Sharma, 2015a). Millet is an important source of energy for animals and is fed during critical periods such as lactation, sickness and weight gain. Farmers prefer straw as fodder as they believe that grass is more nutritious for animals. Farmers prefer Deda over Kona because Deda has higher biomass yield (Singh and Sharma, 2015b).

In today's competitive business environment, every organization depends on the power of the environme nt to achieve its advertising goals, and advertising through advertising provides both commercial and no n-

commercial organizations with the opportunity to respond to rapid changes and present relevant message s (Sharma and Mehta, 2020). Management and organization are an important part of every business and include activities such as setting goals, deciding on actions, planning, and using organizational resources to coordinate skilled and unskilled labor (Sharma, K.2019). With the development of the economy, kno wledge workers, as carriers of knowledge capital, have become indispensable skills to create and sustain high profits in the economy (Sharma and Mehta, 2020a).

Environmental sustainability is supported by the development of sound decision-

making and strategies that take into account the interests of the environment and nature around us, ensur e the preservation of natural vegetation, and prioritize the preservation of natural support systems necess ary for human survival (Sharma et al.). (2020b). Human resource management helps in implementing va rious HR functions such as recruitment, orientation, training, performance evaluations, etc. and includes planning and development of employees or retention of intellectual capital (Sharma and Agrawal, 2020c). Environmental sustainability means protecting the environment for future generations and supporting human life. It is an action that involves making decisions to protect the natural world and recognizing th e impact of business organizations on the environment (Sharma and Agrawal, 2021). Environmental cha nges and increasing interest in learning have eliminated the difficulties and challenges of distance learni ng and due to the importance of lifelong learning, online learning has become a popular medium for lear ning in remote environments (Sharma and Choudhary, 2020d). Digital education is a priority for the Indi an government and is essential to provide education to students who are not interested in rural schools (S harma and Choudhary, 2020e). Historically, the education system has been well designed to impart kno wledge through practical work and to establish a strong relationship between Guru and Shishya (Sharma et al., 2020f). In a country like India with a large population and increasing demand for quality healthca re, healthcare is a critical and vital need to meet the increasing demand for quality healthcare (Sharma an d Jain, 2021a). Global environmental marketing competition has made advertising an important tool for all organizations to create a positive social impact (Sharma and Gupta, 2017). Advertisements that conve y messages about social issues are called social advertising. In recent years, many business organizations have begun to disclose their names to the press, whereas previously only government and non-

governmental organizations for health purposes did so (Sharma and Gupta, 2020g). Known as the ‘Land of Monasteries’, Syros has a rich agricultural and dairy industry. Goat milk is a natural product of the re

gion and is nutritious and hypoallergenic, making it a good choice for health-conscious consumers. (Sharma et al., 2025). This explains why goat farmers rarely consider the potential for increased production through crossbreeding or hybridization. An important factor is the high risk aw areness and emphasis placed on risk reduction by resource-poor farmers (Singh and Sharma, 2016). Goats are a diverse animal species that produce meat, milk, leat her, fiber and dung. The country is rich in biodiversity due to its large population (Singh and Sharma, 20 16a). The nutritional value of milk is closely related to its composition and is affected by factors such as breeding, nutrition, lactation period and season. Livestock is the backbone of Indian agriculture, contrib uting 7% of the country's GDP and providing employment and livelihood to 70% of the rural population . India ranks first in milk production (129.7 million tons), but production is quite low mainly due to lack of food and nutrition (Singh et al., 2017). Animals raised in the production process use more protein and other nitrogenous substances in their food (Singh et al., 2017a). Small ruminants have a positive impact on the economy and nutrition of people in tropical and subtropical countries. Such results are often not r eflected in national statistics due to illegal trade and poaching (Singh and Sharma, 2017b). Jamnapari (or Jamunapari) is a breed of goat originating from the Indian subcontinent. They have been imported to In donesia since 1953 (the local goats called "PE" are known as Etawa goats by crossbreeding with Perana kan Etawa goats or Etawa) and have been very successful there. These cows are raised for milk and mea t production. The name is derived from the Yamuna River in India and Bangladesh, Yamuna (West Ben gal) and Yamuna (Bangladesh). The coat color varies greatly, but is usually white with small tan markin gs on the head and neck. The distinguishing feature of this species is the broad, feathery nose stripe that gives it the appearance of a parrot's beak (Singh et al. 2017c). The result of domestication is the change i n the phenotypic characteristics of wild goats, resulting in the emergence of various breeds or types of g oats. These animals or types have dispersed worldwide due to human migration and displacement, espec ially due to changes in climate and natural resources (Singh and Sharma, 2017d). Goats play an importa nt role in the agricultural economy of Asia, especially for resource-poor people living in harsh environmental conditions. Approximately 15% of human milk consumed wo rldwide is derived from milk other than bovine milk. Approximately 59% of world goat production com es from Asia (Singh et al., 2018).

