14th Annual International Conference on Industrial Engineering and Operations Management Dubai United Arab Emirates (UAE), February 12-14, 2024

Publisher: IEOM Society International, USA DOI: 10.46254/AN14.20240509
Published: February 12, 2024

Enhancing Profit Maximization Strategies: A Case Study of the Songket Industry in Indonesia

Yuana Delvika
Mechanical and Industrial Engineering Department,
Indian Institute of Technology Roorkee, Uttarakhand, India
Industrial Engineering Department, Universitas Medan Area, Indonesia
yuana_d@me.iitr.ac.in

Akshay Dvivedi
Professor, Mechanical and Industrial Engineering Department,
Indian Institute of Technology Roorkee, Uttarakhand, India
akshaydvivedi@gmail.com

Abstract

The primary aim of this study is to design an optimal production unit within the constrain of the existing workforce, aimed at maximizing profitability in the songket industry, which had been significantly impacted by pandemic. The industry faced a sharp decline in orders, leading to a substantial reduction in income and increased costs. To address these challenges, the industry reduced its workforce. With the gradual recovery of industry conditions, customer orders have resumed. However, effective strategies are needed to manage customer demand while optimizing the existing workforce. Focuses on pinpointing the optimal resources required to meet customer demands and enhance industry profitability. By producing 25 units songket, allocating 125 mandays (60.09%) to routine workforce tasks, 50 mandays (48.08%) to professional workforce activities, and utilizing 75 unitdays (48.08%) of equipment, the study remarkably demonstrates a substantial IDR 23,750,000 improve in overall industry profits. This stands as a practical solution to the challenges previously outlined.

Keywords
Process optimization, Quality improvement, Songket, Maximization Profit, Linear Programming

1. Introduction

Several years after the COVID-19 pandemic, industries around the world were still being affected (Nurnazmi et al. 2021; Fitri and Zuryani, 2022). Certain industries had demonstrated resilience and recovery efforts, while others, unable to withstand the negative impacts of the storm, had collapsed (Salleh and Bushroa, 2022). This happened not only in the whole world but also within Indonesia, reach out across essential, secondary, and tertiary industries (Johan G. Ony 2021). Among those significantly affected was the songket industry, which experienced a considerable impact (Feri et al. 2022).

The main object of this study is the songket industry situated in North Sumatra, Indonesia. There was a period of time when the Songket industry experienced a decrease in demand, requiring the reduction of workforce (Feri et al. 2022; Wati et al. 2022). As consumer trust returned and buying power increased, orders for songket resumed. However, producing with the current number of workforces posed challenges for the industry (Wati et al. 2022; Damanik et al. 2021; Nurnazmi et al. 2021). After implementing several different approaches, the profitability did not increase as planned, which frequently led to supply delays (Fonseca et al. 2022; Bashan and Notea 2018; Dachyar and Sanjiwo 2018).

In these scenarios, many methods and approaches are poised to support industries, including Lean Manufacturing, Six Sigma, Process Automation, Kanban, Technology Integration, Training and Skill Development, Supply Chain Optimization, Performance Measurement System, Business Process Re-Engineering and Process Optimization (Prakoso and Hanim 2019; Reda and Dvivedi 2022). Given the constraints of limited resources in this industry, process optimization arises as an appropriate strategy to investigate (Shivam and Gupta 2022). Process optimization, in particular, enables business organizations to find innovative ways to complete work while conforming to organizational goals and consumer requirements, especially when faced with resource constraints (Pratiwi and Dachyar 2020; Shivam and Gupta 2022).

1.1 Objectives
The aim of this study is to improve efficiency in multiple dimensions in order to tackle this issue. Within the constraints of the current workforce, this study attempts to design an ideal production unit with the objective of optimizing profitability.

2. Literature Review
2.1 Optimization
Optimization is the systematic process aimed at enhancing the effectiveness, efficiency, or overall advantage of a system within specified constraints or limitations (Datta et al. 2023). This multifaceted approach involves identifying the optimal solution or outcome from a spectrum of possible choices or variables. The initiation of optimization begins with the precise delineation of objectives or goals, which can encompass diverse objectives such as profit maximization, cost minimization, performance optimization, or the determination of the most efficient route (Prakoso and Hanim, 2019).

