THE EFFECT OF WORK PROCESS AUTOMATION, WAREHOUSE MANAGEMENT SYSTEM, AND EXPERTS ON COMPANY OPERATIONAL EFFICIENCY WITH SMART WAREHOUSING MEDIATION IN E-COMMERCE WAREHOUSES IN JAKARTA

Lunario Rizal Halim[1]
Universitas Trisakti, Jakarta, Indonesia
122012301027@std.trisakti.ac.id

Wahyuningsih Santosa[2*]
Universitas Trisakti, Jakarta, Indonesia
wahyuningsih@trisakti.ac.id*

Triwulandari Satitidjati Dewayana[3]
Universitas Trisakti, Jakarta, Indonesia
triwulandari_sd@trisakti.ac.id

Abstract

Technology, especially in the logistics industry, has experienced rapid development and offers various benefits such as increased efficiency, productivity, and cost reduction, as well as supporting corporate sustainability. This study aims to evaluate the effect of work process automation, warehouse management systems, and experts mediated by smart warehousing on operational efficiency in e-commerce warehouses in Jakarta. This study uses a quantitative method with data analysis through a t-test using SPSS version 27 for Windows. The results of the study indicate that work process automation has no significant effect on smart warehousing and operational efficiency. On the contrary, the warehouse management system has a significant effect on smart warehousing and operational efficiency, while experts have no significant effect on both variables. The effect of smart warehousing on operational efficiency is also significant. These findings indicate that warehouse management systems such as WMS, ERP, OMS, and inventory management systems have a significant positive impact on operational efficiency. However, the lack of readiness and understanding of employees towards technology can hinder the effectiveness of the implementation of work process automation.

Keywords: Work Process Automation, Warehouse Management System, Experts, Company Operational Efficiency, Smart Warehousing, E-commerce Warehouse

INTRODUCTION

The digitalization era is growing. Starting from Industry 4.0 which focuses on productivity and efficiency, and shifting to Industry 5.0 with a focus on sustainable, human-centered, and resilient industrial activities (European Commission, 2020). The shift prompted a review of the warehouse sector, especially in response to the expansion of the e-commerce landscape and the dynamics of integrated systems in contemporary omnichannel settings (Boysen et al., 2019; Junaidi, 2023). The exponential surge in e-commerce sales, especially in the e-grocery sector, which is expected to grow by 12% per year over the next five years (GroceryDive, 2023), has changed customer expectations. There is an increasing demand for faster delivery and increased convenience (PwC, 2022; 2023).

In Indonesia itself, e-commerce companies are increasingly aware of the importance of digital warehouse management systems in company operations (Isbahi et al, 2022). A digital warehouse management system is a technological solution that allows companies to automate and integrate warehouse management processes. Implementing this system allows e-commerce companies to optimize cost efficiency and increase company profitability.

In an e-commerce business, efficient warehouse management is essential to avoid unnecessary costs. With a digital warehouse management system, companies can reduce excessive storage costs or errors in shipping goods. This system also allows companies to do real-time inventory management, so they can make smarter decisions in inventory management. With the right use of technology, companies can reduce their operating costs and increase profits "Digitizing the warehouse can increase the efficiency of the logistics process by up to 40% and reduce operating costs by up to 10%." (McKinsey & Company, 2022).

With increasingly fierce competition and increasingly mature and diverse technologies, the automation trend has also spread among retailers and logistics service providers worldwide (Reiser, 2020; MH&L, 2020). A significant factor is that the latest generation of automation technologies offers the flexibility to handle a variety of products and adapt to demand fluctuations, allowing for effective and efficient storage, handling, and sorting of large product flows (Kembro et al., 2022). Several new technologies are relevant to warehouse operations, including artificial intelligence (AI), the Internet of Things (IoT), cyber-physical systems (CPS), big data, 5G, and intelligent video analytics (IVA) (Chung, 2021). The need for technological adaptability and information and communication technology (ICT) competence among logistics operators can be a potential social issue for companies implementing 4.0 (Ejsmont et al., 2020). Literature shows that Industry 4.0 initiatives generate economic benefits, mainly due to cost reductions (especially operational and labor costs), increased productivity and efficiency, and increased customer satisfaction by reducing lead times and improving delivery and information accuracy, responsiveness, and product customization (Choudhury et al., 2021). The need for technological adaptability and information and communication technology (ICT) competencies among logistics operators has the potential to become a social issue for companies implementing the fourth industrial revolution (4.0) (Ejsmont et al., 2020).

