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Centre for Sustainable Agricultural Skill Development and Community Livelihood Advancement in West Bengal

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Abstract: ***Agriculture in India, particularly in West Bengal, faces a series of critical challenges including decreasing farm sizes, lack of modern farming knowledge, migration from rural areas, and low farmer income despite high workforce participation. This research explores the design and development of an Urban Agricultural Skill Development Centre (UASDC) aimed at bridging the gap between traditional farming practices and modern agricultural advancements. By integrating skill training, marketplace access, and architectural design principles, the project proposes a self-sustaining model to enhance farmer income, promote environmental sustainability, and strengthen rural–urban linkages.***
Keywords: Agriculture, Farmer Training, Urban–Rural Linkages, Sustainable Design, Skill Development, West Bengal

I. INTRODUCTION

Agriculture contributes to 20% of India's GDP while employing almost 60% of the workforce. However, smallholder farmers who produce 80% of food in the developing world often struggle with limited market access, outdated techniques, and declining profitability. In West Bengal, where 96% of farm families are small and marginal, these challenges are acute. The Urban Agricultural Skill Development Centre is proposed to address these issues through skill enhancement, market integration, and sustainable infrastructure.

II. BACKGROUND AND RATIONALE

Agriculture in India is facing multiple interlinked challenges. Farm sizes have been steadily shrinking, declining from 2 hectares in 1976–77 to just 1.08 hectares in 2015–16. Every day, nearly 180,000 people migrate from rural communities to urban areas, further reducing the agricultural workforce. Despite engaging about 60% of the country's workforce, agriculture contributes only 20% to the national GDP, reflecting a significant economic imbalance. Between 1995 and 2019, over 296,000 farmers have taken their own lives, highlighting the depth of farmer distress. A major contributing factor is the lack of exposure to modern farming techniques and effective marketing strategies, which results in low yields and poor market returns. In response, the Urban Agricultural Skill Development Centre (UASDC) is envisioned as both a training hub and a marketplace, empowering farmers to sell directly to urban consumers while enhancing both the quality and quantity of their produce.

III. LITERATURE REVIEW

Successful models of integrated agricultural training, market access, and community engagement already exist in various forms across the world. These examples provide valuable insights for the proposed Urban Agricultural Skill Development Centre (UASDC) in West Bengal.

A. Nimbalak Agriculture Training Centre, Maharashtra (India)

Located in a remote, drought-prone village in Ahmednagar district, the Nimbalak centre—built by the Syngenta Foundation and NGO Snehalaya—serves as a hands-on learning hub for marginalized farmers and their children. The architecture reflects local traditions, using grey and red fly ash bricks, kotah stone flooring, and simple interiors to create a cost-effective yet dignified environment. The building's central courtyard design encourages interaction, while natural lighting reduces energy dependence. Farmers receive training in modern agricultural techniques, organic cultivation, and marketing skills, enabling them to diversify crops and improve incomes. This project demonstrates how vernacular architecture can be harmonized with modern educational needs in a rural context.

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B. Izmir Agriculture Development Center, Turkey

The Izmir model integrates education, production, and environmental sustainability. Situated within agricultural fields, it uses a linear site layout and a bioswales (bio-boulevard) as a central design element for stormwater management and water quality improvement. Training facilities, greenhouses, marketplaces, and open farming areas are connected along this central spine, allowing visitors and trainees to observe agricultural processes seamlessly. The centre's focus on "smart soil" applications, high-order planting techniques, and climate-adaptive strategies makes it an excellent example of how design can actively support sustainable agriculture while engaging the public.

C. Delhi Haat, New Delhi (India)

Delhi Haat represents the cultural-market model, blending craft stalls, food courts, and performance spaces to create an inclusive public venue. Its planning ensures smooth pedestrian circulation, distinct zones for service and vehicular movement, and ample social spaces such as courtyards and seating areas. While its primary focus is cultural and artisanal rather than purely agricultural, its operational model—rotating vendors, direct engagement with producers, and emphasis on local materials—offers a blueprint for creating a vibrant urban marketplace that can sustain community interest and tourism.