Central to the optimization process are constraints, denoting the inherent limitations or restrictions that necessitate consideration throughout the optimization endeavor. These constraints may be related to available resources, time, budgetary constraints, or other factors that circumscribe the array of conceivable solutions (Hozak, 2021). Within an optimization problem, there exist variables that can be adjusted or manipulated to attain the desired outcome, often termed decision variables. Concurrently, the objective function serves as a mathematical representation elucidating the correlation between decision variables and the sought-after objective or outcome (Datta et al. 2023). Describe how alterations in the decision variables influence the objective, with the ultimate aim of determining the set of variable values that maximizes or minimizes the objective function.

Solving optimization problems typically involves the application of algorithms or mathematical techniques (Kang and Bhatti 2019). These algorithms iteratively explore and adjust the decision variables to identify the optimal solution, embodying a systematic and methodical approach to navigate the complex landscape of possibilities.

Tackling optimization problems can be computationally demanding, particularly when dealing with intricate issues encompassing numerous variables and constraints (Ghosh et al. 2004). The crucial nature of accurately pinpointing the objective function and constraints cannot be overstated, as any inaccuracies may result in suboptimal solutions. It should be noted that certain optimization challenges may lack a singular solution, with the optimal outcome based on subjective factors (Samaranayake 2009). Optimization techniques have a substantial influence on problem-solving and decision-making processes spanning diverse industries and disciplines.

2.2 Linear Programming
Linear programming stands as a mathematical optimization technique employed to ascertain the optimal outcome within a mathematical model characterized by linear relationships (Azhari et al. 2023). Its applicability shines in scenarios where finite resources must be allocated judiciously to fulfill specific objectives while conforming to predetermined constraints. In the realm of linear programming, an objective function, often associated with goals like cost minimization, profit maximization, or efficiency enhancement, encapsulates the optimization target (You et al. 2023). Decision variables assume the role of quantifying the quantities of various choices to be made, while linear constraints delineate the permissible range of solutions.

The primary aim of linear programming lies in identifying the optimal values for decision variables that not only adhere to the specified constraints but also either maximize or minimize the objective function (Hozak, 2021). This methodology finds broad applications in diverse domains, spanning business process management, production scheduling, finance, and transportation logistics. As an indispensable tool for decision makers, linear programming facilitates efficient resource allocation and adept problem solving in multifarious fields (Azhari et al. 2023). Commencing with a set of decision variables representing different choices or actions, often continuous and adjustable within defined limits, the process proceeds to define an objective function. This mathematical expression encapsulates the overarching industry goal, whether it be profit maximization, cost minimization, or the optimization of some other metric of efficiency or effectiveness (Azhari et al. 2023).

Essentially, the determination of optimal solutions in linear programming hinges on navigating constraints that dictate the permissible values for decision variables. These constraints mirror tangible real-world limitations, encompassing factors such as budgetary confines, resource availability, capacity thresholds, and regulatory prerequisites. The essence of mastering linear programming lies in orchestrating a synergy of decision variable values that not only optimize the objective function but also concurrently adhere to all specified constraints (Azhari et al. 2023).

The term "linear" in linear programming is ascribed to the linearity inherent in both the objective function and the constraints, manifested as linear equations or inequalities (You et al. 2023). This linear nature not only streamlines the mathematical modeling process but also facilitates the utilization of well-established optimization algorithms, endowing linear programming with computational efficiency and broad applicability as a versatile tool.

2.3 Quality Management and Improvement

Quality management and improvement constitute a comprehensive approach employed by industries to ensure that their products, services, and processes consistently meet or exceed customer expectations (Garza-Reyes 2018; Carpinetti et al. 2003). This holistic framework integrates a set of principles, methods, and practices with the overarching goal of attaining and maintaining elevated levels of quality across an industry. At its essence, quality management embodies a steadfast commitment to continuous improvement, customer satisfaction, and the proactively mitigating defects and errors (Pasch et al. 2016). A cornerstone principle of quality management involves an unwavering focus on customer satisfaction (Psomas et al. 2011). Industries aspire to comprehend their customers' needs and expectations, align their products and services accordingly, and systematically gauge and evaluate customer feedback as part of an ongoing process.