Human and technology involvement is essential in the digital warehouse workflow. Human expertise ensures adaptability and problem-solving, while technology enhances efficiency, accuracy, and automation. Therefore, sustainable logistics providers must focus on employee development to enable them to handle new technologies. To create smooth and innovative operations, drive productivity, and maintain high standards in a rapidly evolving industry. However, on the other hand, the challenge in digital warehouse operations is to achieve an optimal balance between the roles of humans and technology, to increase efficiency while maintaining flexibility and problem-solving skills. As automation increases, it is essential to identify the most effective integration between human supervision and technological precision to ensure the implementation of a smooth and adaptable workflow. Departing from the problems above and the lack of empirical research that discusses the relationship between the variables above and the efficiency of the warehouse process, it encourages researchers to conduct a more in-depth analysis. It is hoped that this research can provide an empirical contribution to determine whether the digital warehouse management system has a significant influence on the efficiency of the company's warehouse operations.

REVIEW OF LITERATURE

Smart Warehousing

The information network is the foundation of the warehouse, providing information exchange channels and basic technological support for the warehouse system. Equipment automation and process integration are the two pillars of the warehouse. Environmental sustainability is the light of the warehouse, supported by the network, automation, and integration. These four perspectives, namely information network, equipment automation, process integration, and environmental sustainability, form the conceptual framework of the smart warehouse (Lu Zhen & Hao Li, 2022).

Work Process Automation

Warehouse automation is the process of automating the movement of inventory into, within, and out of a warehouse to customers with minimal human intervention. As part of an automation project, companies can eliminate labor-intensive tasks that involve repetitive physical labor and manual data entry and analysis. Some studies have used smart warehousing to describe warehouses that include a combination of automated material handling and AI.

Warehouse Management System (WMS)

WMS is an information technology database used to support warehouse operations and improve warehouse productivity by coordinating integrated warehouse activities and maintaining accurate inventory (Istiqomah et al., 2020). WMS acts as a system that regulates all warehouse activities in the supply chain, such as receiving stock, storing stock, and managing stock orders. This software helps track inventory, raw materials, and shipping details as well as customer feedback (Ali et al., 2020).

Experts

According to Obijifo (2012), workforce planning is a process within a company to ensure that the company has the right number of workers, with the right skills, at the right time and place, so that economic value is obtained with maximum utility. Workforce planning involves the process of planning human resources in an organization or company. Due to the new state of technology, there are fewer qualified professionals and operators in the warehousing sector so those who have access to this technology are large-scale companies because they are easier to adopt the latest information technology (Hao et al, 2020).

Warehouse Digitalization

To improve warehouse operations, global online giants such as Alibaba and Amazon have made significant investments in automated material handling technologies (Alibaba Cloud, 2019; Amazon, 2020). With increasing competition and more mature and diversified technologies, the automation trend has also spread among retailers and logistics service providers worldwide (Reiser, 2020; MH&L, 2020).

Operational Efficiency

Zhang et al. (2021) investigated Alibaba's smart warehouse, which uses a series of AI applications, along with robots working collectively and other related human and organizational resources, to improve the efficiency and effectiveness of key business processes. The researchers noted that while humans focus on higher-value tasks that require creativity, robots, and AI are used to carry out repetitive, time-consuming, and/or dangerous tasks.

RESEARCH METHOD

Research Design

The design of this study is hypothesis testing, which aims to test the influence of several independent variables on the dependent variable, as well as the mediation effect. This study uses a quantitative approach using a survey questionnaire.

This research is of a naturepredictive correlation, to test the relationship of independent variables, namely automation, warehouse management systems, and expert personnel to operational efficiency as dependent variables and mediated by smart warehousing variables. This approach was chosen to capture a situational picture of the relationship between the variables being studied in the context of e-commerce warehouses in Indonesia.

The unit of analysis in this study is individuals. Therefore, survey respondents are individuals working in e-commerce warehouses in Indonesia, including warehouse managers, supervisors, and operational workers.

