

ysis indicated that customer knowledge investment affects positively the company's performance. The results also showed that more knowledge investment will not increase financial strength, and in some cases, it will reduce the company's financial strength. According to the results, information technology companies can improve

their performance only through an appropriate amount of investment on customer knowledge management.

**Key Words:** Customer knowledge, corporation performance, system dynamics, investment, information technology.

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**Abstract**

In many industries, some of production capacity will be out of reach when a machine deteriorates. Preventive Maintenance (PM) will enhance the machine condition, but it occupies some of production capacity. The PM will reduce the production capacity and will cause the customer's order delay if it is unnecessary, in contrast the probability of unexpected failure will be increased and will have the same or worst consequences if the PM is too late. One of the ways to deal with this problem is Condition-Based Maintenance with Discrete Monitoring (CBMWDM) whose main challenge is to find an optimal inspection scheme. If the time interval between inspections is too short, the inspection cost will be increased although it will diminish unnecessary PMs and unexpected failures. On the other hand, if the interval between inspections is too long, the sum of unexpected failure and backorder costs will be increased although the cost of inspection will be reduced. Hence, simultaneous planning of the inspections and PM actions should be emphasized. In this paper, a single product single machine system with Markovian deteriorating conditions and demand uncertainty is considered. The main objective is to integrate the inspections and maintenance planning in a tactical level and finite horizon that minimizes the average cost of inspections, maintenances, and backorders. For this purpose, a stochastic dynamic programming model is presented whose structure is dependent to appointed inspection scheme. The state variable of the model is an ordered pair whose components represent the demand and machine condition. The demand is a discrete random variable with arbitrary distribution and the machine condition will be determined after each inspection. Corresponding to each inspection scheme and for each outcome of the state variable, optimal PM decision is obtained and consequently the optimal inspection scheme is determined. The optimal inspection scheme and corresponding PM decisions determine simultaneous inspections and preventive main-

tenance planning. The strategy of the new model is analyzed for a six-month horizon. Numerical results of the model show that the total average cost is non-decreasing in machine state and demand. Secondly, at the time of inspection, the preventive maintenance should be executed at the same time or earlier if machine state is worse or demand is more.

**Key Words:** Inspection planning, condition based maintenance, stochastic dynamic programming.

## INFLUENCE OF CUSTOMER KNOWLEDGE AND KNOWLEDGE INVESTMENTS ON CORPORATE PERFORMANCE-CASE STUDY OF INFORMATION TECHNOLOGY INDUSTRY

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**Abstract**

The purpose of this paper is to investigate the effect of customer knowledge and customer knowledge investment on the financial and non-financial performance of IT companies. System Dynamics approach was used to analyze the interactions. Using Vensim-PLE software the Flow Diagram was plotted and the model was built and simulated for a ten-year period. Different policies were analyzed using the model. The results of the anal-

end up causing important problems such as customers' dissatisfaction leading to market share reduction and finally elimination from the world of competition. Therefore, the topics related to quality engineering has a vital importance in the industry. Several methods have been proposed in this regard, one of which is the response surface methodology. When the relation among the variables of a process are not clear, and the experimenter is interested in finding the optimal adjustments of the input variables and that's why the response surface methodology is utilized to optimize the process parameters. In this study, the response surface methodology has been exploited with the robust designing approach in order to optimize the quality characteristics of the product and effective variables so that in the beginning the control variables and response variables must be identified and then the model should be optimized by designing the experiment and finding the intended regression equations.

**Key Words:** Design of experiments, response surface methodology, stochastic goal programming, robust parameter design.

