



GJCIE 2020 Abstract Book

14 – 15 AUGUST 2020

“INDUSTRIAL ENGINEERING IN THE WORLD OF IOT”



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Title

Abstract Book of Global Joint Conference on Industrial Engineering and Its Application Areas (GJCIE) 2020
“Industrial Engineering in the World of IoT”

Editors

Fethi Calisir, PhD.

Technical Editor

Murat Durucu, PhD.

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WELCOME MESSAGE FROM THE CONFERENCE CHAIR

Fethi Calisir, PhD

Istanbul Technical University, Turkey



On behalf of the organizing committee, I am honored and delighted to welcome you to this conference. The GJCIE 2020 is composed of three co-located conferences: the 5th Global Conference on Industrial Engineering (GCIE), the 6th Global Conference on Healthcare Systems Engineering and Management (GCHSEM), and the 7th Global Conference on Engineering and Technology Management (GCETM). The GGJCIE 2020 will be an internationally renowned forum for researchers, practitioners, and educators to present and discuss the most recent innovations, trends, experiences, and challenges in the field of industrial engineering. It will bring together experts from academia and industry to exchange the latest research results, trends, and practical applications in the areas mentioned earlier. This will be accomplished through the following two modes of communication: keynote presentation and parallel sessions.

The Internet of Things (IoT) is a paradigm where objects can be equipped with identifying, sensing, networking, and processing capabilities that will let them connect, communicate, and exchange data with one another and with other devices and services over the Internet. IoT has been developed vastly due to the developments of various technologies, such as wireless communications, sensors, and computing. There are a lot of applications of IoT, which range from simple home and personal appliances to large-scale systems. IoT is one of the critical technologies that will have an enormous impact on all organizations. For example, IoT may play an enabling role in designing systems and products by making them more effective, better connected, and more intelligent and transparent. This challenges the way we educate industrial engineers and the way we manage organizations. But IoT research is still in its early stages, and related studies are not well integrated. The Global Joint Conference on Industrial Engineering and Its Application Areas (GJCIE) 2020 will shed light on industrial engineering's role in this endeavor. We have a great program and a fantastic keynote speaker this year.

We hope you will find this program interesting and thought-provoking, and the conference will provide you with a valuable opportunity to share ideas with other researchers and practitioners. Putting together this conference was a team effort. We first thank the authors for providing the content of the program. We also thank our reviewers for their thorough and timely reviewing of the papers, and our sponsors LC Waikiki, Elginkan Foundation, and Entertech. Recognition should go to the organizing committee members who have all worked extremely hard for the conference's details.

Enjoy your participation in the conference. We hope you return next time with even more colleagues.

Thank you. Have a wonderful time.

Fethi Calisir, Ph.D.

Conference Chair

KEYNOTE SESSION

KEYNOTE SESSION

KEYNOTE

Ali Allahverdi, PhD

Professor in the Department of Industrial and Management Systems
Engineering of Kuwait University

August 14, 2020



Publishing Your Paper in a Reputable Journal?

Abstract

The answer to the question of how to write a well-structure scientific paper is discussed including what should be incorporated in abstract, introduction, and conclusion sections of the paper. The issue of how to select a journal to submit the paper is discussed and some guidelines are provided. Moreover, some ethical issues are discussed regarding to submission. The factors affecting the chances of having a submitted paper to be accepted are considered. Moreover, the things that irritate reviewers are also addressed. Furthermore, the process of revising your paper and how to respond to reviewers' comments efficiently is discussed. Finally, some real-life examples are provided. The presenter, being editor/associate editor of reputable journals, presents the aforementioned issues as a result of the experiences that he has had as an author, reviewer, and having editorial duties for many years.

PARALLEL SESSIONS

PARALLEL SESSION 01 | PS01

PS01.23

August 14, 2020 | 10:15 – 11:15

Forecasting of Retail Produce Sales Based on XGBoost Algorithm

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Abstract: Sales forecasting of vegetables and fruits imposes a challenging task for the retailers because the demand for them varies depending on several factors, such as temperature, season, holiday. Poor sales forecasting can cause too much cost for retailers since these products are unusable after deterioration. Also, people tend to consume these products freshly. This research aims to compare the forecasting performance of traditional statistical and new machine learning methods. We apply seasonal ARIMA to forecast daily sales of fruits and vegetables as a traditional method. As a machine learning algorithm, we apply LSTM and XGBoost algorithms. The results indicate that the XGBoost algorithm gives more accurate results than the other two methods.

PS01.84

August 14, 2020 | 10:15 – 11:15

A Constraint Programming Approach for the Multi-Product Lot Streaming and Flexible Job Shop Scheduling Problem Considering Sequence-Dependent Setups and Transport Activities

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Abstract: This paper concentrates on an application of lot streaming technique in a multi-product flexible job

shop environment. The lot streaming technique is extended to flexible job shop scheduling problem (FJSP) by considering sequence-dependent setups and transport activities. The aim is to achieve an optimal/near-optimal schedule that minimizes the makespan. In this context, we propose a resource-constrained Constraint Programming (CP) model for the considered problem, which is considered to be in the NP-hard class. Moreover, we added redundant and symmetry breaking constraint to strengthen our CP approach. Redundant constraints are included in order to achieve a reduction in computation time, whereas symmetry breaking constraints are developed to remove the possible symmetries in the solution. Since there is a lack of benchmark instances in the literature, we extend the FJSP benchmark instances to our problem. The computational study is based on those instances which are categorized into small, medium, and large-sized problem classes. Furthermore, we propose variable and value ordering strategies and seek for different tree search strategies to speed up the search process for medium and large size problem instances. The computational results demonstrate that CP model has achieved quality solutions in reasonable computation time.