Indonesian Interdisciplinary Journal of Sharia Economics (IIJSE) Vol. 7. No. 3 (2024)
e-ISSN: 2621-606X Page: 7819-7839

Variables and Measurement

This research involves several variables, which are grouped as follows:

1. Independent Variables (X)
   - Work Process Automation (X1)
   - Warehouse System Management (X2)
   - Expert (X3)
2. Mediating Variable (M)
   - Smart Warehousing (M)
3. Dependent Variable (Y)
   - Operational Efficiency (Y)

Measuring variables in qualitative research involves understanding respondents' perceptions, experiences, and insights. Each variable is explored through open-ended questions designed to elicit detailed responses from participants.

Measurement example:

- Work Process Automation: Measured through things like “The automation systems in our warehouse help increase work productivity.”
- Warehouse System Management: Measured through things like “The WMS used in our warehouse helps with more efficient stock management.”
- Skilled Workforce: Measured through things like “The workforce in our warehouse has the skills necessary for efficient operations.”
- Smart Warehousing: This can be proven by the following statement: "The use of smart warehousing technology in our warehouses improves operational accuracy and speed."
- Operational Efficiency: Measured through things like “Our warehouse consistently meets operational targets.”

The data collection method used in this study is a survey questionnaire. The questionnaire was distributed to individuals working in e-commerce warehouses in Jakarta.

RESULTS AND DISCUSSION

Validity Test

Azwar (2015) stated that the rule used is the limit of r Corrected Item-Total Correlation ≥ 0.30. If the criteria used by the researcher is if the validity coefficient shows more than 0.30 (r count ≥ 0.30) then the statement will be said to be valid. If the validity coefficient is less than 0.30 (r count < 0.30) then the statement is said to be invalid. Validity testing is carried out using SPSS software version 27.0. The criteria are said to be valid or not seen in the SPSS value if r count ≥ 0.30 then the statement can be said to be valid, conversely if r count < 0.30 then the statement is declared invalid.

Based on the calculation results, the respective coefficient values are obtained as follows:

Table 1.
Independent Variable Validity Test

Independent Variable Validity Test			
Statement	**r count**	**r table**	**Information**
1	0.331	0.30	Valid
2	0.431	0.30	Valid
3	0.392	0.30	Valid
4	0.666	0.30	Valid
5	0.627	0.30	Valid
6	0.605	0.30	Valid
7	0.280	0.30	Invalid
8	0.415	0.30	Valid
9	0.634	0.30	Valid
10	0.412	0.30	Valid
11	0.518	0.30	Valid
12	0.468	0.30	Valid
13	0.833	0.30	Valid
14	0.403	0.30	Valid

Table 2.
Mediation Validity Test

Statement	r count	r table	Information
1	0.564	0.30	Valid
2	0.697	0.30	Valid
3	0.748	0.30	Valid

4	0.728	0.30	Valid

Table 3.
Dependent Variable Validity Test

Statement	r count	r table	Information
1	0.600	0.30	Valid
2	0.681	0.30	Valid
3	0.733	0.30	Valid
4	0.628	0.30	Valid

Based on the table above, it is known that the statements tested were 22 questions. The number of invalid questions was 1 question, where the rcount value <0.30. While the number of valid questions was 21 questions, where the rcount value ≥ 0.30. Invalid statements will not be used in the preparation of the research instrument so 21 questions will be used as an instrument to determine the results of the research.

Reliability Test

According to Suharsimi Arikunto (2013:221), "Reliability indicates the understanding that an instrument can be trusted to be used as a data collection tool because the instrument is good."

The validity test was conducted using SPSS software version 27.0 using Cronbach's Alpha test. For the instrument in the form of reliability, it is declared reliable if Crobanch's Alpha value obtained at least reaches moderate reliability.

Table 4.
Reliability Test

Question Reliability	Information
R11 < 0.20	Very Low
0.02 < r11 0.40	Low
0.40 < r11 0.70	Currently
0.70 < r11 0.90	Tall
0.90 < r11 1.00	Very high

Source: Suharsimi Arikunto (2010:93)

Based on the analysis carried out on the 5 variables that have been described, the Cronbach's Alpha value is as follows:

Table 5.

Variables	Cronbach's Alpha	Limit Value	Information
1	0.71	0.60	Reliable
2	0.38	0.60	unreliable
3	0.65	0.60	Reliable
4	0.64	0.60	Reliable
5	0.60	0.60	Reliable

So, it can be concluded that there is 1 variable that is not reliable with moderate reliability criteria. So, in 1 variable there is 1 statement that will be issued so that the following results are obtained:

Table 6.