Adopting a customer-centric approach ensures the industry's offerings remain not only pertinent but also invaluable in the fiercely competitive marketplace. Quality management further underscores a process-oriented perspective (Carpinetti et al. 2003), involving the meticulous definition and documentation of processes, the standardization of procedures, and their consistent application. Often, industries leverage quality management systems, such as ISO 9001, to establish a structured framework for overseeing quality (Psomas et al. 2011). These systems offer guidelines for documentation, risk assessment, and corrective actions that foster a methodical approach to quality improvement.

Another pivotal facet of quality management lies in the reliance on data-driven decision-making. Industries systematically collect and analyze data to monitor performance, discern trends, and make judicious decisions regarding process improvements. Once areas in need of improvement are pinpointed, organizations design action plans to implement changes. This may encompass refining processes, updating technology, providing targeted training to employees, or reassessing supplier relationships. In essence, quality management operates as a dynamic process, driven by customer insights and propelled by data-driven strategies to continually enhance industry offerings and processes.

Methodologies for continuous improvement, exemplified by the Plan-Do-Study-Act (PDSA) cycle, advocate for organizations to institute small, incremental changes and systematically evaluate their impact (González-Benito et al. 1999). Typically, these changes undergo testing on a limited scale before being implemented across the entire organization, a precautionary measure aimed at minimizing risks and disruptions. Employing statistical tools and techniques, such as Six Sigma, Operations Research, and Statistical Process Control, is commonplace for analyzing data and pinpointing areas where quality enhancements are feasible.

Integral to quality management is the cultivation of a culture that values accountability and responsibility at every echelon of an industry(Pasch et al. 2016). Every employee plays a key role in upholding and enhancing quality standards, which leads quality management systems to often include training and educational programs. These initiatives empower employees to actively contribute to the organization's overarching quality objectives (Harrington

1995). In essence, a commitment to continuous improvement, coupled with the use of statistical methodologies and the instillation of a quality-centric culture, forms a solid framework for elevating and maintaining quality standards in organizations.

3. Methods

Research Methodology of this study can be seen in Figure 1.

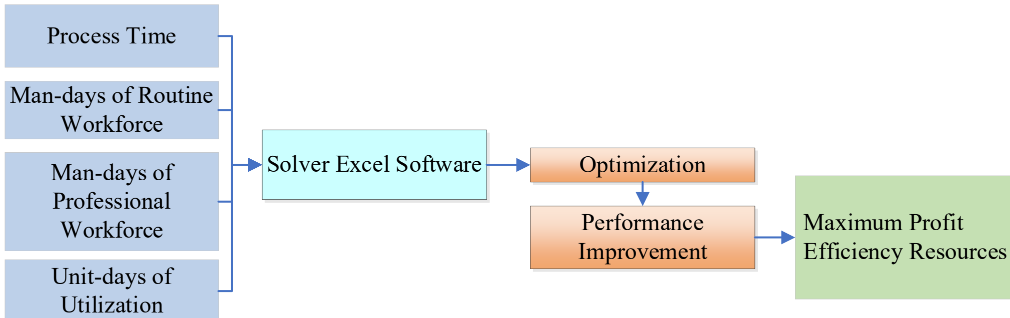

Figure 1. Research Methodology

This study involved are as follows:

1. Mathematical formulations play a pivotal role in the optimization of process parameters. This phase involves harnessing advanced mathematical methodologies and algorithms to find the ultimate solution that increases profit margins. Within the sphere of delineating process constraints, an array of variables was taken, spanning from processing time to workforce-intensive and machine-utilized. Collectively, these variables exert a momentous influence on molding process efficiency and productivity. Here is an explanation of each parameter: a) The process time presages the requisite cycle time for the operation. b) Man-days of workforce bifurcate into dual classifications: encompassing both routine workforce and professional workforce. The former pertains to those engaged in routine responsibilities, while the latter embodies individuals endowed with specialized proficiencies tailored to distinct tasks within the procedure. c) Unit-days of utilization are meticulously computed by factoring in the unit-days indispensable for the apparatus or machinery integral to the operation. This parameter stands as a sentinel, averting operational overload while guaranteeing an ample fleet of machines primed to accommodate the workload's demands.

