CHAPTER 33

OPERATIONAL RESEARCH

Doctoral Theses

01.   HITESH KUMAR
        Innovation Adoption Modelling and Application of Numerical Methods in Marketing has been Carr.
        Supervisors: Prof. Ompal Singh and Dr. Adarsh Anand
        Th 27660

Abstract

In the realm of innovation adoption modelling, dynamic market size and multi stage adoption based modeling has gained fair attention of researchers. However, in the real market, the size of potential customers for a product changes due to shifts in adopter behaviour and the product`s impact on the market. This dynamic nature, where the potential size of a product`s market fluctuates, is called the dynamic nature of adoption. When the number of potential adopters for a product increases, this phenomenon is known as market expansion. Market expansion, a key concept, can occur in two ways: firstly, by including some portion of previous adopters of the product in the set of potential adopters, and secondly, by attracting individuals who were not previously considered potential adopters of the product into the market. Determining optimal launch time for a new generation product has been a very troublesome query for managerial decision makers. Optimally estimating the time to launch a new product generation is crucial for every company. As a common adage, optimizing such timings has brought-in revolution in most of the businesses and can help the company maintain its market position for an extended period. A Brief comment on the methodology used in this study is in under here. Numerical method have been used as main tool to approximate the solution for the problem which otherwise relates in non-closed form solution. Numerical methods are the powerful techniques to find numerical solution without actually solving the problem. They allow the practitioners to handle complex problems that are otherwise intractable through traditional analytical methods. Furthermore, this approach not only saves time but also provides a high degree of accuracy in results.

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1. Introduction 2. Non-Uniform Influence-Based Adopter's Categorization for Technological Products: A New Insight 3. Awareness Based Innovation AdoptionModelling Inclucating the Concept of Dynamic Market Size: A New Insight 4. Modelling Diffusion Processes in Multi-Stage and Dynamic Market Scenario 5. Multi-Generational Product. Conclusion, Limitations and future Scope and References.

02.   SHUJA AHMED
Optimizing Inventory and Pricing Strategies for Advance Order Booking Systems.
Supervisor: Prof. K K Aggarwal
Th 27657

Abstract

Conventional inventory control methods typically focus on systems where products are continuously available to meet consumer demand. However, many modern business organizations use advance order booking strategies to optimize inventory levels. Advance order booking systems allow customers to reserve products in advance, often at a discounted price, before the official release. In addition to advance order booking discounts, contemporary retail practices also incorporate strategies such as advertising, trade credit, product return policies, and warranty provisions to enhance the customer experience. Advertising influences consumer demand and drive sales by increasing product awareness and promoting new launches. Return and warranty policies affect purchasing decisions by mitigating perceived risks, while imperfect quality items can impact satisfaction and demand. Additionally, credit policies, such as delayed payment options, significantly influence consumer demand. These strategies present challenges for retailers in managing inventory levels because they significantly influence customer demand. Therefore, it is crucial for retailers to integrate these strategies into their inventory and pricing decisions. This thesis presents a comprehensive mathematical modelling framework for developing integrated inventory and pricing strategies for advance order booking systems, considering various scenarios such as advertisement, return and warranty policies, and trade credit. This framework aims to provide retailers with effective tools to optimize their inventory management and pricing decisions, with solution approaches illustrated through numerical examples. Additionally, a comprehensive sensitivity analysis is performed to offer practical insights for retailers seeking to refine their inventory strategies.

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1. Introduction 2. Literature Review 3. Integrating Inventory, Pricing, and AdvertisingDecisions for Advance Order Booking System 4. Economic Ordering Policy forAdvance Order Booking System with Price and Refund Amount Dependent Demand 5. Optimizing Inventory, Pricing and Return Policies for an Advance Order Booking System with No Question Asked Return Window 6. Inventory, Pricing, and Warranty Policies: A Joint Analysis of Fresh and Refurbished Product Streams with Imperfect Inspection 7. Inventory and Pricing Strategies for Advance Order Booking System with Part Payment and Trade Credit 8. Conclusions and Future Recommendations. List of Papers Published and Communicated, Bibliography and Appendices.