Variables	Cronbach's Alpha	Limit Value	Information
1	0.71	0.60	Reliable
2	0.61	0.60	Reliable
3	0.62	0.60	Reliable
4	0.68	0.60	Reliable
5	0.60	0.60	Reliable

Table 7.

Variable	Final Statement Number
Warehouse Management System (Emir et, al., 2018)	6 Statements
Experts (Grinold, 1977)	2 Statements
Automation (Adam Nilsson & Daniel Merkle, 2018)	4 statements
Smart Warehousing (Lu ZHEN & Haolin LI, 2022)	4 statements
Operational Efficiency (Second Edition Handbook of Industrial and System Engineering, 2014)	4 statements

Based on the table above, there are 20 statements, 6 of which are for the Warehouse Management System variable, 2 statements for the Expert variable, 4 statements for the Automation variable, 4 statements for the Smart Warehousing variable, and 4 statements for operational efficiency.

Assumption Test

Normality Test

This study uses a normality test with the Kolmogorov-Smirnov Test method with the help of the SPSS version 27 program with a significance level (α = 0.05). If the sig α value > 0.05, then the data is normally distributed and vice versa if the sig α value <0.05 then the data is said to be not normally distributed (Nifiannoor, 2013).

Table 8.

One-Sample Kolmogorov-Smirnov Test			
Monte Carlo Sig. (2-tailed)e	Sig.		0.583
	99% Confidence Interval	Lower Bound	0.570
		Upper Bound	0.596

Table 9 explains that the results of the normality test using the Kolmogorov-Smirnov test show that the warehouse management system, expert personnel, and automation towards smart warehousing have a significance value of α = 0.583 (α > 0.05).

Table 9.

One-Sample Kolmogorov-Smirnov Test			
Monte Carlo Sig. (2-tailed)e	Sig.		0.560
	99% Confidence Interval	Lower Bound	0.547
		Upper Bound	0.572

Table 10 explains that the results of the normality test using the Kolmogorov-Smirnov test on the warehouse management system, expert personnel, automation, and smart warehousing on efficiency are known to have a significance value of α = 0.560 (α > 0.05). So from the two tables above it can be concluded that the variables used in this study are normally distributed.

Structural Equation Model (SEM) Test

The method used in this study is the Structural Equation Modeling-Partial Least Square (SEM-PLS) approach. SEM is one of the modeling techniques in covariance analysis statistics with cross-sectional statistics features in linear models and general models. SEM consists of factor analysis modeling, path analysis, regression, and curve growth in latent variable modeling. Data were processed using Smart PLS software version 3.2.9 with a threshold value for the P value of 0.05.

Hypothesis testing is carried out by looking at the t-statistic value (t-table) and the p-value (p-value). If the t-statistic value is higher than 1.96 or the p-value is smaller than 0.05, then there is a significant influence between the variables.

Table 10.

	T Statistics (|O/STDEV|)	P Values	2.50%	97.50%
Automation -> Smart Warehousing	0.196	0.845	-0.231	0.228
Warehouse Management System -> Smart Warehousing	6,686	0.000	0.335	0.661
Experts -> Smart Warehousing	0.658	0.512	-0.264	0.235
Automation -> Operational Efficiency	0.798	0.426	-0.134	0.260
Smart Warehousing -> Operational Efficiency	2.213	0.029	0.035	0.417
Experts -> Operational Efficiency	0.72	0.473	-0.212	0.141
Smart Warehousing -> Operational Efficiency	5,627	0.000	0.305	0.624
Automation -> Smart Warehousing -> Operational Efficiency	0.238	0.812	-0.152	0.140

Warehouse Management System -> Smart Warehousing -> Operational Efficiency	2.102	0.038	0.020	0.226
Experts -> Smart Warehousing -> Operational Efficiency	1,611	0.110	-0.147	0.284

Based on Table 11, it can be seen that:

