

Abstract

Rapid advances in digital technologies are reshaping the Indian retail sector. However, integrated evidence on how digitalization translates into firm performance, technology investments, and demand forecasting remains limited. This thesis examines retail digitalization that influences firm performance, manufacturer–retailer investment decisions in digital technology, and the adoption of machine-learning models for demand forecasting. Drawing on econometric analysis, game-theoretic modeling, and machine learning–based ensemble model, the study (i) evaluates the impact of digitalization on firm performance; (ii) examines manufacturer–retailer AR investment decisions and their implications on profit and consumer surplus; and (iii) develops a machine learning–based ensemble model to enhance demand forecasting accuracy across online and offline retail channels. First, the study evaluates the impact of digitalization on firm performance. The analysis shows that with the adoption of digitalization; firm performance varies across groups - stronger for firms operating in technologically dynamic environments and for those affiliated with business groups; and weaker for those not associated or affiliated with business groups. Second, the thesis analyzes manufacturer–retailer investment decisions for the adoption of augmented reality (AR) in dual-channel supply chains. The results demonstrate that coordinated AR investment strategies, both by the manufacturer and retailer, outperform unilateral adoption by maximizing firm profits and consumer surplus. Third, the study develops an attention-based BiLSTM–XGBoost ensemble model for demand forecasting. The results show that such an ensemble model achieves superior predictive accuracy compared to traditional and standalone machine learning models across both online and offline retail channels. Overall, the thesis provides an integrated perspective on retail digitalization by linking firm performance, technology investment decisions, and data-driven business forecasting. The findings offer actionable insights for managers and policymakers seeking to leverage digitalization to enhance competitiveness and coordination in emerging-market retail supply chains.

Keywords: digitalization; retail sector; firm performance; augmented reality investment; game theory; demand forecasting; machine learning; ensemble models; India