   Subsequently, deconstructing each parameter, the resolution of a programming problem condenses into the pursuit of the optimal value inherent within this formulated expression.

$$f(x_1 \ldots x_n) = c_1 x_1 + \cdots + c_n x_n \tag{1}$$

   Constrained by an array of articulated limitations:

$$a_{11}x_1 + \cdots + a_{1n}x_n \le b_1 \tag{2}$$
$$a_{21}x_1 + \cdots + a_{2n}x_n \le b_2 \tag{3}$$
$$a_{31}x_1 + \cdots + a_{3n}x_n \le b_3 \tag{4}$$
$$\vdots$$
$$a_{m1}x_1 + \cdots + a_{mn}x_n \le b_m \quad with\ \forall x_1 \ge 0 \tag{5}$$
$$x_1 \ge 0 \tag{6}$$
$$\vdots$$
$$x_n \ge 0 \tag{7}$$

   Typically, the problem articulated in matrix configuration into:

$$min\{c^T x | x \in R^n \wedge Ax \le b \wedge x \ge 0\} \tag{8}$$
$$min\begin{bmatrix} c_1 & c_2 & c_3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \tag{9}$$

$$subject\ to \begin{bmatrix} a_{11} & a_{1n} \\ a_{21} & a_{2n} \\ a_{31} & a_{3n} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \leq \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}, \quad \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \geq \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \qquad (10)$$

2. Upon completion of process optimization, initiatives aimed at bolstering performance measurement are set into motion, fostering a comprehensive refinement in resource utilization.

   Through the following to these two phases, this study endeavors to not only harness mathematical formulations for process optimization but also to realize significant advancements in performance. The focal point of these improvements is the maximization of profits.

4. Data Collection

4.1 Material

In this study, an ensemble of input data, which includes factors such as raw data and process times, was meticulously acquired from the songket industry. Moreover, essential constraints pertinent to this industry, including workforce inputs measured in man-days and utilization denoted in unit-days, were comprehensively gathered. The specifics of this input data compilation are detailed in Table 1.

Table 1. Data as Constrains

Product	Expected Profit (IDR)	Process Time	Workforce		Utilization
			Routine	Professional	
x_1	8,00,000	9.15	4	1	3
x_2	9,50,000	10.22	5	2	3
x_3	6,00,000	8.17	3	1	2
Max		260	208	104	156

4.2 Solver Excel Software

Solver Excel software detail shown in Table 2.

Table 2: Solver Excel Software Detail

Software name	Solver Excel software
Description	The Solver Excel software represents a potent mathematical tool designed to address a diverse array of mathematical conundrums. It finds utility in modeling, analyzing, and performing calculations involving numeric, symbolic or geometric data with precision (Suwannahong et al. 2021).
Version	Microsoft Office 2019
Year	2019
Input	Process time, workforce, utilization machines
Process	Optimization using linear programing
Output	Maximization Profit
Computer required	Compatible with any computer and laptop
Software availability	Free available – Excel options, Add-ins, Solver add-in

5. Results and Discussion

5.1 Formulate the Problem

Formulate the problem is a crucial step as it defines that is trying to optimize. Industry should understand the description of the problem and the context and determine what to achieve through optimization. The objective function of this study is:

$$Maximize\ Profit : Z\ (x) = 800x_1 \ + 950x_2 + 600x_3 \qquad (11)$$

5.2 Plot the Constrains

In this study, the optimization process unfolds through the intricate manipulation of mathematical formulas. The strategic utilization of mathematical formulations, which incorporate constraints through the simplex method, empowers researchers to dissect and refine the production process with a keen focus on temporal efficiency. The tabulated information in Table 3 is poised to illuminate the precise constraints that have been exploited within this mathematical framework.

Table 3: Constrains

Product	Expected Profit (IDR)	Process Time	Workforce		Utilization
			Routine	Professional	
x_1	8,00,000	9.15	4	1	3
x_2	9,50,000	10.22	5	2	3
x_3	6,00,000	8.17	3	1	2
Max		260	208	104	156

Plot the Constrains :

$$Process\ time\ f(x) : 9.15x_1 + 10.22x_2 + 8.17x_3 \leq 260 \quad (12)$$
$$Routine\ workforce\ g(x) : 4x_1 + 5x_2 + 3x_3 \leq 208 \quad (13)$$
$$Professional\ workers\ h(x) : x_1 + 2x_2 + x_3 \leq 104 \quad (14)$$
$$Utilization\ i(x) : 3x_1 + 3x_2 + 2x_3 \leq 156 \quad (15)$$
$$x_1, x_2, x_3 \geq 0 \quad (16)$$
$$x_1, x_2, x_3 = integer \quad (17)$$

5.3 Identify Feasible Solutions

A feasible solution refers to a set of values for the decision variables that satisfies all the constraints of the problem. In other words, it's a solution that lies within the feasible region of the constraint space. Feasible solutions are the possible combinations of decision variable values that meet the limitations imposed by the problem's constraints.