PS01.86

August 14, 2020 | 10:15 – 11:15

A Distribution Network Design Model for Additive Manufacturing

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Abstract: It is without a doubt that additive manufacturing (AM) is to radically change the way manufacturing processes take place. However, the vast majority of the extant literature deals with rather futuristic scenarios on the subject. This paper adopts a more realistic, short-term perspective by stating that new supply chain models have to be designed that adopt AM, but they should still incorporate

conventional manufacturing (CM) as the de-facto means at least for a certain period. To this end, we formulate a new supply chain model where manufacturers are allowed to forward their orders to 3D shops. With some mild assumptions, our optimization model suggests that substantial cost savings could be attained when AM is adopted.

PARALLEL SESSION 02 | PS02

PS02.48

August 14, 2020 | 10:15 – 11:15

s, S Inventory Control Optimization under Inventory Sharing Policy for Omni-channel Network

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Abstract: Rapidly developing technology and multi-channel integrations in marketing have led to the emergence of omnichannel retailing. In omnichannel, consumers can take advantage of all shopping channels interactively. It overcomes the drawbacks of traditional supply chain applications, but uncertain stock demands cause serious difficulties and costs. In this work, an inventory sharing policy study presented for an omnichannel network in order to reduce the risks caused by stock and demand uncertainty. In literature, this policy also referred to as lateral transshipment. Recently, due to the increase in e-commerce, it has become significant to respond to customer demands shortly for customer satisfaction. Inventory sharing allows the exchange of items between the same echelon of the supply chain network enabling high service levels with low costs. Since, in an omnichannel network, physical transshipment may not take place due to the electronic order case, we prefer to state this policy as inventory sharing instead of lateral transshipment. We develop simulation models for three different omnichannel scenarios and optimize the total network cost by considering those three sharing policies. We compare each scenario's optimal cost result. For the modeling and optimization purpose, we use the ARENA 16.0 commercial software and OptQuest to optimize the (s, S) inventory levels.

PS02.53

August 14, 2020 | 10:15 – 11:15

Two Scheduling Rule Comparisons for Operations of Shuttles in Tier-to-Tier SBS/RS

[Melis Kucukyasar](#), Banu Yetkin Ekren

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Abstract: The aim of this paper is to study and compare two different scheduling rules for operations of transactions in shuttle-based storage and retrieval system (SBS/RS) to observe how scheduling rule affects the system performance. SBS/RS is one of the emerging automated warehousing technologies mostly utilized by large distribution centers due to its advantages of fast transaction process rate. Although the increased transaction rate is because of the system (warehouse) design of having multiple numbers of autonomous shuttles in the system, operational rules such as scheduling of waiting transactions in queues may also play a significant role in increasing the system performance. For this purpose, we implement first-in-first-out (FIFO) and shortest processes (i.e., travel) time scheduling rules for selecting waiting transactions in shuttle queues to investigate how these rules affect the performance of the system. We simulate the system under different racking designs and arrival rate scenarios and observe the system performance metrics in terms of average cycle time (e.g., through-put rate) and average energy consumption per transaction, separately. The results suggest that the SPT scheduling rule outperforms FIFO rule, especially for the throughput rate performance metric.

PS02.58

August 14, 2020 | 10:15 – 11:15

An Agent-based Simulation Model for Deadlock Prevention in an Aisle-to-Aisle SBS/RS

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Abstract: Flexibility and high throughput rate in storage and retrieval systems are essential criteria in today's competitive marketing. Recent developments in

information technology enable the intelligent design of systems. This study aims to propose a tier-captive aisle-to-aisle shuttle-based storage and retrieval system (SBS/RS) where shuttles can make autonomous decisions to prevent deadlocks and collisions as well as the efficient process of transactions. Deadlock prevention algorithms are one of the primary concerns in today's autonomous vehicle environment. In the considered tier-captive aisle-to-aisle SBS/RS, multiple shuttles can travel between aisles in a dedicated tier. The advantage of this design is that there may be the fewer total number of shuttles running in the system compared to a traditional tier-captive SBS/RS. Due to the complexity of the proposed system and autonomous shuttle-based decision-making target, we utilized the advantage of an agent-based modeling approach by simulating the system. Agent definitions, roles, and behaviors are specified to ensure that no collision and blockage take place in the system. Thanks to the intelligent abilities of agents so that the system can run effectively by using real-time information.

PARALLEL SESSION 03 | PS03

PS03.21

August 14, 2020 | 11:30 – 12:30

A Children Retail Company's e-Commerce Warehouse Optimization

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² Istanbul Sabahattin Zaim University, Istanbul, Turkey

Abstract: The efficient and well-designed warehouses can provide critical advantages for retail stores. They also play a crucial role in the achievement of supply chain management. Nowadays, warehouses have become centers where fast access to the customer is provided apart from the storage and protection of the goods. The objective of this study is to find the more efficient and useful warehouse design of A Children Retail Company, which is used for e-Commerce. The best place for the products will be determined by using a combination of such tools like the Pareto Principle, ABC Analysis, Technical Drawing, Simulation, and 5S Model. The optimum layout determined from the analyses enables more efficient work for warehouse

employees, and orders to the logistics department are faster and more accurate for the facility. Moreover, an automation system is proposed with the barcode scanning and packaging part for the orders to simplify the existing complexity of the process.