## THE IMPACT OF CONSUMERS' ENGAGEMENT WITH DIGITAL BRANDED CONTENTS ON BRAND EQUITY

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### Abstract

The growing trend of using digital media for branding purposes shows that, in the near future, many companies will spend most of their advertising budget on digital media. In order to evaluate these digital marketing communication efforts, it is vital to develop some

practical indicators such as consumers' engagement with brands in the digital environment. Digital marketing professionals frequently talk about consumers' engagement and consider engagement as one of the most important indicators for evaluating branding activities performed in digital media. However, there is no agreement regarding the definition of engagement. This study offers a comprehensive definition of "consumers' engagement with digital branded contents", which is an emerging concept in the marketing literature. Engagement is a multi-dimensional construct consisting of cognitive, emotional, and behavioral dimensions. Consumers' engagement with digital branded contents is defined as the consumers' perceived usefulness and enjoyment of these contents, as well as the consumers' active participation (e.g., sharing a branded post on social media, commenting on a post, or creating some brand-related posts) and their depth of interaction with brand-related contents in webpages, online forums, or social media (e.g., dwell time, recency, and frequency). This article also contributes to the literature by theorizing the relationship between this emerging key construct and brand equity. In other words, this paper delineates how and through which mechanism the consumers' engagement with brands in digital media can gradually change the consumers' minds about those brands. Four main dimensions of consumer-based brand equity include brand awareness, brand image/associations, brand's perceived quality, and consumers' loyalty towards the brand. Our four propositions state that cognitive, affective, and behavioral dimensions of "consumers' engagement with digital branded contents" have positive effect on four dimensions of consumer-based brand equity. This paper proposed, through the lens of attitude theories, that increasing the consumers' engagement with digital branded content would improve brand awareness, brand image, perceived quality, and brand loyalty.

**Key Words:** Consumers' engagement; brand equity; branding; digital environment.

## A MATHEMATICAL MODEL FOR SIMULTANEOUS PLANNING OF INSPECTIONS AND PREVENTIVE MAINTENANCE IN THE PRESENCE OF MARKOVIAN DETERIORATING MACHINE CONDITIONS AND DEMAND UNCERTAINTY

**Key Words:** Milk run, mathematical model, first-fit algorithm, the pickup and delivery problem.

## NON-LINEAR PROGRAMMING APPROACH AND GENETIC ALGORITHM FOR SOLVING A PRODUCTION -DISTRIBUTION PLANNING PROBLEM

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### Abstract

Supply chain management and integration of its components are a key issue for sustainable economy. One of the most important in optimization supply chain modeling is production- distribution planning problem. Several authors have developed models for the production-distribution problem when only a percentage of solution procedure is in exact area. Most of these models were solved with the meta-heuristic method. In this paper, we are extended a production-distribution nonlinear programming problem in a two-echelon supply chain network, including manufacturers and distributors, and are solved with a mixed of exact solution and a meta-heuristic algorithm. The aim of this research is to determine the value of products delivered and the carrying amount of each vehicle such that the profit average, including sales price, production costs and transportation costs, is maximized. The model is for multiple distributors and all manufacturers in which all manufacturers

are produced a type of product and are sent it to distributors. The mathematical model of the production-distribution problem is derived for which the objective function is proved to be convex, and the constraints being in linear forms are convex too. So, the proposed model is a convex nonlinear programming problem and its local maximum is the global maximum. Then, the proposed nonlinear programming problem is solved by two methods of a genetic algorithm and, Sequential Unconstrained Minimization Technique (SUMT) approach along with steepest descent method. The SUMT is the usual way in which constrained problems are converted to an unconstrained form and solved that way. It makes use of barrier methods as well to find a suitable initial point that over satisfies the inequality constraints. In this study, the genetic algorithm is used to validate the SUMT nonlinear programming approach. The numerical example is provided to illustrate the solution methods. Finally, future research and conclusion recommendations come in the last section of paper.

**Key Words:** Supply chain, production-distribution problem, nonlinear programming, steepest descent method, genetic algorithm.