D. Rythu Bazaars, Andhra Pradesh & Telangana (India)

Launched in 1999, Rythu Bazaars are government-run farmer-to-consumer markets that eliminate middlemen, allowing farmers to sell produce directly at fair prices. Located in urban and peri-urban areas, these markets have improved farmer incomes and reduced consumer prices.

They also incorporate basic infrastructure such as covered stalls, weighing machines, and cold storage. Rythu Bazaars demonstrate that state-supported, permanent urban markets can succeed when linked to farmer groups and supported by consistent policy measures—principles highly relevant for UASDC's marketplace component.

E. Uzhavar Sandhai, Tamil Nadu (India)

Started in 1999, Uzhavar Sandhai is daily government-run markets that connect farmers to urban consumers. The model includes dedicated transport facilities for farmers and provides stall space free of charge. By reducing logistical barriers, it encourages small-scale producers to participate regularly. This initiative's success shows how local government intervention can be paired with basic infrastructure to sustain farmer participation over time, a lesson that could be integrated into UASDC's operations.

F. Apni Mandi, Punjab (India)

Apni Mandi ("Our Market") began in the late 1980s as a weekly farmer market run under the Punjab Mandi Board. It offers farmers a regulated space to sell produce directly to consumers, ensuring transparent pricing. While similar in concept to Rythu Bazaar and Uzhavar Sandhai, its long-standing operation provides insights into governance structures, quality control, and market management practices that could guide UASDC's policy framework.

G. ICAR–Krishi Vigyan Kendras (KVKs), Pan-India

The KVKs are a network of agricultural extension centers established by the Indian Council of Agricultural Research. They provide localized, hands-on training, technology demonstrations, and advisory services for farmers. KVKs operate in rural areas but maintain strong linkages with research institutions, ensuring that farmers receive the latest agronomic innovations. UASDC could adopt similar training methodologies, combining practical demonstrations with classroom learning to build farmer capacity.

H. Evergreen Brick Works, Toronto (Canada)

An adaptive reuse project in a former industrial site, Evergreen Brick Works combines a year-round farmers' market with environmental education, community events, and green infrastructure. Situated in a floodplain, it uses bioswales, permeable pavements, and restored wetlands to manage stormwater.

This project offers lessons on integrating environmental resilience into public market design—particularly relevant for Kolkata, where monsoon flooding is a recurring challenge.

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I. Synthesis of Lessons for UASDC:

Across these case studies, several recurring themes emerge:

- Direct Market Access: Models like Rythu Bazaar, Uzhavar Sandhai, and Apni Mandi highlight the importance of eliminating intermediaries and creating fair-price platforms.
- Integrated Training & Production: Nimbalak and KVKs show that skill development is most effective when linked to demonstration farms and practical experience.
- Environmental Integration: Izmir Agriculture Centre and Evergreen Brick Works illustrate how water management, climate adaptation, and green infrastructure can be embedded into the design.
- Cultural Engagement: Delhi Haat proves that markets thrive when they also function as social and cultural hubs, attracting diverse visitors.

By blending these principles into a single facility, the UASDC can function as both an economic engine for farmers and a sustainable urban destination for the public.

IV. OBJECTIVES

A. Economic Objectives

- To create sustainable revenue streams for farmers through direct sales and value addition.
- To support small and marginal farmers with a dedicated marketplace.

B. Environmental Objectives

- To use sustainable materials and energy-efficient systems.
- To minimize waste through resource optimization.

C. Social Objectives

- To ensure inclusive and accessible spaces for all.
- To strengthen rural urban linkages through community engagement.

V. METHODOLOGY

Approach: Mixed-methods design combining baseline surveys, market analysis, environmental simulation, and participatory design to align with economic, environmental, and social objectives.

A. Economic Methods

- Market Mapping: Identify existing supply chains, price spreads, and value-add opportunities.
- Consumer & Farmer Surveys: Assess willingness-to-pay, demand trends, and enterprise readiness.
- Pilot Interventions: Test direct-sale markets and value-add kiosks; measure income changes and spoilage reduction.
- Financial Analysis: Conduct cost–benefit and break-even studies for proposed facilities.