The feasible region is the area of the graph where all constraints are satisfied. It is the intersection of the half-planes defined by the constraints. Feasible region in this study shown in Figure 2.

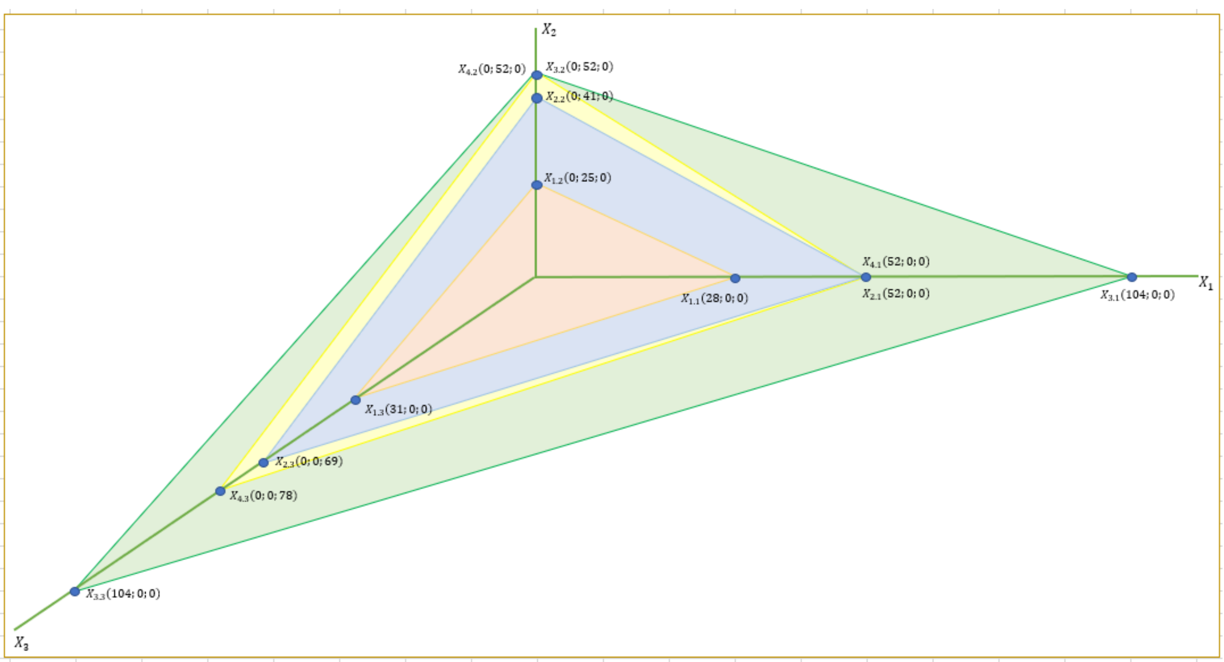

Figure 2: Feasible Region

5.4 Optimal Solutions

The optimal solution is the set of values for the decision variables that maximize the objective function while satisfying all the constraints of the problem. It is the best possible solution according to the defined criteria and limitations. In this study, the optimal solution shown in point 3 that contributes to maximum profit for industry.

Point 1 (0;0;0) = Rp. 0
Point 2 (28;0;0) = Rp. 22,400,000
Point 3 (0;25;0) = Rp. 23,750,000 (Optimal solution)
Point 4 (0;0;31) = Rp. 18,600,000

5.5 Performance Improvement

In this study, the notion of performance enhancement involves quantifying the output that emanates from a specific business process, followed by orchestrated enhancements aimed at amplifying production output, efficiency, and overall efficacy. The data encapsulated in Table 4 is expected to provide a comprehensive quantitative evaluation of the performance of the process.

