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ABOUT NITIE

NITIE was established as a National Institute in 1963 by the Government of India with the assistance of United Nations Development Programme through International Labour Organisation.

NITIE offers 2 years Post-Graduate programmes in Industrial Engineering, Industrial Management, Industrial Safety and Environmental Management, Information Technology Management and a Fellowship Programme of Doctoral level recognized as equivalent to Ph.D of an Indian University. NITIE has been conducting several short-term Management Development Programmes of one week duration in various areas of Industrial Engineering and Management. NITIE can conduct eight courses concurrently. The training programmes of NITIE emphasize on learning with a purpose, and are accompanied by an abiding concern for man. Besides training, NITIE is also engaged in applied research and offers consultancy in the various facets of Industrial Engineering, Operations Research, Information Systems and Computers, Environmental Management, Marketing, Organisation Behaviour and Human Resource Management.

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sectors with the necessary skills for efficient performance.

NITIE has established a Centre of Excellence in Ergonomics and Human Factors Engineering (CEEHFE) as part of Government of India's Technology Mission-2020 through TIFAC (Technology Information Forecasting and Assessment Council) – mission REACH (Relevance and Excellence in Achieving New Heights) in Educational System. NITIE has also established an Advanced Centre of Excellence in Operations and Manufacturing Management. The centre is equipped with ERP/MRP-II, CAD/CAM, EDM, QUEST softwares.

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NITIE campus is located in one of the most picturesque surroundings of Mumbai flanked by Powai and Vihar Lakes. NITIE can accommodate 150 participants at a time in self-contained single rooms.

NITIE is administered through a Board of Governors representing industry, government, labour and professional bodies with **Mr. Shashi Kiran Shetty, Chairman, Allcargo Logistic, ECU worldwide and GATI** as **Chairman** and **Prof. Mr. Manoj Kumar Tiwari** as **Director**.

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Editorial

We are happy to hand over Udyog Pragati's issue – *The Journal for Practising Managers* focusing on various pros and cons evolving in the manufacturing. The efforts are made to draw your kind attention towards India's manufacturing sector, which faces many issues and could contribute only 12% in total employments where the expectations from this sector were very high. The manufacturing industry consists of various activities like the mechanical, physical, or chemical transformation of material, substances, or components to finished products. Despite being an agricultural economy manufacturing sector, it is considered a core contributed 16 to 17%, reaching 25% until 2025.

The first article, entitled, "Implementation of Theory of Constraints using Drum-Buffer-Rope method in the fly-wheel housing manufacturing industry," talks about improving productivity with TOC application. In contrast, the second article articulates the adoption of IoT in Indian manufacturing firms using AHP.

Customer satisfaction is prime in the success of any industry. Further research article focuses on cost optimization using Gurobi Solver Engine to view risk-pooling in the allocation of customer orders in a technology-driven online retailing marketplace. Mumbai *Dabbawala*'s case is thoroughly discussed here with a well-proven supply chain approach.

At the end of this journal, mathematical modeling is applied to solve the case study of a two-sided mixed-model assembly line balancing problem. This study observes that the cost-oriented approach provides a better solution than the station-oriented system to reduce total worker cost and overall cost in terms of efficiency.

Prof. Rakesh Raut

Editor in Chief

Implementation of Theory of Constraints Using Drum-Buffer-Rope Method in Flywheel Housing Manufacturing Industry

Kuldeep S Pawar¹, Reena Pant², Sachin Chavan³

The advances in technology has led to tremendous improvements in manufacturing systems. Synchronous Manufacturing System (SMS) is one such example. It is a manufacturing management methodology that consists of particular techniques and principles where every action is evaluated in terms of common goals of optimization of resources. SMS introduces the concept of Drum-Buffer- Rope (DBR) approach. DBR is a generalized system and solves most of the problem of bottlenecks of inventory in a production line. Reducing Work In Process (WIP), Raw Material (RM) inventory to improve cycle time, improving upon time delivery and hence profit are improved by it. The DBR is a methodology of Theory of Constraint (TOC), introduced by Dr. Eliyahu Goldratt. It works as a special technique for SMS.