Economic Data

Indicator	Value	Source/Year	Relevance
Average operational landholding in West Bengal	0.77 ha	Agriculture Census, 2015–16	Shows prevalence of small/marginal farmers.
% of small & marginal farmers in West Bengal	96%	Agriculture Census, 2015–16	Core target group for UASDC.
Farm gate, Retail Price Gap (vegetables, WB)	30–50%	Commission for Agricultural Costs and Prices (CACP), 2022	Direct markets can reduce gap.
Average farmer monthly income (WB)	₹7,072	NSSO Situation Assessment Survey, 2019	Benchmark to measure income improvement.
Rythu Bazaar daily turnover (Andhra Pradesh)	₹25–35 lakh/day (large cities)	AP Govt Agri Marketing Dept, 2021	Shows scale possible with urban markets.
Value addition potential (fresh produce → processed)	2–5× price increase	FAO & ICAR, 2020	Supports feasibility of value-add training.

Economic Analysis

The baseline agricultural profile of West Bengal reveals that 96% of farm families are small or marginal, with an average landholding of just 0.77 ha (Agriculture Census, 2015–16). Current average monthly farm income stands at ₹7,072 (NSSO, 2019), far below the urban living wage. Price-spread studies indicate a 30–50% gap between farmgate and retail prices for vegetables in the state, implying that direct-to-consumer sales could significantly improve farmer earnings.

Case data from Andhra Pradesh's Rythu Bazaars shows daily turnovers of ₹25–35 lakh in major cities, suggesting high scalability of urban farmer markets. Additionally, value-added processing of fresh produce (grading, cutting, minimal processing) has shown 2–5× price gains (FAO, 2020). Given these figures, a UASDC marketplace and value-add unit could feasibly increase farmer margins by 20–30% in the first operational year, assuming partial elimination of intermediaries and modest demand for premium produce.

B. Environmental Methods

- Site & Climate Study: Evaluate orientation, sun path, wind flow, and flood risk for passive design strategies.
- Energy & Material Assessment: Simulate energy use, day lighting, and ventilation; compare low-carbon materials.
- Water & Waste Planning: Size rainwater harvesting, bioswales, and composting units to minimize waste and maximize reuse.

Environmental Data

Indicator	Value	Source/Year	Relevance
Average annual rainfall in Kolkata	1,582 mm	IMD, 2023	Justifies rainwater harvesting & bioswale design.
Urban heat island intensity in Kolkata	+2–3°C over rural areas	IIT Kharagpur study, 2021	Supports passive cooling strategies.
% of Kolkata flood-prone area	~25%	KMC Flood Mitigation Plan, 2022	Bioswale & stormwater management critical.
Fly-ash brick embodied carbon reduction vs clay brick	~35–40% lower	TERI, 2019	Supports sustainable materials goal.
Daylight autonomy with slit windows + skylights	65–75% (for tropical buildings)	CBRI Roorkee simulations, 2020	Energy-saving benchmark.
Organic waste generated in urban markets (per stall/day)	2–5 kg	NEERI, 2018	Baseline for composting unit sizing.

Environmental Analysis

The UASDC's site in Kolkata receives ~1,582 mm of annual rainfall (IMD, 2023), making rainwater harvesting and bioswale systems viable for both irrigation and stormwater mitigation. Approximately 25% of Kolkata's area is flood-prone (KMC Flood Mitigation Plan, 2022), reinforcing the need for integrated stormwater management.

Urban heat island effects in Kolkata increase local temperatures by +2–3°C (IIT Kharagpur, 2021), supporting the adoption of passive cooling strategies such as slit windows, skylights, and natural ventilation. Simulation studies for tropical climates show these methods can achieve 65–75% daylight autonomy (CBRI Roorkee, 2020), reducing dependence on artificial lighting. Material choice also offers environmental benefits: fly-ash bricks have 35–40% lower embodied carbon than clay bricks (TERI, 2019). Organic waste generation from similar markets averages 2–5 kg per stall/day (NEERI, 2018), which can be composted or converted to biogas on-site, reducing landfill load and producing usable manure.