PS03.77

August 14, 2020 | 11:30 – 12:30

Transition from AC to DC Powered Homes

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Abstract: Increasing electronic appliances in residential buildings have caused researchers to study direct current (DC) powered systems in homes. In this paper, we state a scenario that a home with traditional alternating current (AC) powered appliances are replaced with DC devices. The questions which devices can be replaced, how much savings in terms of energy and electric bill is provided, what are economical, technical, social and environmental problems in this AC-DC transition and which system between DC and AC for residential buildings are much preferable based on the AHP method are answered in the presented study. Results show that 74.126-percentage cost saving in the electric bill is provided. However, the problems that nonexistence in some residential DC devices in the market, immaturity of DC system in terms of technical issue, added system costs, less information about DC by experts and related people, and a public bias that DC is unsafe to exist. In this study, based on these defined advantages and disadvantages of DC and AC system, criteria and sub-criteria have been determined for the analytic hierarchy process (AHP) method. By way of AHP, the result that DC system is much preferable than the AC system for residential buildings has been reached.

PS03.83

August 14, 2020 | 11:30 – 12:30

A Review on Cell Balancing Techniques and Their Complexity Levels

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Abstract: With the increasing adoption of battery-based energy storage systems, especially in areas such as e-mobility and on- and off-grid energy storage applications, techniques to manage these batteries are being developed to address various application-related challenges. Battery Management Systems (BMS) are used to provide reliable protection for the connected battery pack. One of the tasks of a BMS is Cell Balancing (CB), in which the BMS tries to ensure that each individual cell or cell module has the same voltage level during charging and discharging operations. This task can become critical in applications involving Li-ion batteries, due to their sensitivity to being overcharged or deeply discharged. The complexity of a CB technique, and thus its implementation cost, depends on the battery chemistry and the sensitivity of the application. Thus, different designs with different complexity levels are being developed to address the balancing issue. This paper explores the CB techniques found in the literature in the past 20 years and categorizes them based on their complexity level. Operational and feature comparisons were carried out between the different CB designs.

PARALLEL SESSION 04 | PS04

PS04.49

August 14, 2020 | 11:30 – 12:30

An Application Using Stability Increasing for the Grinding Machine Performance Improvement in the Automobile Industry

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²*The Graduate School of Natural and Applied Sciences, Yasar University, Izmir, Turkey*

Abstract: At the beginning of the third millennium, the use of the Industry 4.0 process has been accelerated and spread in different parts of production. With the rapid development of technology in production, the workload also increases due to the role of the human being. The workload is a concept in which the human processing system is expressed in terms of its ability to process information and produce responses within the framework of its physical and mental characteristics. Especially in the manufacturing sector, the contribution of the human being to the production increases with the technological function while physically decreasing with the developing machinery technologies. With this study, it aims to increase the production capacity in line with meeting the increasing demands in these production units, and improve the production plans of these units with the help of solution models to be developed by using appropriate analysis techniques of injector nozzles model measurements especially by using SMED approach within the lean manufacturing.

PS04.79

August 14, 2020 | 11:30 – 12:30

A Strategy for Increasing the Employment Rate of Graduates Using a Compact Module

[Hatice Camgoz Akdag](#), [Cicek Ersoy](#)

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Abstract: The aim is to increase the higher education employment rate in the first six months after graduation at Istanbul Technical University. The paper involves different systems and techniques used, such as; ITU Career and Skill Management System (KAYS), which is an internship- and job-seeking platform for Istanbul Technical University students, annual Career Summit performance analysis, workshops, interview simulations, company network, and mentoring modules. Initially, the process of determining the contents of the Career and Skill Management System platform has been addressed with a Management Engineering approach. In this process, the platform at hand was observed, and the details of the inner workings of the system were noted. Secondly, user groups of the system were interviewed, performance

questionnaires of different activities from different user groups were analyzed, and the methodology has been determined. New strategies have been set according to the results, and the student employment rate has been recalculated after six months, which showed an acceptable increase in the new graduate employment rate.

PS04.80

August 14, 2020 | 11:30 – 12:30

Analysis of the Relationship between Organizational Justice and Job Satisfaction in the Airline Industry

Elif Okan, Cahit Ali Bayraktar

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Abstract: The purpose of this study is to determine the relationship between organizational justice and job satisfaction. For this purpose, three main components of organizational justice, which are distributive, procedural, and interactional justice and three main components of job satisfaction, which are internal, external, and overall satisfaction, have been analyzed. Organizational justice means employees' perception of job applications in workplaces, and recently it has been seen as a critical term that can produce valuable results for employees and organizations. Though there have been many studies in international literature about the relationship between organizational justice and job satisfaction, there is only a limited number of studies in the national literature. To the best of our knowledge, this is the first study that searches the relationship between organizational justice and job satisfaction in the airline industry. For this purpose, we conducted a survey involving 101 pilots. As a result of statistical analysis and data interpretation, a positive relationship was found between organizational justice and job satisfaction. The highest level of relationship was found between procedural justice and external job satisfaction.