This paper is based on the application of TOC to improve the productivity of flywheel housings in an organization. The organization is facing the problem for timely delivery of the flywheel housings. The bottlenecks in the production line are identified by DBR methodology and TOC is applied. For this data of flywheel housing manufacturing process, resources required, WIP inventory and RM inventory is collected. The critical analysis of data has helped in recognizing the constraints in two machines of the production line. The challenges are taken to overcome these constraints by utilisation of available resources. The Successful implementation of TOC is resulted into reduction of WIP, RM inventory and on time delivery. Due to which productivity has improved leading to increase in the profit.

Keywords: DBR, TOC, SMS, Flywheel Housing, Product Costing.

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Analyzing the barriers to Internet of Things (IoT) adoption in Indian manufacturing firms Using Analytical Hierarchy Process

Ashwini Gotmare¹, Sanjay Bokade², Prof S.G. Bhirud³

Manufacturing industries in India are facing intense competition from worldwide, and it is high time that they need to be smarter by embracing upcoming technologies like Internet of things to have a cutting edge in today's competitive world. The purpose of this paper is to identify barriers for IoT adoption in manufacturing sector in Indian context. Authors have identified eleven barriers to IoT adoption and implementation from selected existing literature and expert's inputs. They have adopted Analytical Hierarchy Process (AHP) methodology to rank the identified barriers as per relative significance. The most significant barriers identified through research analysis are - lack of top management vision for adopting new technology (B1), high initial investment cost for implementation (B6) and Risk involved in transitioning to new business model (B4). The findings will help to practise managers to frame the strategies and prioritize their efforts for IoT adoption in Indian manufacturing sector.

Keywords: *Internet of things (IoT); Barriers; Manufacturing sector; India; Analytical Hierarchy Process (AHP)*

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Effects of risk-pooling in the allocation of customer orders and returns in online retailing

Prashant V. Anand^a, Prof. Omkarprasad S. Vaidya^b, Prof. Sushil Kumar^c

This paper deals with allocation of integrated customer orders and returns in an online retail environment employed with virtual pooling and transshipments. A four-echelon online retail supply chain is formulated as a mixed integer programming model which involves the allocation of customer orders and customer returns to the fulfillment or return distribution centres as applicable, with an option to have reactive transshipments between fulfillment distribution centres. The cost minimization problem is solved optimally for some numerical experiments using Gurobi Solver Engine. Findings identified from the study include the importance of risk pooling in online retailing and the benefits of considering return allocation integrated with order allocation. The results from experiments show significant reduction in initial inventory at DCs and overall cost savings when returns and risk pooling are considered during order allocation.

Keywords: *Online Retail, Risk Pooling, Virtual Pooling, Inventory Transshipment, Order allocation, Return allocation*

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Mumbai Dabbawala's Case: An Excellence to Supply Chain Co-ordination

Balan Sundarakani^a, Chirag Mutraga^b, Prof. Balakrishna E. Narkhede^c, Prof. Rakesh Raut^d

The Mumbai Dabbawala Association is an organization based in India which is world famous for its Supply Chain network and expertise. Quite often we have seen businesses fail because of lack of technology mainly for sharing of information but the Dabbawala's are the exact opposite of such organizations. This paper highlights how the Mumbai's Dabbawala's have been able to achieve success by designing its supply chain without any investment in technologies. The Dabbawala's employees are actually partners and not employees of the organization. The Mumbai's Dabbawala's have been delivering home-cooked food from the customer's houses to the customer's offices since the past 129 years and have a track record of making less than 1 mistake in every 16 million deliveries to offices. The association has approximately 85% of its employees/partners who are illiterate and have been able to achieve a 100% customer satisfaction rate.