03.   ARORA(Rajat)
A Study on Software Development Management through Testing Effort based Reliability Models.
Supervisor: Prof. Anu Gupta Aggarwal
Th 27658

Abstract

The primary purpose of the Thesis is to develop Testing Effort-based Software Reliability Growth Models (SRGMs) for quantitative evaluation of Software Reliability and assessment of its performance taking into consideration the perspectives of management, developers, and ultimate clients. The impact of inclusion of change point, imperfect debugging and fault reduction factor is studied in our proposed SRGMs and the models are validated on two real life fault datasets. Also, the performance of the proposed model is compared with other models in literature indicating better performance of the proposed models. The study also investigates optimal release planning problem for the software where modeling is based on the proposed SRGMs. This thesis integrates the concept of slippage and management evaluation into an effort-based SRGM incorporating the application characteristics. Our research assumes that the review process is scheduled by the management team during testing. This crucial evaluation assist in providing critical information regarding the additional efforts required to meet the reliability objective within scheduled time to avoid slippages in Software Project. Also in situations where, effort expenditure could not be increased, probable delay is determined. The optimal allocation of resources/effort to modular software systems during the planning phase of software development has been researched in depth under a variety of decision-making criteria, namely Fuzzy Analytic Hierarchy Process (FAHP), Interval-valued Intuitionistic Fuzzy Analytic Hierarchy Process (IVIF-AHP), Decision making Trial and Evaluation Laboratory (DEMATEL) and Maximum Entropy Minimum Variance Ordered Weighting Averaging Operator (MEMV-OWA). In addition, we have investigated and analyzed the significance of the roles that a variety of software quality characteristics play in the process of achieving optimal resource/effort allocation during Software Development Process (SDP). Further, a comprehensive analysis of a two-dimensional warranty as post-sales service, its impact on sales of the software product and profit for the development firm is also carried out in this Thesis.

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1. Introduction 2. Optimal Release Policy Using Testing Effort-Based Srgm with FRF and Change Point 3. Role of Management Review to Avoid Schedule Slippages in Software Development Project 4. Effort Allocation for Modular Software Using Multi-Criteriadecision-Making Techniques. 5. Optimal Price and Release Planning Under Two-Dimmensional Warranty Framework.Conclusion and Future Scope and References.

04.   KM KAMNA
Optimizing Inventory Strategies for Flexible Manufacturing Systems
Supervisor: Prof. Chandra K. Jaggi
Th 27661

Abstract

This study explores a comprehensive framework for flexible manufacturing systems that addresses the complexities of product deterioration, preservation, and demand influenced by price, advertisement and green investment. The model integrates carbon emission policies, such as carbon tax and cap-and-

trade mechanisms, to assess their impact on reducing the environmental footprint of manufacturing activities. By imposing a carbon tax, manufacturers are incentivized to lower emissions by internalizing the environmental costs, while the cap-and-trade system creates a market for emission permits, encouraging overall reductions. The research highlights the dual challenges of mitigating product deterioration and optimizing preservation to extend product life cycles. Investment in eco-friendly production technologies and renewable energy sources is examined as a critical component for compliance with environmental regulations and gaining a competitive market edge. The study underscores the necessity for manufacturers to adopt dynamic pricing and targeted advertising strategies to influence demand, which increasingly favours sustainable products. This approach not only meets consumer expectations but also aligns with global efforts to combat climate change. By adopting a holistic strategy that encompasses flexible manufacturing, effective preservation, and adherence to carbon policies, manufacturers can achieve economic performance while contributing to environmental sustainability. The findings suggest that integrating these elements can enhance both operational efficiency and sustainability, ensuring manufacturers can adapt to evolving market demands and regulatory landscapes. This model provides a viable pathway for manufacturers to balance economic viability with environmental responsibility, addressing the pressing need for sustainable practices in the industry.

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