PARALLEL SESSION 05 | PS05

PS05.22

August 14, 2020 | 14:00 – 15:00

Metaheuristic Hybridization: A Case Study for Nurse Scheduling

Yakup Turgut, Zikriye Melisa Erdogan

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Abstract: This paper addresses a nurse scheduling problem frequently encountered in hospital management. To make nurses satisfied and use their best skills during the work process is a critical issue at the center of this problem. Besides, hospitals need to minimize personnel costs while keeping service quality at the highest level. We try to schedule nurses by considering their preferences and meet hospital management expectations at the same time. Our problem has hard and soft constraints that are faced in real-world case studies. Hard constraints are satisfied directly by applying the constraint programming method, and soft constraints are satisfied using a penalty cost applied in meta-heuristic algorithms. The initial model is structured using a Genetic algorithm (GA), then it is hybridized with the simulated annealing (SA) to obtain a nurse roster. Results are compared with MIP solutions concerning the quality of solutions and the corresponding running time. Achievements are analyzed and discussed to make the proposed model applicable by hospital managers as well as researchers.

PS05.88

August 14, 2020 | 14:00 – 15:00

What Drives the Turkish Government's Response to COVID-19 Pandemic – Daily Cases or Daily Deaths

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Abstract: COVID-19 has been changed the way of each others' lifestyles. After the outbreak of this virus all

over the world, governments have taken precautions to prevent the spread of it. In some countries, schools are closed, working conditions are changed, international flights are canceled, lockdowns are announced, public gatherings are banned, and so on. Basically, our daily routines and lives have altered into a new pattern. Knowing how contiguous COVID-19, governments had to take serious pre-cautions and develop policies. Government Response Index has been introduced by Oxford University, evaluating the stringencies of 165 countries' government response actions on COVID-19 (Hale et al., 2020a). The main aim of this study is to figure out while governments are developing these policies, whether daily cases and/or daily deaths of COVID-19 drive the Turkish Government's Response. Regression analysis is conducted via Jamovi by gathering data from Oxford's Government Response Index. Findings showed that the Turkish government's responses to COVID 19 are affected by the daily deaths, not daily cases.

PS05.90

August 14, 2020 | 14:00 – 15:00

Taxonomy of Mathematical Modeling Studies for Hepatitis C among Injection Drug Users

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Abstract: Hepatitis C (HCV) is one of the significant public health problems, and around 71 million people have chronic Hepatitis C infections globally. Among infected, people who inject drugs (PWID) have an increased risk of transmission, and it is a key risk population. In the last decade, the introduction of direct-acting antivirals (DAA) has started a new era for HCV treatment, and elimination of HCV globally by 2030 became a World Health Organization (WHO) target. Besides clinical and medical studies on HCV infection, modeling and economic studies have been conducted to analyze the spread of this disease, to prevent and eliminate HCV, to determine interventions and programs that are effective and cost-effective, and to optimally allocate resources among high-risk and general populations. In this paper, we survey modeling and cost-effectiveness studies of HCV among injection drug users, and we provide a taxonomy of 73 studies published from 2000-2020 that represent 15 countries.

We categorized studies based on modeling type, whether it contained cost-effectiveness analysis, the focus of study, and treatment type included. Our taxonomy could be used by modelers, public health policymakers, and researchers to review past HCV models and to develop new models and cost-effectiveness studies.

PARALLEL SESSION 06 | PS06

PS06.65

August 14, 2020 | 14:00 – 15:00

An Overview of Warehouse Operations for Cold Chain

Cansu Yurtseven, Banu Yetkin Ekren, Ayhan Ozgur Toy

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Abstract: Warehouses play a significant role in cold chains as they do for regular supply chains. Although their goals are the same for both cold chains and regular supply chains, the operations of cold warehouses are more sophisticated since the cost of operation is considerably higher due to energy consumption and obsolescence of products in substandard conditions. Recently, there has been an enormous interest in the cold food supply chain to reduce food waste occurring along the chain. Hence, efficient management of cold warehouses becomes an important issue in this direction. Design and operation requirements in a cold warehouse may be different from a traditional non-cold warehouse. In this paper, we aim to provide an overview of cold chain operations, mostly by focusing on cold warehouse operations. We provide some statistics from a cold chain, design, and technology requirements for cold warehouses as well as warehouse operations shaped according to that warehouse features. It is observed that there are quite different design parameters in cold storage.

PS06.73

August 14, 2020 | 14:00 – 15:00

An Experimental Design Study to Identify Significant Factors Affecting Tier-to-Tier SBS/RS Performance

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Abstract: The aim of this paper is to study a simulation-based experimental design to identify significant factors affecting the performance of the tier-to-tier shuttle-based storage and retrieval system (SBS/RS). SBS/RS design is an automated warehousing technology mostly utilized for the storage of mini-loads. SBS/RS has emerged as a response to the recent order profile with low volume and wide variety and quick response. Although the traditional design of SBS/RS is comprised of multi-shuttles each dedicated in each tier of an aisle, there can be different designs in which shuttles can travel between tiers. We call this design as tier-to-tier SBS/RS where shuttles can travel between tiers by using a separate lifting mechanism located at an endpoint of each aisle. Note that in this new design, since shuttles are allowed to travel between tiers, there may be less number of shuttles running in the system. Hence, the shuttle's average utilization value might be larger compared to that traditional one where each tier has a dedicated shuttle. In this work, we study an experimental design to investigate which factors are statistically significant on a critical performance metric (i.e., average cycle time per transaction) in the studied tier-to-tier SBS/RS. First, we simulate the system by using the ARENA 16.0 commercial software and then implement a full factorial analysis. The results are analyzed in MINITAB 17.0 software.

