

## RESEARCH AREAS

### ADVERTISING EFFECTIVENESS FROM THE HERMENEUTIC STANDPOINT

**Doron Faran and Arie Maharshak**

The core of our research focuses on the dilemma of advertising effectiveness: On the one hand companies tend to invest substantial amounts of money to promote their products, while on the other hand quite often customers fail to understand the message embedded in a marketing campaign. Consequently, highly valued campaigns that received prestigious awards did not deliver the goods. While the failures of advertising campaigns have been thoroughly investigated in the literature, few explanations have been proposed. Our contribution builds on the criticism of cognitive narrowness and takes the cultural stance a step further through application of the hermeneutic tradition.

*Keywords: Advertisement, hermeneutics, interpretation, culture*

### APPLIED PROBABILITY

**Tamar Gadrach and Rachel Ravid**

Applied probability is concerned with the application of probability theory to other scientific and engineering areas (e.g., physics, biology, medicine, computer science, technology and social sciences). We apply generalizations of classical models to solve problems that have emerged in modern industry. Occupancy models are an example of one of the models used to generalize the classical coupon collector problem and applied in the area of statistical quality control.

*Keywords: Probability models, statistical quality control, occupancy problems, enumerative combinatorics*

### CROSS CULTURE HR MANAGEMENT

**Hilla Peretz and Yizhak Fried** (Syracuse University, NY)

Cross culture management focuses on content pertaining to HR management with a cross-border dimension. This longitudinal research study examines the effects of national values on a variety of HR practices (among them performance appraisal, training strategies and HR information system) as well as the effect of fit between HR practices and national values on organizational performance indicators. The study comprises a large sample of over 20 countries and is based

on data from several years, with the goal of exploring the stability of these relationships before and after the financial crisis.

*Keywords: National values, human resource management, organizational performance*

## ENVIRONMENTAL ECONOMICS

**Natalia Zaitsev and Mira Baron** (Technion)

In the mid-1990s, we forecast the number of Israeli visitors to a unique planned recreational site in the north of Israel, currently known as Agmon Hula. The contingent valuation method was used to predict this number based on willingness to visit the planned site among tourists visiting all recreational sites in the region.

In the current study, we examine the assumptions and results of that study and compare the forecast to the actual outcome. We concentrate on the number of visitors forecast, which enables us to examine the economic impact and is crucial in analyzing ecological carrying capacity.

The commodity planned was a site which offers a safari, a bird sanctuary, horseback riding, a swimming pool and a picnic area. But the project was not carried out as planned and currently is a bird sanctuary only.

Our forecast of 380,000 visitors in the first year of operation did not materialize. Our prediction might have been closer to the actual number (220,000) if we had considered the percentage of respondents who ranked bird sanctuary as one of their two favorite activities.

We show that updating the predicted number of visitors is straightforward and plays a crucial role in predicting carrying capacity. A new forecast is made of the number of visitors over the next twenty years.

*Keywords: Recreational site, forecasting the number of visitors, contingent valuation method*

## FACILITY LOCATION

**Hussein Naseraldin and Opher Baron** (University of Toronto)

A facility refers to a retail outlet or a service depot or a production plant. In all cases, facility location involves determining how many facilities to open so as to cover a demand created in a specific area. It also involves determining the location of each facility. By determining these two decisions, we fix most of the supply chain network structure. Several approaches are possible in determining these decisions. Among others, a robust optimization approach guarantees solutions that are robust to changes in the parameters due to uncertainty, in particular uncertainty in demand.

*Keywords: Number of facilities, network design, distance metric, robust optimization*

## **FLEXIBLE MANUFACTURING SYSTEMS (FMS): OPERATIONS AND CONTROL**

**Boris Shnits**

Flexibility in FMS is made possible largely owing to the use of versatile and/or redundant machines, which in turn facilitates alternative system routing. Alternative routing enhances a system's ability to better balance machine workloads and achieve higher system robustness and productivity. To fully exploit these features, an FMS must be able to adapt to different shop conditions, i.e. for a given system status to select the appropriate operational policy in real-time. This research focuses on developing methodologies and control schemes that enable an FMS to improve its efficiency and productivity and to cope with the volatile production environment in which the FMS operates. These control schemes deal with solving a multi-criteria dynamic scheduling problem using optimization-based techniques and simulation.