C. Social Methods

1) Accessibility Audit: Ensure barrier-free design as per standards.
2) Participatory Workshops: Co-create layouts and programs with farmers, consumers, and community groups.
3) Safety & Comfort Checks: Measure lighting, heat comfort, and perceived safety through user feedback.
4) Data Analysis

- Quantitative data analyzed using descriptive stats, regression, and cost–benefit models.
- Qualitative data coded thematically to capture stakeholder insights.
- Integrated findings used to refine UASDC design and operational plans.

Social Data

Indicator	Value	Source/Year	Relevance
Rural youth (15–29) engaged in agriculture	54%	NSSO Youth Employment, 2020	Key audience for skill development.
Persons with disability in West Bengal	2.2%	Census, 2011	Supports inclusive design.
Consumer preference for direct-from-farmer produce	68% urban consumers willing to pay premium	NABARD All-India Survey, 2021	Supports marketplace demand.
Women's participation in farmer SHGs (West Bengal)	62%	NRLM, 2022	Women-focused training potential.
Perceived safety index in Kolkata public spaces (night)	3.1/5	Safety Trends and Reporting, 2022	Input for lighting & security design.
Public participation in Delhi Haat & similar markets	1–2 million visitors/year	DTTDC Annual Report, 2019	Shows tourism & cultural engagement potential.

Social Data analysis

Rural youth (15–29 years) account for 54% of the agricultural workforce (NSSO, 2020), indicating strong potential for youth-targeted training programs. Women's participation in West Bengal's farmer self-help groups (SHGs) is 62% (NRLM, 2022), suggesting that women-focused agricultural entrepreneurship could form a major pillar of the UASDC.

Consumer-side data shows that 68% of urban buyers are willing to pay a premium for produce purchased directly from farmers (NABARD, 2021), validating demand for a farmer-to-consumer market format. However, safety perception in Kolkata's public spaces at night is only 3.1/5 (SafetiPin, 2022), which underscores the importance of well-lit, secure, and socially active market spaces.

Visitor data from Delhi Haat (1–2 million/year; DTTDC, 2019) demonstrates the potential for such spaces to become tourist and cultural destinations when integrated with food, craft, and performance zones. This reinforces the idea that the UASDC can serve as both an economic hub and a cultural landmark.

VI. DESIGN PROPOSAL – URBAN AGRICULTURAL SKILL DEVELOPMENT CENTRE (UASDC)

The UASDC is envisioned as a hybrid facility combining a farmer training hub, demonstration farms, value-add processing units, and a vibrant public marketplace. The design is guided by three integrated pillars: Economic Empowerment, Environmental Sustainability, and Social Inclusivity.

A. Site Planning & Zoning

- Main Entry & Plaza:A welcoming forecourt from the highway with shaded seating, kiosks for seasonal produce, and information displays.
- Training Block:Classrooms, skill labs, and digital training rooms positioned for easy access from both rural and urban visitors.
- Demonstration Farms & Greenhouses:Shade-net houses and playhouses showcasing drip irrigation, crop rotation, and organic farming practices.
- Value Addition & Processing Unit:Equipped with grading, sorting, minimal processing, and packaging facilities linked directly to the market zone.
- Marketplace & Cultural Court:Covered stalls for direct farmer sales, food courts, and craft spaces inspired by Delhi Haat's mixed-use model.
- Green Infrastructure Spine:A bioswales and rain garden system inspired by Izmir Agriculture Centre, doubling as a pedestrian promenade.
- Waste-to-Resource Hub:Organic waste composting/vermiculture and biogas units sized for 2–5 kg waste per stall/day.

B. Architectural Features

- Vernacular-Inspired Design: Fly-ash brick walls, lime plaster finishes, kotah stone flooring, bamboo shading devices.
- Climate-Responsive Envelope: North-light skylights, perforated brick jaalis, high thermal mass walls for passive cooling.
- Daylight & Ventilation: Target daylight autonomy of 65–75% through clerestory windows and courtyards.
- Flood-Resilient Platform: Elevated plinth and bioswales system to handle stormwater in Kolkata's flood-prone context.

C. Environmental Systems

- Rainwater Harvesting: Collection from rooftops and Hardscape, integrated with bioswales filtration for irrigation reuse.
- Energy Efficiency: Solar PV on rooftops to offset at least 20–25% of annual electricity demand.
- Waste Management: Segregation at source, compost for soil amendment, and biogas for market food court operations.

