CHAPTER 32

MATHEMATICAL SCIENCES
OPERATIONAL RESEARCH

Doctoral Theses

01.   AGARWAL (Mohini)
Modeling Awareness based Innovation Adoption in Marketing and Economic Analysis of Software Patching.
Supervisors: Dr. Ompal Singh and Dr. AdarshAnand
Th 23471

Abstract
(Verified)

Innovation diffusion modeling is one of the foremost important research topics in the field of marketingthat tries to explain the spread of an innovation in the social system. Many innovation diffusion modelshave been developed in past; they were generally based on assumption that as soon as theinformation is available about the innovation it is adopted by the potential adopters. But, firstlyinformation about the innovation is spread through the channels of communication in the socialsystem which creates influence among individuals. From informed consumers; positively motivatedindividuals go on to make the final purchase which is mathematically modeled here. The time gap inwhich information is processed into purchase may be constant for all individuals, vary with time ormay be random. Therefore, we come up with a methodology of studying adoption pattern based ondeterministic or random delay in the adoption process.Generally, the rate by which an innovation is diffused in the system might get changed due tomodification in packaging, transformations in advertising strategy, increase in the number of outlets,etc. These changes may be reflected by a sudden shift in adoption curve called the change-pointwhich is inculcated in studying the multi stage nature of adoption process. Also, an important featureof new technologies is that they come in successive generations. We have developed a systematicapproach to model the sales for intergenerational diffusion process under the joint impact ofawareness and adoption process.Moving further, we have studied the economic aspect of how the management can be benefited byadopting the strategy of releasing patches to overcome any software failures which may bring downthe system while it is in usage. In this thesis, we have emphasized on the concept of firms providing
patching services and estimated the overall software testing cost.

Contents

1. Introduction 2. Understanding awareness and motivation as different stages for innovation adoption 3.Anew insight into innovation diffusion modelling 4. Queuing theory based innovation diffusion modelling incorporating change in adoption rate 5. Multi-Generation innovation adoption based on conjoint effect OH awareness process 6. Economic impact of software patching and optimal release scheduling.Conclusions and scope for future research.Managerial implication. References. Appendixes.

02. DARBARI (JyotiDhingra) nee DHINGRA Jyoti
Multi-Criteria Optimization Approaches for Sustainable Reverse and Closed Loop Supply Chain Network Design.
Supervisors: Prof. P. C. Jha and Prof. Diego Galar
Th 23468

Abstract
(Verified)

The boom in the technological industry coupled with globalization has manifested inmajor evolution in the supply chain environment. To counterbalance the fast dilapidationof the natural environment, the focus of all supply chain actors has shifted to theconcept of reuse and remanufacture. Recent decades have thus witnessed therecognition of reverse logistics (RL) and closed loop supply chain (CLSC) as the waytowards creating synergy between profitability and sustainability. With this contextualunderstanding, the objective of the thesis is to develop effective decision-makingmodels for configuring and evaluating reverse supply chain and closed loop supplychain network design for electronic companies pursuing to target triple bottom linethrough sustainability. This goal is translated into the following researchobjectives:1)Develop sustainable RL/CLSC network configuration models for makingkey strategic, tactical and operational decisions of supplier selection, capacitated facilitylocation selection, flow planning between network entities, optimal quantity allocation,selection of vehicles and job creation; 2) Design of carbon efficient transportationnetwork using clustering techniques and vehicle routing models for upstream anddownstream flow of products and components in order to reduce the negativeenvironmental impact of the integrated RL/CLSC network; 3) Utilization of various multicriteriaoptimization techniques for evaluation of the sustainable network configurationsbased on the bottom line aspects and in attaining a reasonable trade-off between thesustainability goals in a flexible environment; 5) Validation of the mathematical modelsto reflect upon how Indian electronic manufacturers can gain sustainably from thenumerous electronic product reuse opportunities in the Indian market under uncertaintyof the business environment. Valuable managerial implications are drawn for theory aswell practice within the area of sustainable RL/CLSC network designing for productrecovery. The proposed optimization models can serve as effective decision tools inimplementation of RL/CLSC networks in the Indian electronics industry.