## A HYBRID MODEL BASED ON STOCHASTIC GOAL PROGRAMMING AND RESPONSE SURFACE METHODOLOGY TO OPTIMIZE

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### Abstract

Nowadays, quality is known as a commercial strategy to increase the market share and as it comes off, it will

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**Abstract**

The data envelopment analysis (DEA) technique is one of the most comprehensive techniques for evaluating the performance of the organization. Studies show that the assumptions of all the techniques of data envelopment analysis have been based on evaluating efficiency of decision making unit (DMU) relative to each other. Different and uncontrollable conditions in each decision-making unit can be one of the reasons for the low validity of the results of assessment. Therefore, self-assessment of decision-making units is the best type of evaluation in which the maximum stability of the conditions is considered and as one of the innovations in this research is mentioned. Since the nature of some input or output variables occurs in uncertainty conditions, fuzzy criteria can be evaluated based on intuitionistic fuzzy information. The model of the intuitionistic fuzzy network data envelopment analysis is the proposed model, which is used in this study for self-assessment Moghan wire and cable firm as a network system.

**Key Words:** Self-Assessment, data envelopment analysis, series-parallel production systems (network), intuitionistic fuzzy network data envelopment analysis.

**A MATHEMATICAL MODEL AND A FIRST-FIT ALGORITHM FOR THE MILK RUN LOGISTICS PROBLEM IN THE AUTOMOTIVE INDUSTRY CONSIDERING PACKAGING CONSTRAINTS**

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**Abstract**

Transportation cost accounts for a large portion of costs in automotive supply chain. An effective approach that can reduce the cost of transportation is essential. The supply network of automotive industry is very complex and has many conditions to consider. These include enforcing the feasibility of 3D packing of pallets into vehicles to address vehicle's capacity in terms of weight and volume, compatibility of orders to be loaded in a vehicle, returning empty pallets from assembly plants backwards to suppliers, and order delivery time window. A mixed integer linear programming (MILP) approach is proposed in this paper that takes account of these conditions with the objective of minimizing the total cost of transportation across the network. The structure of the network is a combination of direct shipment and milk-run for both forward and reverse flows of pallets. Any order that is larger than the capacity of the largest vehicle is split and shipped directly, and the remaining pallets can be consolidated in milk-run. For large-size problems where a solution cannot be obtained in a reasonable amount of time, a heuristic algorithm is proposed based on the concept of similarity to generate a reasonable list of orders. First-fit strategy is then employed to generate a feasible solution with the aid of a relaxed version of the proposed MILP. Thereafter, two improvement "reduce" and "merge" heuristics are employed. The effectiveness of the proposed heuristic is tested based on generated instances which demonstrates that it is able to provide optimal solutions for small-size problems. The proposed approach is also tested based on the data of daily auto-parts shipments gathered from SAIPA Corp network that is one of the largest Iranian automobile companies. Results demonstrate that there exists a significant potential for cost saving through milk-run strategy compared with the company's current direct shipping strategy.

location of hospitals in such a way that with limited resources in hand and the normal capacity and extra that can be used in times of crisis, the minimum distances Have Taking into account the decisions of the hardening of existing hospitals and the location of new hospitals simultaneously, post-abandonment distances are reduced compared to when the location is taken regardless of disability and rehabilitation, and this can be an effective step in crisis management. The capacity of hospitals in normal conditions and in the event of a crisis is limited and considering this in the model gives more realistic results. In this research, the problem of locating new hospitals and hardening a number of existing hospitals with limited available budget has been discussed. First, the potential locations to build a hospital are specified. Then, using the proposed mathematical model, the optimal locations for the construction of new hospitals were determined, as well as decisions regarding the hardening of a number of existing hospitals. In order to solve the model due to its bi-objective function, the Epsilon-constraint Method (II) are used. To evaluate the validity of the model, a case study was carried out based on demographic and geographical information of Yazd city. Regarding the possibility of applying the model to large-scale applications and operating issues as well as NP-hardness of the model, an innovative multi-objective two-phase algorithm is proposed and evaluated based on some numerical examples.

**Key Words:** Location, hospital hardening, GIS, augmented epsilon constraint method (II), multi-objective two-phase heuristic algorithm.