PS06.75

August 14, 2020 | 14:00 – 15:00

Blockchain Technology for Supply Chain Management

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Abstract: Blockchain technology offers important opportunities for the supply chain management. This paper aims to overview the employment of blockchain technology in the field of the supply chain. Although the technology has been widely associated with cryptocurrencies, non-financial applications such as supply chain, power, and food industry are also promising. Blockchain can provide a permanent, shareable, auditable record of products through their supply chain, which improves product traceability, authenticity, and legality in a more cost-effective way. Potential improvement expectations via blockchain technology for the case of agribusiness were discussed. The proposed case for automotive manufacturing-micro factory with blockchain technology was also introduced.

PARALLEL SESSION 07 | PS07

PS07.34

August 14, 2020 | 15:15 – 16:15

Home Health Care Services Management: Districting Problem Revisited

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² *Ivey Business School, University of Western Ontario, Ontario, Canada*

Abstract: In this paper, we study the optimal partitioning of home health care (HHC) units among different subregions of a city. Given each HHC crew is in charge of patients in a single subregion, the problem aims to group locations (districts) where patients live in larger subregions such that the total workloads of HHC crews are balanced. Moreover, due to geographical reasons, some locations cannot be assigned to the same subregion, which gives rise to feasible assignment problem of locations. First, we tackle the complexity of these problems and show that the feasible assignment problem is NP-complete. Then we propose a new objective function for the HHC workload balancing

problem and develop a heuristic method to deal with the NP-hardness of the optimal partitioning problem. Compared to a mixed-integer linear model from the literature, the heuristic quickly finds an optimal solution in most of the problem instances and gives efficient and competitive results for instances which are not optimally solved

PS07.40

August 14, 2020 | 15:15 – 16:15

Next-Day Operating Room Scheduling with Time-Dependent Stochastic Surgery Durations

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Abstract: Operating rooms (ORs) are the costliest part of hospitals, thus a priority for hospital administrations. In this paper, we consider the next-day OR scheduling problem for multiple operating rooms. We assume that surgeries have uncertain durations, and distributions of surgery durations are time-dependent. Our aim is to find the assignment of surgeries to the available ORs, the sequence, and the planned starting times of surgeries in order to minimize the weighted sum of expected waiting time of patients, idle time of ORs, and overtime of the hospital staff. In order to find solutions to the problem, we propose an L-Shaped method, customized to our problem formulation. We quantify the penalty of ignoring the time-dependency of surgery durations within a numerical study. We find that the penalty of ignoring the time-dependency increases with the overtime cost, average surgery durations, and decreases with surgery variability.

PS07.43

August 14, 2020 | 15:15 – 16:15

Value of MRI and Ultrasound Screening for Breast Cancer in Non-High-Risk Populations

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Abstract: Mammography is the gold standard for breast cancer screening in the vast majority of the world, but it is known to be less accurate for women with dense breasts. To improve cancer detection accuracy, supplemental ultrasound, and Magnetic Resonance Imaging (MRI) screening have been recently introduced and are actively recommended for high-risk populations by many agencies. This chapter studies the value of supplemental tests in non-high-risk populations using a partially observable Markov decision process model alongside a simulation model. A numerical study using these models driven by clinical data reveals that supplemental tests may not cause any meaningful improvement in the quality-adjusted life expectancy for non-high-risk women, and they may indeed be harmful if used routinely after biennial or annual mammographies for non-high-risk women. However, they are associated with significant improvements in overall cancer detection rate, the time to detect cancer, fraction of in situ cases that deteriorate to the invasive stage as well as the fraction of women who die with undiagnosed cancer. While MRI is generally more effective than ultra-sound on several performance metrics, it also suffers from significantly increased false positives, hindering its viability for this population.

PARALLEL SESSION 08 | PS08

PS08.27

August 14, 2020 | 15:15 – 16:15

Increasing Service Performance in the Physical Therapy and Rehabilitation Department of a Health Institution by Using Lean Techniques

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Abstract: Health care services are facing similar problems both in Turkey and in other countries. As in other sectors, the presence of non-value-added activities within the service process in the health sector

leads to delays, disruptions, and dissatisfaction of patients.

Lean philosophy is an idea that aims to reduce or eliminate waste points by identifying problems and tries to continuously increase system efficiency. Although this idea was first applied in the automotive manufacturing sector, it has become more comprehensive today and has begun to be applied in the businesses that provide services. In particular, the necessity of using lean philosophy in healthcare institutions is important in terms of increasing patient satisfaction by meeting the expectations and needs of patients.

In this study, the examination process of the Physical Therapy and Rehabilitation department of a healthcare institution in Ankara was aimed to improve by using Value Stream Mapping (VSM), scenario simulation, and Multi-criteria Decision Making (MCDM) techniques. The current state map was obtained by using the VSM, which is the first step in the introduction of lean philosophy that is widely used to analyze and visualize activities that add value to the service. In this context, 35 different scenario suggestions have been developed upon the detection of many undesirable situations to be improved, such as bottleneck points, resource deficiencies, delays, overtime obligations, waiting, patients who are left at the end of the day. These scenarios were run in the Arena program and the results were compared using two different integrated approaches, namely Combinative Distance-based Assessment (CODAS) and Criteria Importance through Intercriteria Correlation (CRITIC) method, another is Evaluation based on Distance from Average Solution (EDAS) and CRITIC integration. Accordingly, the priority order of the scenarios has been obtained and solutions have been proposed to the management of the health institution.