Contents

1. Introduction 2. Multi-Objective optimization of environmentally sustainable reverse logistics network configuration 3.Multi-criteria fuzzy optimization approach for sustainable recovery facility selection decision making 4.Fuzzy multi-objective optimization of eco-efficient closed loop supply chain network incorporating supplier selection decision 5.Optimizing the TBL performance of supply chain network design problem for product recovery using fuzzy multi-criteria programming approach.Conclusion.Limitations and future scope.Bibliography.

03. GARG (Kiran)
Study of Optimized Integration of Product Recovery in Reverse and Closed Loop Supply Chain Network.
Supervisors: Prof. P. C. Jha
Th 23748

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1. Introduction 2. Optimization of reverse logistics network for product recovery 3. Optimization of third party provider's product recovery process 4. Optimization of closed loop logistics for product recovery 5.Product recovery and manufacturing sustainability. Conclusion. References. Appendies.

04.   GUPTA (Mamta)
Study of Inventory Policies for Deteriorating Items in Two Warehouse Environment.
Supervisors: Prof. Chandra K. Jaggi
Th 23469

Abstract
(Verified)

Inventory is defined as tangible asset maintained by all business enterprises. "*Inventory*"includes raw materials, work in progress; supplies used in operations, and finished goods.Traditionally, the inventory models were developed to decide how much to order and when toorder. But with changing business environment the decisions should include the variousother realistic crucial factors for effective inventory control. Deterioration of goods is apractical phenomenon in many business organizations. Managing deteriorating items – likefruits and vegetables, pharmaceuticals, chemicals, volatile liquid, blood, etc. is the mainproblem in inventory systems. In order to represent a more realistic approach to theinventory models, there is need to include the effect of deterioration in inventory modeling.With varying market trends, another realistic problem in inventory control is of limited storagecapacity. There can be several reasons for the retailer to place bulk orders such as to takeadvantage of attractive price discounts for bulk purchases, or in anticipation of growth indemand with time or when the item under consideration is a seasonal product. Also ininflationary market conditions when prices of the product tend to increase in near future, theretailer may place a bulk order in order to sustain in such market conditions. Thus, retailer isforced to order a quantity that exceeds the capacity of his own Warehouse (OW), and useRented Warehouse (RW) to store additional units.The present thesis entitled "*Study of Inventory Policies for Deteriorating Items in TwoWarehouse Environment*" includes various inventory models in two warehouse system underdifferent practical situations such as deterioration, price, and stock dependent demand, ramptype demand, inflation, permissible delay in payments, two-echelon supply chainperspective, etc. The main objective of this study is to develop inventory models applicableto current business establishments for deteriorating items in two warehouse environment.

Contents

1. Introduction 2. Literature review 3. Optimal replenishment policy for deteriorating and non-deteriorating items in two warehouse environment 4. Supply chain inventory models for deteriorating items in two warehouse environment 5. Optimal decisions for deteriorating items with different demand function in two warehouse environment under trade credit 6. Inventory system for time varying deteriorating items in two warehouse environment under trade credit policy 7.Conclusion and scope for future research. Appendix. List of publications. Bibliography.

05.   SACHDEVA (Nitin)
Quantitative Assessment of Software Warranty, Innovation and Big Data Projects Adoption.
Supervisors: Dr. Ompal Singh and Prof. P. K. Kapur
Th 23470

Contents

1. Introduction 2. Modeling and optimizing software warranty 3. Modeling and optimizing warranty length and price for customer satisfaction 4. Modeling innovation adoption with multiple parameters, time lag, and segmented markets 5. Modeling innovation adoption with multiple parameters, time lag, and segmented markets 6. Modeling and optimizing product remanufacturing under diffusion dynamics 7. Adoption of big data projects: Application of multi-criteria decision-making techniques. Conclusions and future research directions. References. Appendix.

06.   SANTOSH KUMAR
Some Contributions to Optimization Medelling of Uncertain Allocation Problems.
Supervisors: Prof. Pankal Gupta and Prof. Mukesh Kumar Mehlawat
Th 23747

Contents

1. Introduction 2. Multiobjective interval-optimization models for optimal supplier portfolio 3. Fuzzy multiobjective optimization models for optimal supplier portfolio 4. A Weighted fuzzy possibilistic approach for sustainable supplier selection and order allocation 5.A multi-choice goal programming approach for a multiobjective assignment problem 6.A solution method for fuzzy linear fractional problem with an application to transportation problem. Bibliography.