1. The first hypothesis (H1) is not accepted where there is no significant influence of process automation on smart warehousing with a path coefficient value of 0.196 and p-value (0.845 > 0.05).
2. The second hypothesis (H2) is accepted, namely there is a significant influence of the warehouse management system on smart warehousing with a path coefficient value of 6.686 and a p-value (0.000 <0.05). Where every change that occurs to the warehouse management system will increase the capability of the smart warehouse which is located from 0.335 to 0.661.
3. The third hypothesis (H3) is not accepted where there is no significant influence of expert personnel on smart warehousing with a path coefficient value of 0.658 and a p-value (0.512 > 0.05).
4. The fourth hypothesis (H4) is not accepted where there is no significant influence of work automation on operational efficiency with a path coefficient of 0.798 and a p-value (0.426 > 0.05).
5. The fifth hypothesis (H5) is accepted, namely there is a significant influence of the warehouse management system on operational efficiency with a path coefficient value of 2.213 and a p-value (0.029 <0.05). Where every change that occurs to the warehouse management system will increase the capability of the smart warehouse which is located from 0.035 to 0.471.

6. The sixth hypothesis (H6) is not accepted where there is no significant influence of expert personnel on operational efficiency with a path coefficient of 0.720 and a p-value (0.473> 0.05).
7. The seventh hypothesis (H7) is accepted, namely there is a significant influence of smart warehousing on operational efficiency with a path coefficient value of 5.627 and a p-value (0.000 <0.05). Where every change that occurs to the warehouse management system will increase the capability of the smart warehouse which is located from 0.305 to 0.624.
8. The eighth hypothesis (H8) is not accepted where there is no significant influence of work process automation mediated by smart warehousing on operational efficiency with a path coefficient value of 0.238 and a p-value (0.812 > 0.05).
9. The ninth hypothesis (H9) is accepted where there is a significant influence of the warehouse management system mediated by smart warehousing on operational efficiency with a path coefficient value of 2.102 and a p-value (0.038 <0.05). Where every change that occurs to the warehouse management system will increase warehouse efficiency by 0.020 to 0.226.
10. The tenth hypothesis (H10) is not accepted where there is no significant influence of work process experts mediated by smart warehousing on operational efficiency with a path coefficient value of 1.611 and a p-value (0.110 > 0.05).

Based on the results of the first hypothesis, there is an influence between automation and smart warehousing, fourth, there is an influence of automation on operational efficiency and eighth, there is an influence of automation mediated by smart warehousing on operational efficiency from the three hypotheses, the results obtained are not significant. Similar results were also stated in a study conducted by Mahroof (2019), the study revealed that when a company does not have a good enough understanding of the technology used, there is a tendency for the company to fail to benefit from the use of the technology that has been implemented. Moreover, if there is a lack of clarity in the technology roadmap in the company, it will also have a negative impact on the operational level. However, in a study conducted by Kembro & Norrman (2022), it was stated that several companies focus on technology such as automation, but there are supporting factors that cause the implementation of this technology to run, namely a good understanding of business actors and their employees and the existence of adequate and urgent needs such as a lack of manpower, requiring the business to adopt automation technology. A similar thing was also stated by Nantee & Sureeyatanapas (2021) which stated that a mature understanding of the technology that will be used is needed to get maximum results from the use of technology. Ali, et.al (2023) stated that the use of automation such as drones and driverless vehicles requires in-depth observation before implementation such as work structure, company resources and even government regulations. The results obtained are different due to different factors where in the research results that have been mentioned, previous researchers conducted research on warehouse operations directly such as the use of drones, unmanned vehicles to automation for the production and packing sectors while researchers focus more on the use of document automation such as RPA or the use of UI-path technology.

Based on the results of the third hypothesis, there is an influence of experts on smart warehousing, sixth, there is an influence of experts on operational efficiency, and tenth, there is an influence of experts on operational efficiency mediated by smart warehousing. From the three hypotheses, insignificant results were obtained. This was also stated in a study conducted by Gupta et al. (2021) which discussed the need for readiness and willingness of workers and business owners to learn ideas from new business models and their implications. This is different from the study conducted by Fabera et al. (2017) which stated that when a manager can use technology well, productivity in the company can increase significantly. Karim et al. (2020) in his research stated that when a manager can use technology well, the level of operational productivity will increase, this indicates the need for readiness and good understanding from actors when using technology. The results obtained are different due to different factors where in the research results that have been mentioned, previous researchers focused on users and managers who are already trained in the development and use of technology, while researchers took all groups without limitations on respondents' understanding of the technology used by the company.