PS08.38

August 14, 2020 | 15:15 – 16:15

Meta-Analysis Study on the Effect of Managers' Leadership Behaviors on Work Performance of Employees

Baris Evcin, Cemil Ceylan

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Abstract: In today's world, where technological developments accelerate and great competition is experienced, managers play an important role in achieving the goals of the business. Managers must ensure the continuity of the enterprises. In order to ensure continuity, managers are trying to keep the work efficiency and quality of the work done as high as possible. In order to bring these factors to the level they want, managers knowingly or unknowingly exhibit various leadership behaviors. These leadership behaviors of managers are of great importance for employee performance. The culture and systems that leaders create within the organization have a significant impact on employee performance. For this reason, a meta-analysis was conducted to explain the relationship between leadership behaviors and employee performance and to determine the parameters that leaders indirectly affect employee performance. Within the scope of the meta-analysis study, the relationship between leadership behaviors and employee performance has been prioritized, and other parameters that have an indirect effect on the employee performance of the leaders have been examined. A synthesis by analyzing applications made in different regions and sectors in Turkey are formed. This research aims to explain the relationship between leadership behaviors and employee performance, to contribute to the researches about employee performance, and to serve as an example for those who will conduct a meta-analysis.

PS08.57

August 14, 2020 | 15:15 – 16:15

POLCA Approach on Make to Order Production System: An Application from the Hydraulic Industry

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Abstract: Applications of production control systems such as pull systems, which are also called Kanban control systems have attracted attention not only in the

field of production but also in the academic world. Suri (1998) has introduced a different production control system to ensure attractiveness in production systems with high product variety: Paired-cell Overlapping Loops of Cards with Authorisation (POLCA) production control system. The POLCA system aims to ensure the effective use of the pull system in a wide variety of products and in a low volume. In the literature, the POLCA system has been examined for make-to-order systems (MTO), but its advantages have not been seen clearly. In MTO systems, the simulations are not fully understood, and the comparisons may not yield clear results. In this article, a more general perspective on the design issues in the POLCA system has been introduced, and the tools and methods that can be understood by the people who are not licensed and who manage the production company have been summarized. Within this paper, the definition of POLCA is mentioned first. Then the industrial application area and conditions of use have touched on. The current and proposed examining the advantages and disadvantages of the systems, the basic calculations, and re-researches on the shaping of the production line according to the proposed POLCA system have presented.

PARALLEL SESSION 09 | PS09

PS09.30

August 15, 2020 | 09:00 – 10:00

Flowshop Scheduling Problem with Stochastic Processing Times to Minimizing Total Completion Time

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² Department of Industrial and Management Systems Engineering, Kuwait University, Khalidiyah, 13190, Kuwait

Abstract: We address the four-machine flowshop scheduling problem with stochastic processing times to minimize total completion time. The performance measure of total completion time is substantial when inventory or holding cost is a concern. The addressed problem with this performance measure exists in some manufacturing environments. However, the flowshop scheduling literature indicates that the problem has not been addressed for the four-machine flowshops. In the

current paper, we address this Np-hard problem. We first develop several dominance relations for the problem, which help reduce the size of the solution set. Since it is highly unlikely to find the optimal solution by the developed dominance relations, we next propose several different heuristics to solve the problem. The main difference among the heuristics is related to the weights assigned to the processing times on different machines. The proposed heuristics are next improved by the developed dominance relations. Computational experiments are conducted to evaluate the performance of the proposed heuristics by randomly generating processing times following different distributions such as uniform, normal, positive linear, and negative linear. The computational experiments indicate that the performances of a few proposed heuristics are superior to the others. The performances of these few heuristics are statistically verified by constructing confidence intervals.

PS09.31

August 15, 2020 | 09:00 – 10:00

Minimizing Maximum Lateness on No-Wait Flowshops with Stochastic Setup Times

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Abstract: No-wait flowshop scheduling problem is applicable in many industries such as chemical, plastic, metal, and pharmaceutical. The no-wait flowshop literature reveals that the problem has been investigated with the assumption that setup times are deterministic. However, setup times are stochastic in some environments. We address the two-machine no-wait scheduling problem to minimize maximum lateness where setup times are stochastic. It should be noted that there may not exist a single schedule that remains optimal for all possible realizations of setup times for environments with stochastic setup times. Thus, in such an environment, a set of dominating schedules is necessary to acquire. Hence, the objective in such a scheduling environment is to reduce the size of the dominating set. Therefore, we develop theorems, providing dominance relations, which help in reducing the size of the dominating set. Illustrative

examples illustrate that developed dominance relations are effective.

PS09.69

August 15, 2020 | 09:00 – 10:00

Design and Optimization of Automated Storage and Retrieval Systems: A Review

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Abstract: Automated Storage and Retrieval Systems (AS/RS) are warehouses, specifically de-signed for material handling in modern manufacturing systems and are extensively utilized as distribution centers, due to the advantages of improved inventory control, cost-effective utilization of time, space and equipment. With the advent of smart manufacturing in the Industry 4.0 era, the significance of adopting automation technology in warehousing becomes increasingly imminent. Techniques and tools are being developed to manage, control, design, and optimize the AS/RS(s). Over the years, many researchers have focused on the design, analysis, and optimization of various AS/RS configurations. This paper aims to present a systematic literature review on the research in Configuration design and Optimization of AS/RS, by classifying the research according to the design objectives, configurations and optimization algorithms used, in order to highlight and expand the awareness on the current best practices, progress, and future research directions.

