Marwadi University Marwadi Chandarana Group	**Marwadi University** **Faculty of Engineering and Technology** **Department of Information and Communication Technology**	
Subject: CP	Aim: Innovation and Originality	
	Date: 25-09-2025	**Enrolment No: 92310133002**

Innovation and Originality

Introduction

This project proposes an AI-assisted insurance advisory platform that delivers transparent, privacy-preserving, and context-aware guidance across life, health, and general insurance products. Unlike conventional quote engines or static comparison sites, the system integrates explainable AI, hybrid knowledge representation, and multi-criteria decision-making (MCDM) to align recommendations with a user's risk profile, financial goals, and behavioral preferences. The core objective is to bridge the gap between algorithmic accuracy and human trust by combining modern personalization techniques with rigorous transparency and data minimization.

The novelty centers on four pillars:

1. Hybrid knowledge-graph–enhanced personalization that fuses expert-understood coverage concepts with behavioral data.
2. Explainable model outputs suited for lay users, not just data scientists.
3. Privacy-preserving personalization pathways (client-side modeling with optional federated learning).
4. Decision support tuned for insurance via MCDM and contextual bandits to handle evolving user inputs and changing market conditions.

Novel Approach

1. Hybrid Knowledge-Graph + Collaborative Personalization

- Encode insurance domain knowledge into a lightweight knowledge graph (KG).
- Combine KG signals with collaborative and content-based features to learn embeddings.
- Apply KG-driven constraint-aware filtering before ranking, while embeddings improve fine-grained ordering.

2. Explainable, Layperson-Facing Model Outputs

- Provide reason codes tailored to end-users.
- Use post-hoc and inherently interpretable components.
- Interactive UI with explanation snippets and what-if sliders.

3. Privacy-Preserving Personalization

- Sensitive preference modeling occurs locally (browser-based).
- Optional federated learning for cohort-level improvement.
- Enforce "privacy floor" via minimization, retention limits, and differential privacy.

4. Decision Support via MCDM and Contextual Bandits

- Allow explicit weighting of criteria or selection of archetypes.
- Bandit models adapt recommendations through implicit signals.
- Guardrails ensure exploration never degrades overall utility.

5. Compliance- and Constraint-Aware Recommendation Flow

- Hard constraints first (regulatory, eligibility, riders).
- Soft optimization via user weights and satisfaction predictions.
- Full audit trail for compliance and trust.

Technical Illustration (Example Flow):
Intent capture → KG constraint filter → feature/embedding generation → candidate scoring → MCDM re-ranking → explanation generation → privacy gate → final UI.

Comparison with Existing Solutions

- Static comparison sites: Limited personalization, no semantics.
- Pure collaborative recommenders: Struggle with constraints and cold-start.
- Opaque scoring engines: Accuracy but little user trust.
- Centralized personalization: Privacy risks from server-side personal data storage.
- One-shot ranking: Lack of adaptability during live sessions.

Evidence and Support

- Knowledge-graph recommenders show improved transparency and cold-start handling.
- XAI improves auditability in regulated decisions.
- Federated learning enables privacy-preserving model updates.
- MCDM provides long-established methods for explicit trade-offs.
- Contextual bandits are well-suited for live, personalized recommendation dynamics.

Contribution to the ICT Field

- Trustworthy AI in consumer finance/insurance through actionable XAI.
- Privacy-preserving personalization at the edge via local-first modeling and FL.
- Constraint-aware, explainable decision pipelines combining compliance with preference optimization.
- Methodological integration of KG, MCDM, and bandits for real-time advisory systems.

Stakeholder Impact

- End-users: Clarity, control, and privacy.
- Businesses: Reduced compliance risk, improved product fit, higher trust.
- Researchers: Blueprint for regulated domain recommender systems.

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Current Trends and Gaps Addressed

- Rising demand for ethical, transparent algorithms in finance/health.
- Increasing product complexity in insurance markets.
- Balancing personalization with strict privacy constraints.

Potential Applications and Future Work

- Expand KG to handle provider quality and regulatory nuances.
- Investigate counterfactual explanations for user actionability.
- Study fairness and stability in bandit-driven personalization.
- Explore secure enclaves/TEEs for enhanced local computation.

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