Original Article

# Challenges and Opportunities: Trends of AI, ML & Blockchain Technologies on IT Business — A Perspective from a Bakery Chef

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## Abstract

*Artificial Intelligence (AI), Machine Learning (ML), and block chain technologies have become foundational forces in today's business transformation. While their impact is well studied in IT sectors, much less is documented from the perspective of small food businesses such as bakeries. This research paper explores how these emerging technologies influence IT businesses, and interprets these effects through the practical, real-world viewpoint of a bakery chef. The study connects high-level technological trends with ground-level challenges, opportunities, and decisions faced by small food entrepreneurs. Key opportunities include automated ordering, predictive demand forecasting, quality control using computer vision, personalized customer experiences, block chain-enabled supply chain transparency, and improved business optimization. However, challenges exist in terms of data quality, skills gaps, high costs, regulatory pressures, and trust issues. By interpreting these insights through a bakery lens, this paper provides an accessible understanding of technology adoption for small businesses while highlighting what IT businesses must address to support such users. Practical recommendations are offered to help bakery owners adopt AI/ML and block chain in simple, cost-effective stages.*

***Keywords:*** *AI, ML, Block chain, IT Business, Bakery Industry, Technology Adoption, Digital Transformation*

## Introduction

Artificial Intelligence and Machine Learning have quickly moved from technical concepts to everyday business tools. Today, even a small bakery interacts with AI—through online ordering apps, digital payment gateways, or marketing algorithms on social media. Similarly, blockchain is redefining how transparency, trust, and traceability operate within supply chains. Yet, these technologies are often explained from a corporate IT perspective, not from the standpoint of a small bakery chef who balances creativity, food safety, daily operations, staffing, and customer satisfaction. The purpose of this paper is to bridge this gap. It studies the current trends of AI/ML and blockchain in IT businesses while translating those insights into a bakery chef's point of view. A bakery is a perfect example of a micro-enterprise with unique challenges: highly perishable goods, fluctuating demand, manual processes, and tight margins. Understanding how large IT trends can support such businesses provides a grounded and practical way to evaluate emerging technologies.

This paper aims to answer:

- What major AI/ML and blockchain trends influence IT businesses today?
- What opportunities do these trends create for bakery operations?
- What challenges do bakery owners face in adopting such technologies?
- How can small food businesses practically implement these tools?

## Scope, Perspective & Methodology

### Scope

This research focuses on:

- Key global AI/ML and blockchain trends.
- Their impact on IT businesses.
- Practical interpretation from a bakery chef's viewpoint.
- Opportunities, risks, and recommended adoption pathways.

**Perspective**

The paper uses the practical experience of a bakery chef who:

- Manages ingredients, labor, daily production, and customer orders.
- Faces challenges with forecasting demand, maintaining consistency, and running promotions.
- Must evaluate technologies not academically, but based on ROI, simplicity, and daily usefulness.

**Methodology**

A mixed-method approach was followed:

- Review of industry reports, business articles, and technology trend documents.
- Mapping technology trends to bakery operations.
- Practical reasoning based on bakery workflows: ordering, preparation, baking, branding, delivery.
- This ensures that complex IT concepts become relatable and actionable for food businesses.

**Background: Understanding AI, ML & Blockchain**

**Artificial Intelligence (AI)**

AI refers to systems that can perform tasks requiring human-like intelligence — such as decision-making, pattern recognition, and problem-solving. AI is already used by platforms like Instagram, Zomato, Swiggy, and payment apps that bakeries interact with daily.

**Machine Learning (ML)**

ML is a subset of AI that learns from data. For bakeries, ML could forecast weekend demand or predict which dessert will trend during festivals.

**Blockchain**

A blockchain is a secure digital ledger that records transactions transparently. In the food industry, it can track:

- Origin of flour, butter, or chocolate
- Storage conditions
- Supplier authenticity
- Expiry and freshness

**Relevance to IT Businesses**

IT companies build and maintain the platforms that bakeries depend on: POS systems, accounting apps, online ordering platforms, and inventory management software. As AI/ML and blockchain evolve, IT companies must adapt, pushing bakery owners toward new digital workflows.

**Key AI/ML Trends Impacting IT Businesses**

1. **Automation and AI Agents**

IT businesses are building AI agents that can:

- Schedule orders
- Manage customer chats
- Suggest inventory restocks
- Analyze sales patterns

For a bakery chef, this means less manual recordkeeping and fewer errors.

2. **Predictive Analytics**

Predictive ML models can estimate:

- Daily footfall
- Which items may sell out
- Seasonal trends in pastries

This helps prevent underproduction or wastage.

3. **Personalized Recommendations**

AI systems personalize what customers see:

- Instagram promotes bakery reels to people who like desserts.
- Swiggy shows offers based on past orders.

This increases customer reach for bakeries.

4. **Vision AI**

Computer vision can analyze:

- Cake shapes
- Color of baked products
- Burn marks
- Consistency of icing or topping
- Even small bakeries can apply such tools via mobile-based apps.