*Keywords: FMS control, dynamic scheduling, multi-criteria decision making, simulation*

## **HOUSE OF RELIABILITY FOR MULTI-STATE SYSTEM**

**Shuki Dror and Kobi Tsur**

This research proposes an innovative method that enables a company to determine its vital activities in a reliability program for a multi-state system (MSS). The method is based on a House of Reliability for translating the system's failure costs into the relative importance of corresponding activities listed in the reliability program. A Mean Square Error (MSE) criterion supports the selection of vital reliability program activities. It divides a set of activities in a reliability program into two groups: the vital few (activities in a reliability program for MSS) and the trivial many. This partition minimizes the overall MSE and hence delineates two homogeneous groups. A case study illustrates the application of the developed methodology in a warfare system (a tank). The vital reliability program activities - treatment routine and spare parts storage - were found to be the best activities for reducing the costs of tank failures.

*Keywords: Multi-state system, reliability program, house of reliability, mean square error*

## **HUMAN FACTORS IN DESIGNING JOINT COGNITIVE SYSTEMS FOR MANUFACTURING**

## **Nirit Gavish and Hussein Naseraldin**

Recently, several cognitive systems for manufacturing management have been developed. In these systems, human and artificial intelligence work together as a team, a situation previously termed a "Joint Cognitive System." Humans utilize the computerized system most effectively if they accept the system's analysis of the problem and recommendations for handling it. Our assumption is that in joint cognitive systems for manufacturing, human performers begin their interaction and decision making processes using an explicit, analytic and theory-based style. After gaining experience with the results of their decisions, they shift to an implicit, experience-based and non-analytic style. Hence, to achieve a good cognitive coupling, the computerized system should adapt itself to performers' shifts in cognitive style. That is, the system input should be analytic and theory-based at the beginning (e.g., "According to model X, the recommended production plan is Y") and later heuristic and experience-based (e.g., "Last time in a similar situation you chose production plan Y"). Our research hypothesis regarding the contribution of adaptive cognitive style to the performance of the joint cognitive system will be empirically evaluated within a manufacturing management setting using simulation. The research will be conducted in two phases. The first phase will examine the hypothesis regarding the changes in the operator's cognitive style. In the second phase, the effect of the system's cognitive style will be evaluated using different cognitive styles in various stages and levels of interaction. Participants will be freshmen students in the Department of Industrial Engineering and Management at ORT Braude College of Engineering, Israel, who are enrolled in the course Introduction to Industrial Engineering.

*Keywords: Joint cognitive systems, manufacturing, decision making, cognitive style*

## **HUMAN RESOURCE MANAGEMENT - DIVERSITY STUDY**

### **Hilla Peretz**

In recent years, the importance of group diversity has rapidly penetrated organizations and research theory. Diversity has been credited with both positive and negative outcomes for team performance. In our ongoing research we explore two major topics:

1. The factors influencing positive implementation of diversity with regard to group performance and its effectiveness.
2. The acceptance of affirmative action in different contextual settings (both organizational and national) and its implementation on performance.

*Keywords: Diversity, team performance*

## INVENTORY MANAGEMENT

**Illana Bendavid, Hussein Naseraldin, Yale T. Herer** (Technion – Israel Institute of Technology) and **Edward A. Silver** (University of Calgary)

A major decision in the supply chain context is the inventory level of a product kept along the supply chain. The inventory level affects the service level the customer receives and thus affects operational performance. Though decisions regarding inventory levels are typically made after several other strategic and tactical decisions are made, integrating inventory decisions with strategic decisions at an early stage has a crucial effect on overall performance. Inventory management encompasses policies and practices of inventory. For example, lateral transshipment is a practice in which excess inventory is moved along the supply chain to locations with a shortage of inventory, thus eliminating excess and shortage costs.