## AN INTEGRATED MODEL OF STATISTICAL PROCESS CONTROL AND MAINTENANCE BASED ON DELAYED MONITORING IN TWO-STAGE PROCESSES

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### Abstract

One of the most important goals of organizations and manufacturing companies is to provide suitable products and services to customers, requiring high-quality processes and keeping them at a desired quality level. In many cases, product quality is low due to equipment deterioration; however, it cannot be figured out until the equipment breaks down. On the other hand, control charts can be used to identify the condition of the process, where the out-of-control state for a quality characteristic means deterioration in the equipment, which is used for the manufacturing purpose. Hence, the statistical process control and maintenance decisions can be combined to form an integrated model that enjoys higher efficiency in reducing costs of quality and maintenance. Furthermore, using delayed monitoring policy to monitor processes is one of the newest research fields in this regard. Delayed monitoring means that processes are in control at the beginning of the process and sampling can be delayed until the pre-specified scheduled time. With a delayed monitoring policy, the total cost of production per unit is expected to be more affordable as the sampling rate decreases; however, it may lead to an increase in the quality and maintenance costs. Therefore, determining efficient decision variables is important in the model. In this paper, an integrated statistical process control and maintenance model based on delayed monitoring is designed for a two-stage process. By using this procedure, 28 different scenarios are created in which variations in quality and different breakdown states are considered.  $\bar{X}$  residual mean control charts have been used for monitoring purposes. In order to integrate statistical process control and maintenance, a model is proposed such that the expected cost per time unit of manufacturing is minimized by using a genetic algorithm. To evaluate the performance of the proposed method, an illustrative example is presented. In addition, sensitivity analysis of some parameters of the proposed model is carried out. The results show the appropriate performance of the proposed model.

**Key Words:** Condition-based maintenance, delayed monitoring, genetic algorithm, statistical process control, two-stage processes.

## SELF-ASSESSMENT OF NETWORK PRODUCTION SYSTEMS WITH INTUITIONISTIC FUZZY DATA (CASE STUDY: FIRM OF MOGHAN WIRE AND CABLE)

## THE ECONOMIC PRODUCTION QUANTITY (EPQ) MODEL CONSIDERING INFLATION, TIME VALUE OF MONEY AND INVESTMENT VARIABLE IN PRODUCTION CAPACITY

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### Abstract

The classical inventory models do not consider the real-world competitive situations and management desire to enhance the system and economic parameters such as inflation and time value of money. Studies show that the management wishes an investment in system components in order to improve them and gain a competitive advantage over other businesses. Moreover, the value of system financial resources depends on the time that the use and cash flow of different time is not aggregate. Due to inflation, prices become volatile and change constantly. Therefore, disregard for inflation and time value of money parameters does not lead to optimal ordering policy for inventory systems in reality. For these reasons, it is necessary to consider these components for an inventory system. Previous researchers have conducted various research studies on the performance of inventory systems from various perspectives. Many of these papers did not consider economic parameters and also production environment. During our studies, this study found a gap in the literature that was related to the enhancement of the production capacity in inventory systems in an economic structure. The present paper presents a literature review of time value of money, inflation, and investment in inventory systems and, then, investigates economic production quantity (EPQ) model considering inflation and time value of money in situations, where there is a possibility of investment as a decision variable with the aim of increasing production capacity. The goal of this model is to find economic production quantity and optimal quantity of investment in production capacity so that the total profit function, consisting of system revenues and costs, is optimized. Due to com-

plicated behavior of the proposed model, it is not possible to solve this model analytically. Therefore, a grid search algorithm is proposed for solving the model. The solving algorithm process is investigated by a numerical example. Sensitivity analysis is carried out by changing various parameters. Finally, it is concluded that there is an ascending relationship among the total profit function and the number of algorithm iterations, grid factor, demand rate, selling price, and inflation rate of price; there is also a descending relationship among the total profit function and ordering price, purchase price, rate of return, and inflation rate of sales. At the end, some possible research problems are proposed for the future.

**Key Words:** Inventory control system, economic production quantity, inflation, time value of money, two variable optimization.