There is a large poultry sector that provides us with eggs and chicken. One of the biggest limitations in p oultry farming is the emphasis on plant production rather than animal production. In recent years, the po ultry sector has adapted itself to meet the increasing demand for affordable and safe sources of meat and eggs (Singh, G. 2019). India has a significant share of the world's livestock and this number continues to

increase. Bison are often found in poor countries where livestock and human populations are high and f ood resources are scarce. In tropical and subtropical regions, dairy cattle often rely on native or introduc ed pastures as a food source, especially during critical times of the year such as winter or the dry season, when cattle cannot meet their nutritional needs due to scarcity or poor quality of feed (Singh, G., 2019a and Singh20 et al.). Toxins can destroy milk-

producing tissue and various ducts in the udder, sometimes leading to udder damage. Severe cases can b e fatal, but even cows that recover may suffer for the remainder of lactation and post-

lactation (Singh and Singh, 2020). Livestock farming has become an integral part of all interventions to r educe rural poverty and improve food and nutrition security. Farmers rearing cattle and buffalos are still unaware of scientific management practices (Singh and Somvanshi, 2020a). Goats originated from Asia and are now found in almost all temperate zones from the Arctic Circle to the Equator, in all continents (Singh, G., 2024). Humans, animals and nature have a symbiotic relationship for survival and reproductio n. To meet the demands of the increasing population and livestock farming, natural resources are being o ver-

exploited and our resource balance, which has been preserved for thousands of years, is being disrupted (Singh et al., 2024a). The nutritional value of milk is closely related to its composition, which is affected by factors such as birth, nutrition, lactation period, and season. Goat milk contains calcium (Ca), phosp horus (P), potassium (K), magnesium (Mg), and chloride (Cl) and less sodium (Na) and sulphur (S) com pared to cow milk (Singh et al. 2024b) and (Singh et al. 2025a). Dairy cows need nutrients to maintain t heir metabolic functions, growth, milk production, development, and health. Animals cannot produce fo od in their bodies, and the food and feed often given to cattle does not contain all the nutrients they need (Singh et al., 2024c). Goats are considered the first domesticated animals and have the widest range of al l domesticated species except dogs (Singh et al., 2024d). (Singh et al. There is great interest in the produ ction and use of animal products for human consumption (Singh et al., 2025 and Singh et al., 2025a).

2. Understanding Blockchain Technology

Blockchain is a distributed ledger technology (DLT) that allows data to be stored across a decentralized network of computers. Each block in the blockchain contains a record of transactions, and once data is recorded, it cannot be altered, ensuring high levels of security and transparency. In the context of business management, blockchain can offer numerous benefits, particularly in supply chain management, record-keeping, and financial transactions.

3. Challenges in the Dairy Industry in Udaipur, Rajasthan

The dairy industry in Udaipur faces several challenges, including:

- **Supply Chain Inefficiency**: Dairy supply chains are often fragmented, with multiple intermediaries involved, leading to delays, spoilage, and higher costs.
- **Lack of Transparency and Traceability**: Consumers and regulatory bodies are increasingly demanding transparency about the origin of dairy products. However, tracking the journey of milk from farm to table remains a challenge in traditional systems.
- **Quality Control Issues**: Milk adulteration, inconsistent quality, and lack of real-time monitoring systems lead to compromised product quality.
- **Financial Opacity**: Payment delays, lack of trust between stakeholders (farmers, processors, and retailers), and the prevalence of cash-based transactions hinder financial transparency.