Table 4: Efficiency Resources

Number of Products = 25 unit		
Process Time	255.5 days	
Routine Workforce	125 man-days	125 out of 208 (60.09%)
Professional Workforce	50 man-days	50 out of 104 (48.08%)
Utilization	75 unit-days	75 out of 156 (48.08%)

5.6 Proposed Improvements

The study seems to focus primarily on profit optimization. Measures such as worker reductions could have negative social and ethical implications, such as loss and exploitation. It does not address other important aspects of sustainability and social responsibility, such as the well-being of workers, environmental impact, or ethical considerations. Ignoring these aspects can be a limitation, especially in industries where sustainability is a growing concern. To address these limitations, future study could incorporate a more comprehensive and multidisciplinary approach that takes the broader implications of optimization, including ethical, social, and environmental considerations, and considers a wider range of external factors. Additionally, ongoing monitoring and evaluation of the implemented changes would be necessary to ensure their long-term viability and impact.

6. Discussion and Inferences

The global industrial landscape confronted unprecedented challenges and intricacies in the aftermath of the pandemic. Among the industries significantly affected was the songket industry, which experienced a profound impact due to the fallout of the pandemic. A substantial decline in orders led to a consequential plunge in revenue, coupled with increased expenditures. In response to this crisis, corrective measures such as reduced workforce were implemented. Although customer orders gradually regained momentum as conditions improved, the industry faced the critical challenge of effectively aligning customer demand with the available labor force. Despite concerted efforts to streamline internal processes and resort to subcontracted orders, the desired outcomes proved elusive. The industry grappled with the ongoing complexity of navigating the post-pandemic landscape, seeking sustainable solutions to realign operational dynamics and bolster resilience.

Industries bear the responsibility of judiciously allocating resources and identifying critical production windows to meet customer demands effectively and enhance overall profitability. Using the capabilities of Solver Excel software for process optimization, this study unveils the potential to maximize Kain Songket Bunga Penuh production by up to 25 units, paving the way for increased productivity. Furthermore, by strategically optimizing routine workforce allocation by 125 mandays (60.09%), professional workforce utilization by 50 mandays (48.08%), and equipment usage by 75 unitdays (48.08%), the study demonstrates a significant surge of IDR 23,750,000 in cumulative industry profits. This highlights the tangible impact of employing advanced optimization tools to improve operational efficiency and financial outcomes for the industry. In summary, the study highlights provide valuable information to optimize the songket production process.

Acknowledgements
The authors wish to thank all who assisted in conducting this work.

References
Aldowaisan, Tariq A, and Lot® K Gaafar. "Business Process Reengineering: An Approach for Process Mapping.", 2023. www.elsevier.com/locate/orms.

Azhari, Mulkan, Syahril Efendi, and Halim Maulana, "Applying the Simplex Method to Optimize Employee Distribution to Increase Sales Internet Data Package" 4 (3): 143–48, 2023. https://doi.org/10.30596/ijems.v4i3.15151.

Bashan, Aviva, and Amos Notea, "A Hierarchical Model for Quality Management Systems in Global Organizations." *International Journal of Quality and Reliability Management* 35 (7): 1380–98, 2018. https://doi.org/10.1108/IJQRM-03-2017-0055.

Bögel, Stephan, Stefan Stieglitz, and Christian Meske, "A Role Model-Based Approach for Modelling Collaborative Processes." *Business Process Management Journal* 20 (4): 598–614, 2014. https://doi.org/10.1108/BPMJ-07-2013-0094.

Bolsinger, Manuel, Anna Elsäßer, Caroline Helm, and Maximilian Röglinger, "Process Improvement through Economically Driven Routing of Instances." *Business Process Management Journal* 21 (2): 353–78, 2015. https://doi.org/10.1108/BPMJ-02-2014-0011.

Carpinetti, Luiz C.r., Thiago Buosi, and Mateus C. Gerólamo, "Quality Management and Improvement: A Framework and a Business-Process Reference Model." *Business Process Management Journal* 9 (4): 543–54, 2003. https://doi.org/10.1108/14637150310484553.

Couckuyt, Dries, and Amy Van Looy, "A Systematic Review of Green Business Process Management." *Business Process Management Journal* 26 (2): 421–46, 2020. https://doi.org/10.1108/BPMJ-03-2019-0106.

Dachyar, M., and Z.A.H. Sanjiwo, "Business Process Re-Engineering of Engineering Procurement Construction (EPC) Project in Oil and Gas Industry in Indonesia." *Indian Journal of Science and Technology* 11 (9): 1–8, 2018. https://doi.org/10.17485/ijst/2018/v11i9/92741.