## AN INTEGRATED SOLUTION APPROACH FOR THE HOSPITAL LOCATION-HARDENING PROBLEM WITH LIMITED CAPACITY

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### Abstract

Hospitals are one of the most important centers of medical service. At the time of the occurrence of natural and abnormal disasters, the demand for these centers may increase and some of these hospitals will be damaged and lose their functionality. On the other hand, in order to protect the lives of the injured, the distance and time of their transfer to hospitals is of particular importance. The proposed problem addressed simultaneously the crisis and normal conditions and tried to determine the

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### Abstract

In recent years, competition has grown stronger due to technological advances. Market members need to be careful and decide to remain competitive by using scientific tools. One of the important decisions of manufacturers in the competitive market is to decide on how much their products are compatible with the environment. One of the most important aspects of environmental compatibility is energy consumption and pollution. With the rapid growth of the industry, the number of energy-consuming devices in the world is increasing day by day. These devices made life easier for humans; however, excessive energy consumption of these products has caused serious damage to the environment, and the consequences of these damages have made the general public more sensitive to environmental issues. An effective factor in reducing energy consumption improves the energy efficiency of consumer products. Increasing the energy efficiency of products that use fossil fuels will directly reduce greenhouse gas emissions and air pollution. For this reason, this paper considered a supply chain consisting of two manufacturers. Each manufacturer produces a product that consumes a certain amount of energy when used to perform a specific task. It is assumed that manufacturers can reduce the energy consumption of their products by upgrading their production technology. The purpose of this study is to analyze the behavior of these manufacturers in a competitive environment and answer the question of how much manufacturers need to spend on improving energy consumption and how to determine the price of the final product when consumers are sensitive to the cost of energy and environmental issues. The results show that, by increasing customers' public awareness concerning environmental issues, manufacturers must reduce the energy consumption of their products. Another result shows that the increased price of a unit of energy can make manufacturers increase the energy efficiency of their products.

**Key Words:** Supply chain, energy consumption, pricing, game theory.

## PERIODIC ROUTING OF WELL TECHNICAL SERVICES GROUPS IN OFFSHORE SHARED OIL FIELDS

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### Abstract

Production wells in offshore shared oil fields require well technical services. These services are done by two types of well technical services groups: wellhead services and wire-line services. Production wells in offshore shared oil fields require well technical services and the lack of services affects production productivity of oil wells. In fact, due to supply limitations, there are fewer well technical service groups compared to the number of oil wells. Failure to service oil wells by well technical service groups based on a predetermined plan will lead to considerable loss in production performance of oil wells and, hence, higher costs. However, the stopping production process is one of the requirements in giving some services to oil wells and, thus, this leads to greater oil production than the competitor neighbor countries and increasing opportunity cost for us. Therefore, in these conditions, making a balance between servicing with stopping production process and minimizing stopping production is very important. Firstly, a mixed-integer programming model is proposed for the problem considering new applicable and practical features that have not been introduced before. Secondly, algorithms based on Benders and L-shaped exact methods are developed. Moreover, algorithms based on Lagrangian relaxation heuristic method in seven states are developed. Each state involves eliminating some selective constraints of the proposed mathematical model and adding its objective function to obtain the best constraint selection. In fact, the professed goal is to produce a variety of lower bounds. In order to evaluate the performance of the developed algorithms, various small to large instances are generated and, then, the algorithm is applied to simulated instances. Computational results indicate that algorithms based on L-shaped and Lagrangian relaxation methods produce better lower bounds. Moreover, by strengthening the model, algorithms based on Lagrangian relaxation method are able to produce better lower bounds with respect to the algorithms based on the L-shaped method in a short time period.

**Key Words:** Production wells in shared oil fields, well technical services, mixed-integer programming model, lower bound.



mixed-integer programming (MIP). This model is aimed to specify the composition (size and mix), deployment (assignment fleet to stations of MRCCs), and adjustment of vessel fleet (through chartering, lay-upping and sharing strategy) in a MRCCs. We ran a pilot study on MRCCs that located in the south of Iran (the Persian Gulf and the Oman Sea) for a quarterly planning period (three months - spring season). We optimized the problem by hybridizing our developed heuristics for constraint handling phase in the Grouping Evolution Strategy (GES) algorithms. Our model could successfully cover the demands and determine the adjustment strategies in a reasonable vessel fleet's utilization cost; 72 million USD during the planning period.