PARALLEL SESSION 10 | PS10

PS09.11

August 15, 2020 | 09:00 – 10:00

Safety Risk Management in Complex Systems

Gulsum Kubra Kaya

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Abstract: Risk management has been applied in a wide range of industries to ensure safety. As part of the risk management process, risks are assessed by using risk management tools and techniques. Many of those techniques were developed long ago to analyze individual system components. In complex systems, however, accidents emerge from system interactions. Hence, traditional risk management methods have become inadequate to analyze risks in complex systems. The Functional Resonance Analysis Method (FRAM) was recently developed to address the limitations of traditional risk management methods. This study provides an example of the use of FRAM to demonstrate its use and to highlight its potential value in safety risk management.

PS10.19

August 15, 2020 | 09:00 – 10:00

The Problems of Project Management Companies in the Turkish Construction and the Real Estate Industries

Levent Sumer, Fatih Kiraz

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Abstract: Effective project management has always been important for the success of different industries. From scope, time, and cost management to quality, risk, and procurement management, all aspects of project management need an integrated approach by using skilled staff and providing efficient communication among all stakeholders. While some companies establish in-house teams for managing their projects, some companies hire professional companies to act on their behalf. It is critical to measure the success of these companies, yet there are major obstacles that project management companies face while they are performing their responsibilities, which may cause failures. In that context, this study, as far as being the first research in the literature, investigates the main problems of project management (PM) companies in Turkey by focusing on the PM services in the construction and real estate industries. A survey was conducted among PM professionals working for PM companies, contractors, employers, de-signers, vendors, and sub-contractors to find out these problems. The need for PM standards, the balance

between the responsibility and the authority of the PM companies, the existence of the PM companies providing very low prices, excessive employer intervention and delayed payments by employers were found to be the most important factors that cause problems. Developing PM standards, issuing legal regulations to be a PM company, right pricing policy, and on-time payments by the project owners were recommended by the participants as solutions.

PS10.55

August 15, 2020 | 09:00 – 10:00

Urban Transportation Planning Model for Long Term Refugees Camps Development: Case of Naher El Bared Camp in Lebanon

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Abstract: This paper investigates the urban transportation planning framework related to long term refugee camps and their integration with the surrounding areas. The research considers the case of Naher El Bared Camp (NBC) in North Lebanon. First, the transport study for NBC before 2007 is analyzed via implementing the four steps model and performing a micro analysis using Emme regional transportation model linked with ArcGIS and Synchro software for signalized intersection traffic analysis. Then, a new transport model for the year 2030 is developed subject to several to social, economic, land use, and political constraints. This paper is the first documented study that investigates urban transportation planning for long term refugee camps in the Middle East region countries.

PARALLEL SESSION 11 | PS11

PS11.59

August 15, 2020 | 10:15 – 11:15

A Comparison of the Multi-Criteria Decision-Making Methods for the Selection of Researchers

Gulsum Kubra Kaya, Fatih Ozturk

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Abstract: Multi-criteria decision-making methods (MCDM) have been introduced to make effective decisions under conflicting criteria. This study used AHP-based VIKOR, TOPSIS, and MOORA methods to select two researchers among the twenty-six alternative candidates and to compare the findings of the different MCDM methods. The results revealed that the AHP-based VIKOR and TOPSIS methods suggested the selection of the same candidates. However, all of the methods sorted the candidates in a significantly different order. This study indicates that although MCDM methods are useful to aid in decision-making and easy to apply, they might not always be reliable.

PS11.81

August 15, 2020 | 10:15 – 11:15

Global E-commerce Market Segmentation by Using Fuzzy Clustering

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Abstract: Customer segmentation is essential for marketing, communication, and even operations management activities. E-commerce provides the data required for novel perspectives to customer segmentation. In this study, we focus on customer segmentation based on purchase variety. To this end, first, the data is preprocessed, and the optimal customer number is detected. Then the fuzzy c-means algorithm is applied, and the segments are formed.

PS11.87

August 15, 2020 | 10:15 – 11:15

Brain Drain: A Multi-criteria Decision Model

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Abstract: In this study, a multi-criteria decision model is proposed to examine the criteria affecting the decision on brain drain, which is the immigration of highly educated and competent individuals. Due to the interconnections among the criteria, the Analytic Network Process (ANP) is selected to model the decision problem and to obtain priorities. Based on the assessments of twenty-six participants who immigrated temporarily or permanently to different countries, economic situations, career opportunities and, political situations are the most important criteria pushing educated people (e.g., students and academicians) to immigrate. Brain drain has a significant effect on economic, political, and socio-cultural drivers, especially in the sending countries, and causes a considerable change in the population. Thus, the proposed model will be a guide for policymakers to develop effective policies regarding the mitigation and management of brain drain.

PARALLEL SESSION 12 | PS12

PS12.25

August 15, 2020 | 10:15 – 11:15

Churn Prediction in the Payment Services Industry: An Application at Token Financial Technologies for IoT Devices

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Abstract: This paper presents a study on churn prediction in the payment services industry. Churn prediction is crucial in preventing customers from switching to competition and also in keeping and developing relationships with the customers. Previous studies mainly focus on the problem of churn

prediction for customers. Using machine learning algorithms, this study, for the first time, predicts churn rates for IoT devices and, thereby, generalizes the concept to the usage of devices. A dataset on POS devices provided by Token Financial Technologies - a company that aims to develop a churn prediction system - was used for the analyses. The methods Naïve Bayes, Generalized Linear Model, Logistic Regression, Deep Learning, Decision Tree, Random Forest, and Gradient Boosted Trees were applied. The experimental results show that the best predictions are obtained by the algorithms Random Forest and Fast Large Margin. According to experimental results, battery life has a significant effect on the device churn as well as lifetime value of device has a major impact. The predictions helped Token Financial Technologies to save more than 60% of the usage of EFT-POS devices from potential churns by changing batteries and EFT-POS devices in the last quarter of 2019.