Damanik, Ramlan, Robert Sibarani, and Warisman Sinaga, "Management, Function and Meaning of Songket BatuBara." *Turkish Online Journal of Qualitative Inquiry* 12 (7): 8634–45, 2021. https://www.tojqi.net/index.php/journal/article/view/5246.

Datta, Soumyajyoti, Rohit Kapoor, and Peeyush Mehta, "A Multi-Objective Optimization Model for Outpatient Care Delivery with Service Fairness." *Business Process Management Journal* 29 (3): 630–52, 2023. https://doi.org/10.1108/BPMJ-07-2022-0335.

Feri, Setria, Sudarmiatin Sudarmiatin, and Imam Mukhlis, "The Business Potential of Riau Malay Songket Woven Cloth Enterprise - Wan Fitri toward the International Market." *Journal of Economics, Finance and Management Studies* 05 (12): 3746–54, 2022. https://doi.org/10.47191/jefms/v5-i12-36.

Fitri, Anisa, and Hilmah Zuryani, "Journal of Sustainable Entreprenuer Regional Industry |" 1, 2022. https://doi.org/10.31004/JOSERI.vxix.xx.

Fonseca, Luis Miguel, Maria Cristiana Cardoso, and Maria Henriqueta Nóvoa, "Motivations for ISO 9001 Quality Management System Implementation and Certification – Mapping the Territory with a Novel Classification Proposal." *International Journal of Quality and Service Sciences* 14 (1): 18–36, 2022. https://doi.org/10.1108/IJQSS-02-2021-0031.

Garza-Reyes, Jose Arturo, "A Systematic Approach to Diagnose the Current Status of Quality Management Systems and Business Processes." *Business Process Management Journal* 24 (1): 216–33, 2018. https://doi.org/10.1108/BPMJ-12-2016-0248.

Ghosh, Sid, Heston Surjadjaja, and Jiju Antony, "Optimisation of the Determinants of E-Service Operations." *Business Process Management Journal* 10 (6): 616–35, 2004. https://doi.org/10.1108/14637150410567848.

González-Benito, J., A. R. Martinez-Lorente, and B. G. Dale., "Business Process Re-Engineering to Total Quality Management: An Examination of the Issues." *Business Process Management Journal* 5 (4): 345–58, 1999. https://doi.org/10.1108/14637159910297385.

Harrington, H. James, "The New Model for Improvement: Total Improvement Management." *Management Decision* 33 (3): 17–24, 1995. https://doi.org/10.1108/00251749510085030.

Hofacker, Ingo, and Rudolf Vetschera, "Algorithmical Approaches to Business Process Design." *Computers and Operations Research* 28 (13): 1253–75, 2001. https://doi.org/10.1016/S0305-0548(00)00038-1.

Hozak, Kurt, "Online Software Using Randomization and Automated Grading to Help Teach Linear Programming with Excel and Solver in Business Courses." *Journal of Education for Business* 96 (5): 327–34, 2021.