**Key Words:** Fleet planning, search and rescue (SAR / S&R), fleet composition, maritime fleet size and mix problem (MFSMP), fleet deployment, grouping evolution strategies (GES).

## A MATHEMATICAL MODEL FOR LOCATING EMERGENCY BASES SUBJECT TO SERVICE TIME MINIMIZATION: A CASE STUDY IN TEHRAN EMERGENCY CENTER

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### Abstract

Pre-hospital emergency is one of the most important issues of the health and treatment system of a country. Awareness of the incident, the dispatch of rescue teams to the place where the incident occurred, the conduct of primary medical care and the transfer of injured or wounded people to health centers in the shortest time and at a desirable quality level are among the most important tasks and objectives of a pre-hospital emergency system. The realization of these objectives requires an accurate estimate of the magnitude and type of the in-

cidents, the proper deployment of emergency facilities, the availability of adequate equipment and specialized personnel at the emergency bases, comprehensive, centralized, and regional management, and reliable communication facilities among bases, rescue team, and health centers. It is obvious that the more the number of emergency bases and equipment is available in an area, the shorter the service time is achievable, and thus, a higher level of satisfaction is realized. However, some constraints and considerations exist. For example, the government budget for establishment of the bases is often limited; some of the equipments for the transfer of patients cannot be used due to urban and interurban transportation conditions, and so on. Thus, the determination of optimal location of the emergency bases, in such a way that the minimum service time would be achieved for all people is of special importance.

In this paper, a 0/1 nonlinear programming model is proposed for locating emergency bases with the goal of minimizing the mean and standard deviation of emergency service time for a given region while satisfying the relevant constraints. The simultaneous consideration of mean and standard deviation of service time, not only increases the number of successful missions, but also places this time for missions to an average time. This, in turn, can lead to relative fair justice for different people in that area. To test the validity and use of the proposed model, the model is applied for a part of the Tehran metropolis and its results are presented.

**Key Words:** Pre-hospital emergency, non-linear integer programming, emergency bases locating, mean of service time, standard deviation of service time.

## A GAME THEORETIC APPROACH FOR PRICING AND ENERGY CONSUMPTION IN A SUPPLY CHAIN WITH ENVIRONMENTALLY SENSITIVE CUSTOMERS

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# Abstracts of Papers in English

## A MATHEMATICAL MODEL AND A GROUPING EVOLUTION STRATEGY ALGORITHM FOR MARITIME SEARCH AND RESCUE (SAR) VESSEL FLEET COMPOSITION: A PILOT STUDY ON RESCUE CENTERS OF THE PERSIAN GULF AND THE OMAN SEA

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### Abstract

Since the ago times, maritime transportation has been considered as one of the most effective, secure and economical ways for shipment of goods and humans. However, maritime accidents are the subject can cause a huge damage on the maritime transportation. In the recent decades, there has been a lot of effort to reduce and control maritime transportation damage (For example, the International Maritime Organization conventions such as SAR, SALVAGE and MARPOL can be mentioned). However, the maritime accident occurrence is still high. The conditions of Iran are the same. Iran maritime industry are facing with various type of maritime accidents and these accidents result in human and asset casualties. Therefore, it is imperative to implement appropriate plan in this subject. The planning of the maritime Search and Rescue (SAR / S&R) vessel fleet in Maritime Rescue Coordination Centers (MRCCs) is an important problem that can control and reduce the damages caused by maritime accidents remarkably. In this research, we utilized the general concepts of 'Fleet Composition Problem (FCP)' and 'Maritime Fleet Size and Mix Problem (MFSMP)' to provide a bi-objective (Twofold Objective) mathematical model on the basis of