Keywords: *Mumbai Dabbawala, Supply Chain, Performance Excellence*

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Cost Oriented Mixed Model Two-Sided Assembly Line Balancing – a Company Case Study Solved By Exact Solution Approach

Ashish Yadav¹, Pawan Verma², Sunil Agrawal³

The main aim of this paper is to develop a new mathematical model for the mixed model two-sided assembly line balancing problem (MTALBP) generally occurs in plants producing large-sized high-volume products such as buses or trucks. In this paper, the proposed mathematical model is applied to solve case study of two-sided mixed-model assembly line balancing problem to optimize the cost of machinery, worker and transportation in mated stations of an assembly line. Since the problem is well known as NP-hard problem proposed mathematical model is solved using a branch and bound algorithm on Lingo 16 solver using the exact solution approach. Based on the computational results of the assembly lines with cost-oriented objective are compared with the results of station oriented objective. From this study, it is observed that in terms of efficiency, the proposed cost-oriented approach provides better solution than the solution obtained by station oriented approach and help to reduce total worker cost and overall cost.

Keywords: *Two-sided assembly line balancing, Mixed model, Mathematical model, Case study problem, Lingo 16.*

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Guidelines for Authors

Scope

Udyog Pragati invites original contributions in the form of 'State of the Art' Papers and Case studies on the application of industrial engineering and management concepts/techniques in industrial and government organisations.

Types of Papers

The following types of papers will be considered for publication in the Journal.

- Theory based paper
- Practice based papers
- Empirical papers
- Case Studies
- Review papers

A paper should contain 3000 to 5000 words. In addition, discussion on paper published previously could also be incorporated.

Submission of Manuscripts

The following guidelines are to be adhered to while submitting the manuscript.

1. The desired order of content is
 - a) Title
 - b) Author (s)
 - c) Affiliation (s)
 - d) Abstract
 - e) Main Text
 - f) Acknowledgment
 - g) Reference, and
 - h) Appendices

Tables and illustrations, complete with titles, labels and art-work should be placed in the text at the appropriate locations. The diagrams, graphs, etc. should be sent in original.
2. The abstract should be brief, self-contained, explicit and should not exceed 200 words.
3. The manuscript should be typed on one side of good quality white bond paper in double spacing. Mathematical terms, symbols and other features that cannot be typed should be inserted neatly into the text by hand in black ink.

The author should also send an 'electronic version' of the paper on diskette (3.5" Floppy Disk) using standard software - Word/Word Perfect.
4. The equations should be numbered sequentially in parentheses by the right margin. The theorems,

propositions, corollaries, etc. should be numbered in one sequence as, for example, (1) Proposition, (2) Corollary, (3) Theorem, etc.

5. Reference should be given by Author's name and year of Publication i.e. (Tapley and Lewallen 1967). They should be mentioned in alphabetical order in the Bibliography. References should be listed as follows :
 - a) B.P. Tapley and J. M. Lewallen, (1967), "Comparison of several numerical optimization methods," Journal of Optimization Theory and Application, Vol. 1, No. 1, o.32
 - b) Neil Botten and John McManus, (1999), 'Strategic Management Models, Tools and Techniques', Competitive Strategies for Service Organisations, Macmillan Press, pp. 107-161.
6. The authors should submit a brief statement of their professional career i.e. qualifications, appointments held, research interests, Published work, etc.
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8. Whenever the copyright material is used, authors should be accurate in reproduction and obtain permission from copyright holders if necessary. Articles published in Udyog Pragati should not be reproduced/reprinted in any form either in full or part without prior written permission from the Editor.
9. Correspondence and proof for correction will be sent to the first name author, unless otherwise indicated. The authors will receive page proof for checking, but it is hoped to correct only typesetting errors. Proof should be returned within a week.
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MDP CALENDAR 2020-21 (Jan-Mar 2021)