*Keywords: Inventory policy, inventory-location model, lateral transshipments, unit-price discount*

## LINE BALANCING

**Boris Shnits**

Production or assembly line balancing refers to assigning work elements and resources to workstations in the line so that the workload at all workstations is equal. One specific research direction involves the balancing of a robotic assembly line. In robotic assembly line balancing (RALB), the problem is that different robots may be assigned to assembly tasks, and each robot needs different assembly times to perform a given task because of its capabilities and specialization. The solution to the RALB problem includes finding the optimal assignment of robots to line stations and achieving a balanced distribution of work among the different stations. A genetic algorithm was used to find a solution to this problem.

*Keywords: Line balancing, robotic assembly lines, genetic algorithms*

## MULTINATIONAL CORPORATION (MNC)

**Hilla Peretz**

A multinational corporation (MNC) is defined as a corporation that has its managerial headquarters in one country and operates (manages production or delivers services) in several other countries. The purpose of this research is to build a model of a successful MNC based on three groups of factors: professional characteristics, organizational characteristics and similarities among

countries. The aim of the study is to understand the necessary conditions for a MNC to attain high performance levels and thus to suggest a useful typology for MNCs.

*Keywords: Multinational firms, organizational culture, professional culture, national culture*

## **A NEW FRAMEWORK FOR ORGANIZATIONAL KNOWLEDGE THAT ENABLES CRITICAL JUSTIFICATION**

**Doron Faran**

Knowledge is defined as "justified true belief," but both justification and truth are paid very little attention by knowledge management. This paper reviews the justification methods that organizations employ de facto – positivism, conventionalism and pragmatism – and discusses their weaknesses. The method of critical rationalism (CR) is then presented as a remedy for these weaknesses, and the opposition to this method in the organizational field is discussed. A new knowledge framework that realigns the canonical theories of organizational knowledge is constructed. The main argument in this paper is that the framework does facilitate CR. The implementation of CR is demonstrated in a case study.

*Keywords: Knowledge, truth, justification, critical rationalism*

## **PROJECT MANAGEMENT AND SCHEDULING**

**Illana Bendavid and Boaz Golany** (Technion – Israel Institute of Technology)

Project scheduling is one of the nine knowledge areas in the body of knowledge comprising project management. This area is the keystone of project planning and control since it requires and integrates information about several project characteristics, such as estimated durations of activities, precedence constraints deriving from the technological precedence relations among the activities, resource constraints and due-date constraints. After this information has been processed, the scheduling activity generates a feasible schedule that optimizes one of the multiple existing objective functions, such as minimization of project duration, maximization of project's net present value and many others. This feasible schedule is generally used as a baseline schedule according to which commitments with external entities are made for planning activities such as material procurement and delivery of orders. In other words, this schedule determines when suppliers have to deliver materials needed for the project activities and also sets due dates for subcontractors who execute some of the project tasks.

*Keywords: Stochastic project scheduling problem, activity gate, flexible commitment, resource management, project control*

## QUALITY AND SAFETY ENGINEERING

**Emil Bashkansky, Tamar Gadrach, Shuki Dror and Rachel Ravid**

This research focuses on effective methods for evaluation, statistical control analysis and prediction of quality measured based upon nominal or ordinal scales. Such scales are also widely used in other fields of quality and safety engineering: customer satisfaction surveys, FMECA and risk analysis, defects and quality classification, inter- and intra-laboratory comparisons, homogeneity/heterogeneity tests, statistical process control, QFD and others. In turn, design and analysis of optimal control schemes for such scales facilitates effective quality data mining and determination of dominant distinguishing parameters. Some of the developed methods are ready for immediate industrial application and have been applied for decision making in patient-involved health care, product quality classification, security arrangements and metrology.

*Keywords: Quality control, data analysis, prediction, ordinal scale*

## QUEUEING SYSTEM

**Rachel Ravid and David Perry** (Haifa University)

This research focuses on performance analysis of priority queueing systems. We assume that the systems are in a steady state, and our aim is to find the steady state probabilities and the customer sojourn time distribution.