Key Blockchain Trends Impacting IT Businesses

1. **Supply Chain Transparency**
   Blockchain ensures every ingredient can be traced.

For example:

● Cocoa → Supplier → Transport → Distributor → Bakery
   The entire chain can be verified.

2. **Blockchain Payments**
   Digital tokens and secure payment ledgers reduce fraud and speed up settlements for IT-based delivery platforms, which indirectly benefits bakeries.

3. **Loyalty Tokens**
   Future loyalty systems may use blockchain-based digital stamps or rewards that customers can use across multiple partner outlets.

4. **Food Safety Compliance**
   Regulators increasingly demand traceability. Blockchain helps ensure:

- Authentic ingredients
- Expiry management
- Allergen tracking
- This builds customer trust.

**Opportunities for Bakeries through AI/ML**

1. **Demand Forecasting**

AI models can predict:

- Weekend demand
- Festival rush
- Holiday trends
- Best-selling items
   A 10–20% improvement in accuracy reduces wastage and improves profit.

2. **Dynamic Production Planning**

AI can automatically suggest:

- How many loaves to bake
- How many pastries to stock
- Optimal baking sequences

3. **Customer Personalization**

AI helps bakeries send:

- Birthday offers
- Special festival combo messages
- Personalized discounts

4. **Recipe Development**

AI tools can suggest:

- New flavor combinations
- Ingredient alternatives
- Cost-effective recipes

 **Example:** AI might suggest pairing orange zest with dark chocolate ganache based on global bakery trends.

**Opportunities for Bakeries through Blockchain**

1. **Ingredient Authenticity**

Customers increasingly demand:

- Organic flour
- High-quality cocoa
- Authentic vanilla
   Blockchain can verify supplier claims.

2. **Food Safety & Hygiene Compliance**

Digital ledgers store:

- Storage temperatures
- Expiry details
- Transportation conditions

3. **Trust & Branding**

A bakery can market itself as:

   "Blockchain verified: 100% ingredient traceability" This builds premium appeal.

4. **Smart Contracts with Suppliers**

Payments can automatically release only after quality checks — preventing fraud or poor-quality supply.

## Challenges Faced by IT Businesses & Bakeries

1. **Data Quality Issues**

Bakery data is often:

- Unrecorded
- Inconsistent
- In handwritten registers

This limits AI accuracy.

2. **High Cost of Technology**

Small businesses may struggle with:

- Subscription fees
- Devices
- Automation equipment

3. **Skills Gap**

A bakery chef is not a data scientist.

Training is required to understand AI tools.

4. **Resistance from Staff**

Workers may fear:

- Job loss
- Machine replacement
- Increased monitoring
- Change management is essential.

## Blockchain Challenges

- **Complexity**

Blockchain is difficult for non-technical users to understand.

- **Integration with Existing Systems**

Most bakeries use simple POS or notebooks. Integrating blockchain is hard.

- **Regulatory Uncertainty**

Laws around digital assets and blockchain payments change frequently.

## Limited Short-Term ROI

Unless a bakery markets itself as "premium and traceable," blockchain's benefits may take time to reflect financially.

## Bakery Chef's Point of View: Practical Concerns

From a bakery chef's perspective, the real questions are:

- Will this technology reduce my daily stress?
- Will it help me bake better products?
- Will customers appreciate this?
- Will it save money or increase sales?
- A bakery chef wants simple tech that:
- Works automatically
- Doesn't require coding
- Doesn't interrupt kitchen workflow
- Improves quality and consistency
- The adoption must respect the creative, human nature of bakery craft.

## Practical Roadmap for Adoption

### Phase 1: Basic Digitization

- Move to digital POS
- Start recording daily production
- Maintain simple sales datasets

### Phase 2: AI Pilots

- Try simple forecasting tools
- Use Instagram AI promotion
- Automate WhatsApp replies using AI agents

### Phase 3: Quality & Inventory AI

- Camera-based product quality check

- Automated inventory alerts
- Waste analysis dashboards

**Phase 4: Block chain Pilots**

- Introduce ingredient traceability for premium products
- Offer block chain loyalty points

**Phase 5: Full Integration**

- Combine AI forecasting + block chain traceability
- Partner with IT companies for customized bakery solutions

### Discussion

The integration of AI, ML, and blockchain technologies into bakery operations has transformative potential. IT businesses must design simpler, affordable, user-friendly tools tailored for small enterprises. Meanwhile, bakery chefs must develop basic digital literacy to make use of these technologies. The collaboration between IT providers and bakery owners can unlock new market opportunities, especially in areas like quality control, predictive planning, and transparent supply chains. The future bakery will be partly automated, partly artisanal — a balance of technology and creativity.

### Conclusion & References

### Conclusion

AI, ML, and blockchain are reshaping IT businesses and will soon define how bakeries operate. While these technologies bring opportunities like improved forecasting, reduced waste, better customer personalization, and ingredient traceability, they also introduce challenges like cost, training, data management, and complexity. A bakery chef must adopt a balanced, phased approach — embracing technology while maintaining the essence of artisanal baking.

### Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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