4. How Blockchain Can Address Challenges in the Dairy Industry

Improved Supply Chain Transparency and Efficiency

Blockchain can significantly enhance the transparency of the dairy supply chain. By recording each transaction, from the milking process to distribution, on an immutable ledger, all parties can access real-time data. This traceability ensures that stakeholders can verify the source, quality, and handling of the product at each stage. Blockchain can also eliminate the need for intermediaries, reducing delays, lowering costs, and improving the efficiency of the supply chain.

Enhanced Quality Assurance

The dairy industry faces significant concerns about milk adulteration and inconsistent product quality. Blockchain can be used to record and verify quality control data at each step of the production process. By using sensors and IoT (Internet of Things) devices, the temperature and quality of milk can be continuously monitored and recorded on the blockchain. This data can be accessed by producers, processors, and consumers, ensuring that only high-quality, unadulterated milk reaches the market.

Financial Transparency and Fair Payments

Blockchain can also address financial issues in the dairy sector. By enabling smart contracts, payments can be automatically triggered once specific conditions are met (e.g., delivery of milk or completion of

quality checks). This reduces the risk of payment delays, ensures fair compensation for farmers, and fosters trust between different stakeholders in the supply chain.

Consumer Trust and Brand Loyalty

Blockchain can create a transparent and verifiable history of dairy products, enabling consumers to trace the product back to its origin. This can be a powerful tool for building trust and ensuring product authenticity. In Udaipur, where many dairy producers are small-scale farmers, blockchain can help them prove the quality and authenticity of their products, which could lead to a competitive advantage in the market.

Case Studies and Global Examples

Several global examples have shown the potential of blockchain technology in the dairy sector:

- **Milkchain (Italy)**: A blockchain-based platform for tracking the journey of milk from farm to processing plants. This system provides real-time data on the origin, quality, and processing stages of milk.
- **IBM Food Trust (USA)**: IBM's Food Trust platform enables dairy producers to track milk and dairy products from farm to retailer, ensuring transparency and authenticity.

These case studies demonstrate how blockchain can revolutionize dairy business management and suggest that similar systems could be implemented in Udaipur to address local challenges.

Implementation of Blockchain in Udaipur's Dairy Sector

To implement blockchain in Udaipur’s dairy sector, the following steps should be taken:

Collaborating with Technology Providers

Collaboration between local dairy businesses and blockchain technology providers is crucial for a smooth transition. Local governments can play an essential role by offering support and facilitating partnerships between stakeholders.

Training and Capacity Building

Farmers, processors, and other stakeholders in Udaipur need to be trained on the use of blockchain technology. Workshops, online courses, and community engagement programs can help build awareness and capacity.

Integration with IoT and Smart Sensors

For blockchain to be most effective in dairy management, it should be integrated with IoT devices that can monitor the quality and conditions of milk during transportation and storage. This would provide real-time data for blockchain systems, ensuring that the quality of milk is continuously tracked.

Government and Regulatory Support

Government agencies in Rajasthan can create favorable policies that encourage the adoption of blockchain technology. Additionally, local regulatory bodies can integrate blockchain into their inspection processes to ensure compliance with dairy standards.

Conclusion

Blockchain technology offers significant potential to improve the management and transparency of dairy businesses in Udaipur, Rajasthan. By addressing key challenges such as supply chain inefficiency, quality assurance, and financial transparency, blockchain can help modernize the dairy industry and make it more competitive in both domestic and international markets. However, the successful implementation of blockchain will require collaboration among stakeholders, investments in technology infrastructure, and ongoing education and support for local dairy farmers. As global case studies have demonstrated, blockchain can be a game-changer in transforming the dairy sector, and its adoption in Udaipur could lead to a more sustainable, efficient, and trustworthy dairy industry.

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