Based on the results of the second hypothesis, there is an influence of the warehouse management system on smart warehousing, fifth, there is an influence of the warehouse management system on operational efficiency, seventh, there is an influence of smart warehousing on operational efficiency and ninth, there is an influence of the warehouse management system mediated by smart warehousing on operational efficiency from the four hypotheses, significant results were obtained. This was also expressed in a study conducted by Kembro & Norrman (2022) which stated that the warehouse management system will be the backbone of warehouse operational activities. A similar thing was also stated by Fabera et al. (2017) where the use of a warehouse management system can increase productivity at a fairly significant level. As well as research conducted by Sahara & Aamer (2021) found that a digital transformation of the warehouse operational process is needed to be able to meet the increasingly complex needs of consumers. Nantee & Sureeyatanapas (2021) stated that technological developments, especially in Industry 4.0, have a good impact on various aspects. In his research, Ali et al. (2023) found that smart warehousing when used optimally can increase operational efficiency and can even become an important part of a reliable supply chain process.

CONCLUSION

Technology has developed rapidly and become a very useful tool for the logistics industry. Technology that is used properly can increase the level of efficiency, work productivity and reduce costs, and direct the company to be more sustainable. Based on the results of the study, it can be seen that most companies that have implemented the use of WMS have a positive and significant impact. However, the use of technology without understanding, readiness, and willingness from technology users and stakeholders in the company can result in the implementation of technology not having a significant effect and even causing losses as stated in the results of the study.

The purpose of this study was to determine the effect of work process automation, warehouse management systems, and experts mediated by smart warehousing on the operational efficiency of companies in e-commerce warehouses in Jakarta. The subjects in this study were active employees who work in e-commerce and are in the information technology division, head office operations, or warehouse operations. The research method used is quantitative. The data analysis technique uses the t-test with the help of SPSS version 27 for Windows.

Based on the results of the t-test, the calculated t value was 0.196 and the p-value (0.845 > 0.05) which means that there is no significance of process automation on smart warehousing, there is a significant influence of the warehouse management system on smart warehousing with a calculated t value of 6.686 and a p-value (0.000 < 0.05), the calculated t value was 0.658 and a p-value (0.512 > 0.05) which means that there is no significant influence of experts on smart warehousing, there is no significant influence of work automation on operational efficiency with a calculated t value of 0.798 and a p-value (0.426 > 0.05), there is a significant influence of the warehouse management system on operational efficiency with a calculated t value of 2.213 and a p-value (0.029 < 0.05), there is no significant influence of experts on operational efficiency with a calculated t value of 0.720 and p-value (0.473 > 0.05), there is a significant influence of smart warehousing on operational efficiency with a t-value of 5.627 and p-value (0.000 <0.05), there is no significant influence of work process automation mediated by smart warehousing on operational efficiency with a t-value of 0.238 and p-value (0.812> 0.05), there is a significant influence of the warehouse management system mediated by smart warehousing on operational efficiency with a t-value of 2.102 and p-value (0.038 <0.05), there is no significant influence of work process experts mediated by smart warehousing on operational efficiency with a t-value of 1.611 and p-value (0.110> 0.05). This means that there is a significant influence felt by employees on the use of warehouse management systems such as the use of WMS, ERP, OMS, or inventory management systems, another thing that was found was that even though the use of warehouse management systems was already running, this was not in line with the level of readiness or willingness of employees who used the technology and the lack of clarity regarding technology caused the ineffectiveness of the implementation that had been carried out regarding the automation of work processes.

REFERENCES

Abbass, N.M., Rahman, A.A., Aziz, Y.A. and Sidek, S. (2019), "A systematic literature review on sustainable production indicators to assess the sustainable performance of industries", International Journal of Academic Research in Business and Social Sciences, Vol. 9 No. 2, pp. 497-515.

Aboulola, O. I. (2018). GIS spatial analysis: A new approach to site selection and decision making for small retail facilities (Doctoral dissertation, The Claremont Graduate

University). Retrieved from https://www.researchgate.net/profile/OmarAboulola/publication/325536724_GIS_Spatial_Analysis_A_New_Approach_to_Site_Sel ection_and_Decision_Making_for_Small_Retail_Facilities/links/5b1841c8a6fdcca67b61 b560/GIS-Spatial-Analysis-A-New-Approach-to-Site-Selection-and-Decision-Makingfor-Small-Retail-Facilities.pdf

Agrawal, A., Garg, A., & Goel, M. (2021). Unlocking the potential of artificial intelligence in supply chain management. Journal of Enterprise Information Management, 34(3), 642– 662. doi: 10.1108/JEIM-07-2020-0284.