PROGRAMME CODE	COURSE	COURSE LEADER/S	DURATION	DATES
1 21 4 27	Effective Communication, Team Dynamics and Conflict Management	N. K. Mehta	15 Hrs	17 Jan, 24 Jan & 26 Jan
1 21 4 01	Six Sigma Green Belt Programme	Santosh Dabral	20 Hrs	16 Jan - 31 Jan
1 21 4 02	Enhancing Quality using Data Analytics	Ravindra S. Gokhale / Rakesh D. Raut	15 Hrs	18 Jan - 20 Jan
1 21 4 34	Business Analytics (To be confirmed)	Hema Date	15 Hrs	18 Jan - 20 Jan
1 21 4 20	Developing Commercial & Financial Skills for Strategic Business Decisions	K. S. Ranjani	15 Hrs	23 Jan - 6 Feb
1 21 4 06	Project Management	A K Pundir	15 hrs	1 Feb - 3 Feb
1 21 4 07	Work-Study for Productivity	Milind A. Akarte	15 Hrs	1 Feb - 5 Feb
1 21 4 21	Financial Analytics with Time Series Modeling and Neural Networks using Python	Ajaya Kumar Panda / Rakesh Verma	15 Hrs	6 Feb - 20 Feb
1 21 4 30	Managerial Effectiveness	T. Prasad	15 Hrs	8 Feb - 10 Feb
1 21 4 22	Business Strategies for Emerging Markets	Utpal Chattopadhyay / Binilkumar A. S.	15 Hrs	10 Feb - 12 Feb
1 21 4 23	Understanding Economic Indicators for Managerial and Business Decision Making	Mainak Mazumdar	15 Hrs	10 Feb - 15 Feb
1 21 4 09	Project Planning & Scheduling	V. B. Khanapuri	15 hrs	15 Feb - 17 Feb
1 21 4 25	Design Thinking for Business Excellence	Ranjan Chaudhuri	15 Hrs	18 Feb - 20 Feb
1 21 4 10	Business Competitiveness through Operational Excellence	B. E. Narkhede / Jinil D. Persis	15 Hrs	19 Feb - 21 Feb
1 21 4 11	Project Procurement and Contracts Management	V. B. Khanapuri / Kanchan D. Joshi	15 Hrs	22 Feb - 24 Feb
1 21 4 12	Manufacturing Strategy	Milind A. Akarte	15 Hrs	22 Feb - 26 Feb
1 21 4 13	Data Analytics in Operations Management	Ravindra S. Gokhale / Rakesh D. Raut	15 Hrs	22 Feb - 24 Feb
1 21 4 26	Business to Business Marketing	M. K. Jha	15 Hrs	22 Feb - 24 Feb
1 21 4 14	AI/ML driven Customer Relationship Management	Purnima Sangle / Neeraj Pandey / Debabrata Das	15 Hrs	22 Feb - 26 Feb
1 21 4 35	Application of Time Series Modelling on Business Forecasting	Poonam Singh / Mainak Mazumdar / Ajaya Kumar Panda	15 Hrs	26 Feb - 7 Mar
1 21 4 15	Applications of AI/ML in Operations & Supply Chain Management	Sushmita A. / Priyanka Verma / Debabrata Das	15 Hrs	27 Feb - 14 Mar
1 21 4 32	Management of Sustainable Development Goals in post COVID-19 era	Shirish Sangle / V. V. Gedam	15 Hrs	1 Mar - 5 Mar
1 21 4 24	Managerial Decision Making	Vijaya Gupta / Utpal Chattopadhyay	15 Hrs	8 Mar - 10 Mar
1 21 4 31	Thinking Strategically; Business strategies to navigate VUCA world and attain competitive advantage	S S Bhattacharya	15 Hrs	12 Mar - 14 Mar
1 21 4 16	Decision Making in Supply Chain	P. Acharya / Priyanka Verma	15 Hrs	15 Mar - 19 Mar
1 21 4 33	Addressing Environmental, Social, & Governance (ESG) for Corporate Sustainability: Aligning SDG	Hema Diwan	15 Hrs	22 Mar - 25 Mar
1 21 4 36	Management of Intellectual Property (IP) for Gaining Competitive Advantage (Creation, Protection and Leveraging of IP)	B. Koteswara Rao Naik	15 Hrs	26 Mar - 30 Mar

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