https://doi.org/10.1080/08832323.2020.1821345.
Johan G. Ony, Antonius Singgih Setiawan, Agustinus Widyartono, "Implementation of Business Strategy, Technology Usage, and Business Continuity during the Covid-19 Pandemic." *Jurnal Akuntansi* 25 (2): 186, 2021. https://doi.org/10.24912/ja.v25i2.805.
Kang, Parminder Singh, and Rajbir Singh Bhatti, "Continuous Process Improvement Implementation Framework Using Multi-Objective Genetic Algorithms and Discrete Event Simulation." *Business Process Management Journal* 25 (5): 1020–39, 2019. https://doi.org/10.1108/BPMJ-07-2017-0188.
Nurnazmi, Nurnazmi, Ida Waluyati, and Arifuddin Arifuddin, "Opportunities and Challenges of Women's Small and Medium Enterprises (SMEs) in Producing Bima's Traditional Songket Woven Fabric During the Covid-19 Pandemic.", 2021. https://doi.org/10.4108/eai.28-9-2020.2307415.
Pasch, Florian, Christoffer Rybski, and Roland Jochem, "Empirical Study on Quality Management for Product-Service Systems in Industrial Environment." *Business Process Management Journal* 22 (5): 969–78, 2016. https://doi.org/10.1108/BPMJ-01-2016-0023.
Pattanayak, Santosh, and Supriyo Roy, "Synergizing Business Process Reengineering with Enterprise Resource Planning System in Capital Goods Industry." *Procedia - Social and Behavioral Sciences* 189 (May): 471–87, 2015. https://doi.org/10.1016/j.sbspro.2015.03.194.
Prakoso, Indro, and Kholida Hanim, "Dengan Model Matematika Optimasi" 5 (1): 2621–1262, 2019.
Pratiwi, Firdaus Nur, and Muhammad Dachyar, "Hospital Improvement Process View Project SME's Business Process Improvement in Food Industry Using Business Process Re-Engineering Approach." *International Journal of Advanced Science and Technology* 29 (7s): 3665–74, 2019. https://www.researchgate.net/publication/341966454.
Psomas, Evangelos L., Christos V. Fotopoulos, and Dimitrios P. Kafetzopoulos, "Core Process Management Practices, Quality Tools and Quality Improvement in ISO 9001 Certified Manufacturing Companies." *Business Process Management Journal* 17 (3): 437–60, 2011. https://doi.org/10.1108/14637151111136360.
Reda, Hiluf, and Akshay Dvivedi, "Application of Value Stream Mapping (VSM) in Low-Level Technology Organizations: A Case Study." *International Journal of Productivity and Performance Management* 71 (6): 2393–2409, 2022. https://doi.org/10.1108/IJPPM-03-2021-0118.
Rotab Khan, M R., "Business Process Reengineering of an Air Cargo Handling Process.", 2023.
Salleh, Siti Zuliana, and A.R. Bushroa, "Bibliometric Analysis on the Implementation Digitization Technologies in Cultural Heritage in Malaysia." *Malaysian Journal of Society and Space* 18 (2): 287–300, 2022. https://doi.org/10.17576/geo-2022-1802-22.
Samaranayake, Premaratne, "Business Process Integration, Automation, and Optimization in ERP: Integrated Approach Using Enhanced Process Models." *Business Process Management Journal* 15 (4): 504–26, 2009. https://doi.org/10.1108/14637150910975516.
Shivam, and Manish Gupta, "Quality Process Reengineering in Industry 4.0: A BPR Perspective." *Quality Engineering* 0 (0): 1–20, 2022. https://doi.org/10.1080/08982112.2022.2098044.
Suwannahong, Kowit, Surachai Wongcharee, Torpong Kreetachart, Chadrudee Sirilamduan, Javier Rioyo, and Akkharaphong Wongphat, "Evaluation of the Microsoft Excel Solver Spreadsheet-Based Program for Nonlinear Expressions of Adsorption Isotherm Models onto Magnetic Nanosorbent." *Applied Sciences (Switzerland)* 11 (16): 1–18, 2021. https://doi.org/10.3390/app11167432.
Tennant, Charles, and Yi Chieh Wu, "The Application of Business Process Reengineering in the UK." *TQM Magazine* 17 (6): 537–45, 2021. https://doi.org/10.1108/09544780510627633.
Wati, Dedek Ambar, Irwansyah Irwansyah, and Rina Devianty, "Kain Tenun Songket Melayu Batu Bara: Sejarah, Motif Dan Fungsinya." *Warisan: Journal of History and Cultural Heritage* 3 (1): 1–6, 2022. https://doi.org/10.34007/warisan.v3i1.1210.
You, Articles, May Be, and Interested In, "Reducing Non-Optimal Solution Space for Interval Linear," no. July 2008, 2023.

Biographies

Yuana Delvika is a Research scholar in Mechanical and Industrial Engineering Department, Indian Institute of Technology Roorkee, India. She is also working in Industrial Engineering Department, Universitas Medan Area, Indonesia. She graduated her B.Tech and M.Tech in Universitas Sumatera Utara, Indonesia.

Akshay Dvivedi is a Professor in Mechanical and Industrial Engineering Department, Indian Institute of Technology Roorkee, India. His expertise in Advanced Manufacturing Process, Quality Management and Quality Function

Deployment. He graduated his Ph.D in Indian Institute of Technology Roorkee. He got many research grants from some sources. He contributed more than 100 international publications, patents dan book chapters. He also member of American Society of Mechanical Engineer (ASME), Global Science and Technology Forum (GSTF), The Minerals, Metals & Materials Society and Society of Automotive Engineers (SAE International). Akshay Dvivedi is the corresponding author and can be contact on email akshaydvivedi@gmail.c