*Keywords: Queueing systems, renewal processes, priority queues, scale*

## RISK MANAGEMENT

**Meir Tahan, Tsvi Kuflik** (Haifa University) and **Mrs. Efrat Yuval** (Haifa University)

Development and deployment programs continue to suffer from budget overruns, schedule delays and poor technical performance, in most cases as a result of failure in handling uncertainty in complex software system development. Development communities lack a systematic method for identifying, communicating and resolving technical uncertainty. We focus on the risk identification stage and try to understand the reasons for unidentified risk appearing during project development. We interviewed project managers from industry. The findings suggest that the unidentified risk factors can be divided into three main types: managerial, behavioural and external. Each category consists of factors that, by means of awareness and openness on the part of project teams and managers, can help avert many problems and achieve project

success.

*Keywords: Risk identification, unidentified risks, uncertainty*

## **SERVICE DESIGN WITH APPLICATION TO EMERGENCY DEPARTMENT SYSTEMS**

**Late Maya Kaner, Tamar Gadrach, Shuki Dror and Yariv Marmor** (Mayo clinic)

To handle problems and trends in emergency department (ED) operations, designers and decision makers simulate and evaluate various scenarios before testing them in a real-life environment. However, conceptualizing broad possible scenarios for ED operations prior to simulation is usually neglected. We suggest a framework for the schematic conceptual development of these scenarios. We illustrate the application of our methodology in a specific ED. We contribute to the area of ED computer simulation by suggesting a methodology that offers the following advantages: (1) Simulation scenarios can be schematically formulated rather than based on trial-and-error experiments. (2) Scenario development can be integrated in the different stages of simulation model development to support designers and management in understanding ED problems, improvement goals, data that should be collected and operational changes that should be applied.

*Keywords: Simulation, design of experiments, conceptual modeling, scenarios, emergency department*

## **SMART GRID OPERATIONS MANAGEMENT**

**Hussein Naseraldin and Liron Yedidsion** (Technion – Israel Institute of Technology)

Technology development has led to a new form of electricity network, named Smart Grid. The basic notion behind the concept of Smart Grid is to improve the overall efficiency of electricity production, delivery, and consumption, while increasing the reliability and security of the electrical grid. Deviations in electricity consumption rates throughout the day lead to different pricing schemes for electricity. It is plausible to assume that consumers (individuals and businesses alike) will adapt to the new pricing schemes and thus postpone usage of some electrical devices until off-peak periods. As a result, costs will be reduced. Furthermore, the electricity provider will benefit as the demand at peak periods will be leveled and capacity requirements will be balanced over time. Smart Grid operations management involves the determination of related decisions using operation management and operations research tools and methodologies.



*Keywords: Smart Grid, lot-sizing, algorithm complexity*

## **A STRATEGIC SERVICE QUALITY FRAMEWORK USING QFD**

**Shuki Dror and Yafit Sukenik**

This research has developed a strategic service framework that provides a global overview of the important components of different dimensions of a service system. The framework is designed to reveal where the quality of service characteristics requires improvement, as highlighted by customers. After this, a Quality Function Deployment (QFD) method translates the deficiencies into internal improvement needs.

The framework was implemented in a call center run by a bank to manage incoming product support and information inquiries from consumers. The model identified service deficiencies in five dimensions of the service system: service quality, worker attitude, information, organization features, and technology.

*Keywords: Service Quality, quality function deployment (QFD), call center*

## **SUPPLY CHAIN DESIGN AND MANAGEMENT**

**Hussein Naseraldin**

The main objective of supply chain management is to achieve operational excellence across all aspects of a firm. This can be achieved by maximizing the value created by each and every decision and operation. This results in superior performance that leads to an increasing market share with satisfied customers. To achieve the above, all decisions must be aligned and integrated. That is, operational decisions must be taken into consideration while determining strategic decisions. Among the most important strategic decisions in a supply chain context are the number and the location of facilities.

