



Special issue: engineering digital transformation

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Published online: 15 October 2019
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1 Introduction

New technological developments, hyperconnectivity and the internationalisation of operations are allowing for great opportunities and challenges in different industrial sectors. Industries must adapt to them to advance and become internationally referenced. This context today is a part of Industry 4.0, which is based on the cooperative digitalisation and coordination of industrial processes through information technologies or smart robots. It is sustained mainly on the internet of things (IoT), cyber-physical systems (CPS), machine-to-machine (M2M) communications, cloud platforms, blockchain technologies or smart robots. In this environment, production processes should be capable of manufacturing a wide range of sustainable product configurations in small lots at very competitive prices. As customers are becoming increasingly demanding and expect increasingly smarter and personalised products, the entire supply chain should adapt to this new paradigm and improve the operational research methods supporting decisions on economics and environmental issues (Behrens et al. 2018), improving ergonomics (Calzavara et al. 2019; Bogataj et al. 2019) and controlling processes (Inderfurth et al. 2018). It is necessary to connect supply chains to face challenges associated with this ever-increasing demand; the players in the supply network should be capable of coordinating and cooperating smartly with other value chain actors and should be able to automate their processes by minimising the costs involved or maximising the net present value (Gaspars-Wieloch 2019). These processes need to be properly digitalised to develop product processes that organise and improve themselves, i.e., that are self-managed.

This engineering digital transformation was addressed by the 11th International Conference on Industrial Engineering and Industrial Management and XXI Congreso

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de Ingeniería de Organización (CIO'17) on 5th and 6th July 2017 in Valencia. It was organized by the Universitat Politècnica de València (UPV) and the Association for Organization Engineering Development (ADINGOR), with the collaboration of the Research Centre on Production Management and Engineering (CIGIP) and the Reengineering Operations Group Work Logistics Excellence (ROGLE). From CIO'17 conference, 12 of the best communications focused on operations research were selected and extended in high-quality papers to be published in this special issue of CJOR. The following section provides an overview of these selected papers.

2 Overview of the papers

The topics of the papers published in this special issue refer to modelling and solving the industrial engineering and management problems from an operations research perspective. Specifically, the paper, “Mixed integer linear programming models for flow shop scheduling with a demand plan of job types,” by Joaquín Bautista-Valhondo and Rocío Alfaro-Pozo (2018) presents two mixed integer linear programming (MILP) models that extend two basic flow shop scheduling problems incorporating the concept of an overall demand plan for types of jobs or products. The paper is based on the recently published articles in OR journals, also considering the solutions in Ozolins (2017). The literature review and the industrial instances through the CPLEX solver, which provide acceptable results, validate the models.

The paper, “Analysis of telecom service operation behavior with time series,” by Iciar Civantos and Javier García-Algarra (2018) presents the time series analysis to measure and forecast the real behaviour of telecom services, to solve network failures of three live services: IPTV (Internet Protocol Television), cloud infrastructure and IoT. This approach, known as the incident management, provides numerical evidence of the uncertainty in troubleshooting of digital services and assesses the economic and operational impact of service releases.

The paper, “Fill rate: from its definition to its calculation for the continuous (s, Q) inventory system with discrete demands and lost sales,” by Eugenia Babiloni and Ester Guijarro (2018) propose two expressions, the traditional (units short) and the standard (expected satisfied demand), to compute the fill rate in the continuous reorder point, the order quantity (s, Q) policy on the lost sales context and the discrete distributed demands of any inventory system. The experiments identify that the traditional approach is biased as it underestimates the real fill rate while the standard determines it more accurate, and therefore, both approaches are not equivalent.

Considering the remarks given by Branzei et al. (2010), and improving the approximation of Alparslan-Gök et al. (2010), the paper, “Interval-valued n -person cooperative games with satisfactory degree constraints,” by Jian Li, Jian-qiang Wang and Jun-hua Hu (2018), develops nonlinear programming models for interval-valued cooperative games, which consider the decision makers' risk attitudes. The authors use and compare satisfactory degree comparison methods for ranking interval-valued fuzzy numbers.

In the case of “Characterization of strategic emerging technologies: the case of big data” by Iñaki Bidosola, Gaizka Garechana, Enara Zarrabeitia and Ernesto Cilleruelo

(2018), the authors propose an approach to obtain the characterization of emerging technologies. This characterization is based on bibliometrics, text mining, principal component analysis and time series analysis. When applied to the big data technology field, the results of this approach suggest that sub-technologies such as mobile telecommunications and IoT will lead this field in the near future.

The paper, “Coordination mechanisms with mathematical programming models for decentralized decision-making, a literature review,” by Gregorio Rius-Sorolla, Julien Maheut, Sofía Estelles-Miguel and José P. Garcia-Sabater (2018b), elaborates on the collaborative planning in the last decade on the mechanisms of coordination in mathematical programming models.

Additionally, in “Lagrangian relaxation of the generic materials and operations planning (GMOP) model” by Gregorio Rius-Sorolla, Julien Maheut, Jairo R. Coronado-Hernandez and José P. Garcia-Sabater (2018a), a procedure to solve the GMOP formulation, which operates with different materials and process lists, by the Lagrange relaxation is presented and compared with a linear solution method.

The paper, “Hybrid approach of discrete event simulation integrated with location search algorithm in a cells assignment problem: A case study,” by Aida Saez-Mas, Julio J. Garcia-Sabater, Jose P. Garcia-Sabater and Julien Maheut (2018), discusses a case study based on a cell assignment problem in an assembly facility through a hybrid approach comprising mathematical optimization and discrete event simulation.

Some basic approaches on the robust optimization for the vehicle routing problem with multiple deliverymen was published in De La Vega et al. (2017). In the article “Master production schedule using robust optimization approaches in an automobile second-tier supplier,” by Antonio G. Martín, Manuel Díaz-Madroñero and Josefa Mula (2019), the authors further developed the robust optimization approaches, here proposing a robust optimization approach to the master production schedule in a well-known automotive second-tier supplier that manufactures a decorative surface treatment of injected parts.

Alcoy and Cartagena, August, 2019.

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