D. Social & Cultural Integration

- Inclusive Design: Step-free circulation, tactile paving, wide aisles, and seating for all user groups.
- Community Event Spaces: Open courtyards for farmer festivals, food fairs, and cultural performances to draw urban crowds.
- Safety Measures: Well-lit pathways, clear sightlines, and security presence to address nighttime safety concerns.

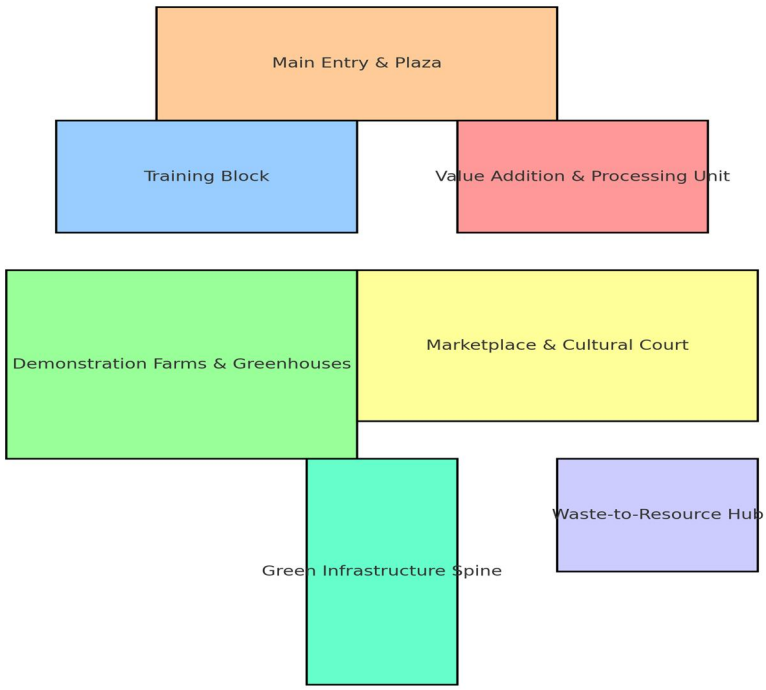
E. Phasing Strategy

- Phase 1 (Year 1–2): Training block, demonstration farms, and pilot marketplace.
- Phase 2 (Year 3–4): Value-add processing unit, expanded market stalls, and full bioswales network.
- Phase 3 (Year 5+): Cultural plaza, renewable energy scaling, and tourism-linked programming.

VII. EXPECTED OUTCOMES

1) Economic: Farmer incomes increase by 20–30%; direct sales account for at least 40% of produce marketed.
2) Environmental: ≥60% organic waste diverted from landfill; ≥30% water needs met from rain/greywater.
3) Social: ≥50% women participation in training; ≥80% visitor satisfaction for accessibility and comfort.

Conceptual Zoning Diagram – Urban Agricultural Skill Development Centre



VIII. EXPECTED IMPACT

The proposed Urban Agricultural Skill Development Centre (UASDC) aims to transform the local agricultural economy by increasing farmer income through the elimination of middlemen and the establishment of direct farmer-to-consumer sales channels. It seeks to retain youth in agriculture by offering targeted skill enhancement, entrepreneurship training, and access to modern farming techniques, ensuring agriculture remains a viable and attractive livelihood. The centre will promote organic and sustainable farming practices by incorporating demonstration farms, awareness programs, and certification support, encouraging environmentally responsible production. Beyond its economic and environmental impact, the UASDC is envisioned as a vibrant tourist and community hub, integrating markets, cultural events, and educational experiences to engage both local residents and visitors, strengthening rural–urban connections