*Keywords: Supply chain design, network configuration, multi-echelon, supply chain performance*

## **SYSTEM INTEGRATION**

**Meir Tahan**

Engineering system integration presents a multiplicity of challenges. Among other things, different disciplines must be balanced, the work of several teams must be coordinated, and the issue of units that are necessary but not available on time must be handled. Special test equipment must be designed, hubs and stubs must be prepared, and risks that are liable to occur during integration must be assessed and prevented. All these problems and difficulties result in schedule

delays and unplanned expenses.

We present a structured methodology for building an integration preparation plan and thereafter guiding the actual integration. The methodology is based on the “V” model for systems engineering. The left side of the "V" represents the design stage and the right side represents the integration stage. The “looking forward” methodology follows the development steps and at each step looks forward to the relevant integration step, anticipating what may be required for successful integration. This action creates versatile integration tools that are sufficiently flexible to absorb unexpected variations in the project.

*Keywords: System integration, testing, verification, validation*

## **SYSTEM INTEGRATION**

**Meir Tahan and Roy Benish** (HTS – High-Tech Solutions)

An integration plan is usually prepared intuitively by experienced engineers based on their previous experience and on project constraints. Since this plan is intuitive, it may be not optimal. The integration process involves severe uncertainties, such as units not being available on time, integration increment duration, and testing costs. Many times such uncertainties cause changes in the project plan. The members of the integration team may find themselves unprepared for these changes – again, because the integration plan is not optimal. Our research offers a model-based software tool for finding an optimal path for system integration. The tool finds the optimum path assuming deterministic integration parameters or parameters with inherent uncertainties. The tool is designed for project managers, integration teams and academic integration research. It has built-in flexibility in order to serve a variety of organizations and users.

*Keywords: System integration, integration plan, integration tool*

## **THE EFFECT OF FEEDBACK ON IMPROVING VISUAL ATTENTION SKILLS**

**Nirit Gavish and Hagit Krisher**

A common cause of reading disorders is visual attention deficit. Research has demonstrated that training using a dedicated training program and protocol can improve visual attention skills and reading abilities. The common method is based on exposing trainees to slow smooth pursuit tracking of fragmented stimuli. This gradual exposure enables the trainees to acquire the needed visual attention skill. However, until now training was based solely on bottom-up processes, and higher-level cognitive inferences and top-down processes were

not considered. The current research examines whether adding controlled feedback to the training protocol can support top-down processes which, in combination with bottom-up processes, will facilitate learning and skill transfer.

*Keywords: Training, visual attention, reading, bottom-up, top-down*

## **USE OF SERIOUS GAMING TO IMPROVE INTELLIGENCE ANALYSIS**

**Doron Faran and Nirit Gavish**

The quality of intelligence analyses depends on the analysts' skills. Even though training programs supported by e-learning have shown progress, there is still room for improving the creative reasoning skills and reflexes of law enforcement agents. This research focuses on capturing how analysts must use both deduction and induction in their thinking and must fully exploit their skills, knowledge, experience and creativity. As a result, a computerized training program that addresses the major training needs of analysts will be developed, and the serious gaming approach will be used for this training program.

*Keywords: Intelligence, serious gaming, training, analysis*

## **WATER QUALITY FUNCTION DEPLOYMENT**

**Shuki Dror and Natalia Zaitsev**

The main goal of this study is to create a framework to enable water suppliers to select technology to improve the quality of tap water.

The Quality Function Deployment (QFD) tool is utilized as an instrument for ranking the relevant technologies. The QFD is designed to reveal which water quality characteristics require improvement, to translate these deficiencies into demands on technical water characteristics, and, ultimately, to rank the relative importance of relevant technologies. First, we assess the wishes and conceived preferences of the final customers (“voice of the customer” – VOC) for tap water quality. In the next stage, we conduct an expert survey consisting of two groups of questions.

In the first group, experts are asked to estimate the influence of technical water parameters on characteristics of the water quality as perceived by the customers. The second group of questions in the expert survey comprises relevant water treatment technologies and their effect on technical parameters.

*Keywords: Quality function deployment, tap water quality, importance of technology*