PS12.45

August 15, 2020 | 10:15 – 11:15

Industry 4.0 and Components in Production Enterprises

[Fatih Ozturk](#)

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Abstract: The globalizing world economy is constantly challenging producers with difficult competitive conditions. Manufacturer companies determine various methods to overcome these difficulties. Industry 4.0 and IoT applications, which have been popular in recent years, are the main ones of these methods. With these methods, solutions covering almost every area of our lives started to be produced. This approach, which we also call digitalization, has spread rapidly all over the world. In order for manufacturers to have more advantageous status, they need to reduce production costs in order to achieve more production flexibility and more efficient processes. Digitalization provides great advantages for efficiency increase. This method, which covers the product life cycle in all aspects and provides instant answers, seems to be developed for many years and will remain in the focus of the manufacturers.

PS12.89

August 15, 2020 | 10:15 – 11:15

Regenerative Supply Chain through Digitalization in Dairy

[Peiman Alipour Sarvari](#)¹, [Sebastien-Augustin Martin](#)¹, [Gulcan Baskurt](#)², [Mohammad Nozari](#)³, [Djamel Khadraoui](#)¹

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Abstract: Globally, enterprises are leveraging social media to promote their brands, monitor consumer trends, research new product ideas, drive business growth, and improve business processes. Integrating social media into existing supply chain networks is essential to provide instant access to real user data. This study defines tailored metrics by examining the current supply chain considering the data gathered from social media in order to have a re-designed supply chain based on the requirements defined by end-users alongside utilizing organizations' strategy, technology, process, and evaluation metrics. The target is to define a framework to take full advantage of intelligent automation in retail and consumer feedback for creating efficiency and creativity. As a case study, this study introduces a social data-driven causal analytics-based methodology that reflects Tweeter data for diagnosing supply chain management issues and determining its capabilities in a milk products company in Luxembourg.

PARALLEL SESSION 13 | PS13

PS13.26

August 15, 2020 | 11:30 – 12:30

Future of Engineering Education: Cyber-Physical Systems Engineering

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Abstract: Recent Industry 4.0 developments have created disruptive changes in industries. It has also changed the way people work and the required skills of the workforce for the future. This new technological advancement has created a requirement of work-force combining information technology (IT) and production knowledge. Unfortunately, many schools and universities have still been training students behind Industry 4.0 developments and requirements. Therefore, it is important to understand what characteristics and knowledge, as well as skills, are required for the future of jobs and engineering profiles to shape the new education requirements. This paper aims to address the future of engineering education, specifically by focusing on a promising engineering department that is the cyber-physical systems (CPS) engineering. We also aim to discuss how the curriculum of that novel discipline, CPS engineering, should be for the future of engineering requirements.

PS13.46

August 15, 2020 | 11:30 – 12:30

Virtual Reality: A Possibility for Training Operator 4.0

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Abstract: As technological advancements have led to the onset of industry 4.0, there must be a shift in the organizational frameworks, wherein manufacturing propensities and the traditional workplaces must transform to adopt a system wherein humans and machines can work together towards a rise in productivity and flexibility. These recent developments call for an up-gradation of the traditional operator to Operator 4.0 or Smart Operator as there has been a rise in a typical, unique work relationships which will require interactions between the operators and machines. These are challenging circumstances for engineers and operators as they must enhance their skills and abilities to keep up with the changing trend. Smart operators will also need to update their cognitive skills parallel

with the innovations in the field of virtual reality and wearable technology equipment, as the equipment's augment the abilities of the Operator 4.0. This article aims to (1) Highlight the cognitive ergonomics skills required by operator 4.0 for Virtual Reality VR applications (2) Demonstrate how VR can be used to train future operator 4.0 to do his future tasks (3) Suggest how VR application in manufacturing can be improved for operator 4.0. The methodology in this research involves the usage of Virtual Reality to simulate a factory setup emulating Industry 4.0 factory. Based on the feedback of the participants, the efficiency of VR in training workers in the manufacturing industry can be determined. Also, this exercise can aid designers in avoiding Graphical User Interface issues and further develop the system to maximize efficiency and to provide a positive user experience.

PS13.91

August 15, 2020 | 11:30 – 12:30

The Effect of Social Media Usage on Loneliness

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Abstract: This study has been done in order to determine the effect of social media usage on loneliness perception. At the same time, it has been examined whether there was a significant difference in terms of loneliness for gender, age, and frequency of use. One hundred eighteen women and 83 men took part in the study. Social Media Use Scale (Akin et al., 2015) and the UCLA Loneliness Scale (Demir, 1989) have been used together with the Personal Information Form developed by the researcher. Correlation Analysis and Multiple Linear Regression Analysis have been used to determine the relationships between variables (social media use and loneliness). The relationship of loneliness according to gender, age, and frequency of use has been determined used one-way ANOVA. As a result of the analysis, social integration and emotional connection factor of social media use scale positively affect the sociality variance of loneliness scale. Furthermore, the loneliness scale of both factors of social media use scale has an effect on high human communication. High human communication is influenced positively by social

integration and emotional engagement and is influenced negatively by social routines. At the same time, it was determined that the perception of loneliness did not differ according to gender and age, but differed significantly according to the frequency of internet use. The results of the study have shown that those who use social media for 5-6 hours a day differ significantly on a social variable compared to those who use less than 1 hour or 1-2 hours a day.

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