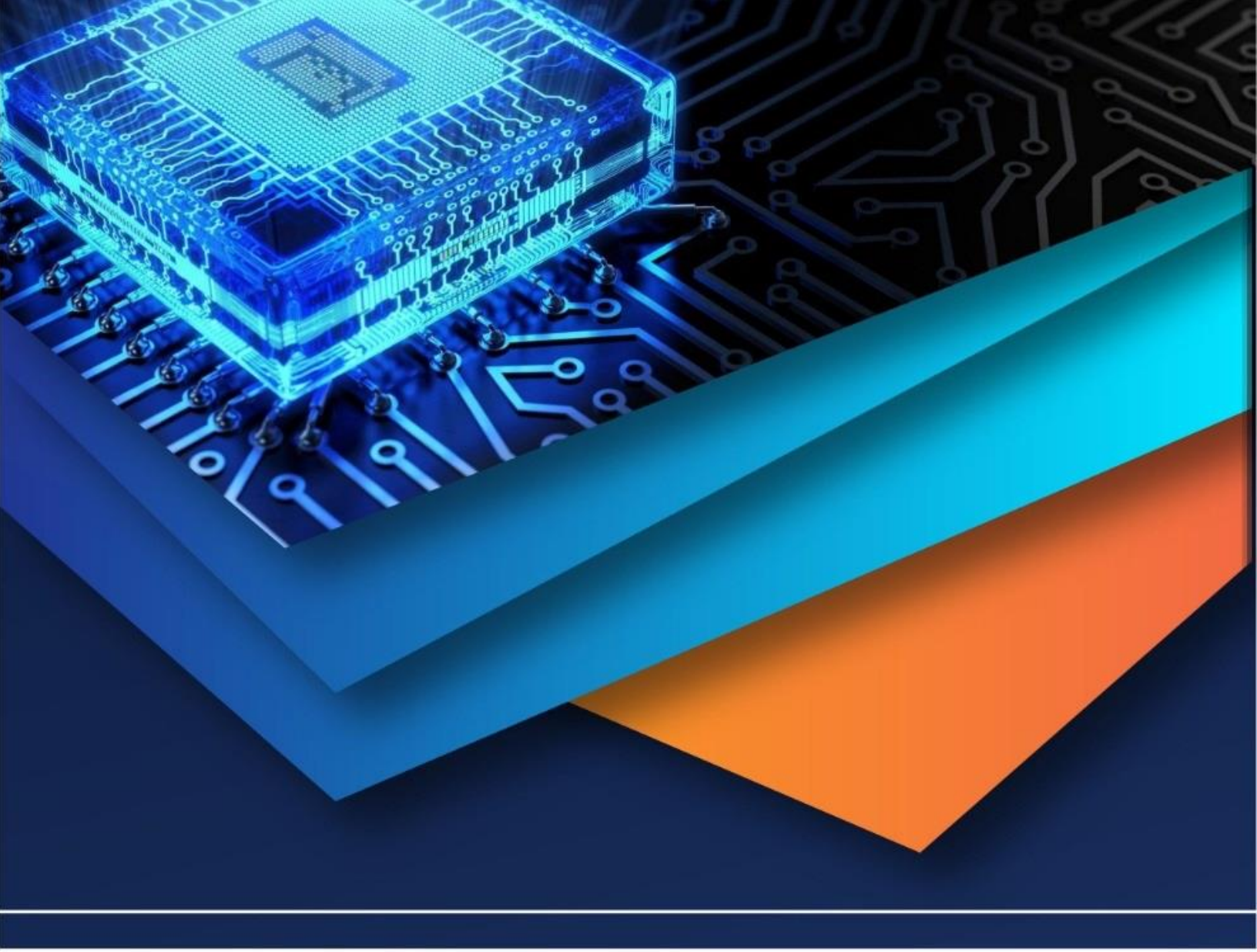
IX. CONCLUSION

The Urban Agricultural Skill Development Centre (UASDC) represents a holistic approach to addressing the intertwined economic, environmental, and social challenges facing small and marginal farmers in West Bengal. By eliminating middlemen and creating direct market linkages, it has the potential to significantly enhance farmer incomes while fostering entrepreneurship and value addition. Through targeted training programs, demonstration farms, and access to modern technologies, the UASDC can inspire and retain youth in agriculture, ensuring the continuity of skilled farming practices. Its emphasis on organic and sustainable methods will contribute to environmental resilience, reducing the sector's ecological footprint. Furthermore, by integrating cultural, educational, and recreational components, the centre can become a vibrant tourist and community hub, strengthening rural–urban linkages and public awareness about agriculture. Together, these interventions position the UASDC as a model for sustainable agricultural development and community-driven economic growth in the region.

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