Alibaba Cloud (2019), "Double 11 logistics: Cainiao's battle of 'billions of parcels'", available at: https:// www.alibabacloud.com/blog/double-11-logistics-cainiaos-battle-of-billions-of-parcels_595648 (accessed 17 September 2020).

Ali, A. and Haseeb, M. (2019), "Radio frequency identification (RFID) technology as a strategic tool towards higher performance of supply chain operations in textile and apparel industry of Malaysia", Uncertain Supply Chain Management, Vol. 7 No. 2, pp. 215-226.

Amazon (2020), "Fulfilment in our buildings", available at: https://www.aboutamazon.co.uk/amazonfulfilment/fulfilment-in-our-buildings (accessed 15 September 2020).

Azadeh, K., De Koster, R. and Roy, D. (2019), "Robotized and automated warehouse systems: review and recent developments", Transportation Science, Vol. 53 No. 4, pp. 917-945.

Bai, C., Dallasega, P., Orzes, G. and Sarkis, J. (2020), "Industry 4.0 technologies assessment: a sustainability perspective", International Journal of Production Economics, Vol. 229 No. 107776, pp. 1-15.

Bertsimas, D., O'Hair, A., & Zabinsky, Z. (2021). Real-time price optimization with machine learning: Application to a retailer. INFORMS Journal on Applied Analytics, 51(1), 31–42.

Bogue, R. (2019), "Strong prospects for robots in retail", Industrial Robot: The International Journal of Robotics Research and Application, Vol. 46 No. 3, pp. 326-331.

Bolu, A. and Korcak, O. (2019), € "Path planning for multiple mobile robots in smart warehouse", 2019 IEEE 7th International Conference on Control, Mechatronics, and Automation, Delft.

Chung, S.-H. (2021), "Applications of smart technologies in logistics and transport: a review", Transportation Research Part E: Logistics and Transportation Review, Vol. 153, 102455, pp. 1-17.

Choudhury, A., Behl, A., Sheorey, P.A. and Pal, A. (2021), "Digital supply chain to unlock new agility: a TISM approach", (in press), Benchmarking: An International Journal. doi: 10.1108/BIJ-08-2020-0461.

Dutta, G., Kumar, R., Sindhwani, R. and Singh, R.K. (2020), "Digital transformation priorities of India's discrete manufacturing SMEs–a conceptual study in perspective of Industry 4.0", Competitiveness Review: An International Business Journal.

Edirisuriya, A., Weerabahu, S. and Wickramarachchi, R. (2018), "Applicability of lean and green concepts in logistics 4.0: a systematic review of literature", The 2018 International Conference on Production and Operations Management Society, Peradeniya, Sri Lanka.

Ejsmont, K., Gladysz, B. and Kluczek, A. (2020), "Impact of industry 4.0 on sustainability - bibliometric literature review", Sustainability, Vol. 12 No. 5650, pp. 1-29.

Gawankar, S.A., Gunasekaran, A. and Kamble, S.S. (2020), "A study on investments in the big datadriven supply chain, performance measures and organisational performance in Indian retail 4.0 context", International Journal of Production Research, Vol. 58 No. 5, pp. 1574-1593

Ghadge, A., Kara, M.E., Moradlou, H. and Goswami, M. (2020), "The impact of Industry 4.0 implementation on supply chains", Journal of Manufacturing Technology Management, Vol. 31 No. 4, pp. 669-686.

Ghobakhloo, M. (2020), "Industry 4.0, digitization, and opportunities for sustainability", Journal of Cleaner Production, Vol. 252, pp. 1-21.

Goh, S.H. (2019), "Barriers to low-carbon warehousing and the link to carbon abatement: a case from emerging Asia", International Journal of Physical Distribution and Logistics Management, Vol. 49 No. 6, pp. 679-704, doi: 10.1108/IJPDLM-10-2018-0354.

Hao, J., Shi, H., Shi, V. and Yang, C. (2020), "Adoption of automatic warehousing systems in logistics firms: a technology-organization-environment framework", Sustainability, Vol. 12 No. 12, doi: 10. 3390/su12125185.

Hennelly, P.A., Srai, J.S., Graham, G., Meriton, R. and Kumar, M. (2019), "Do makerspaces represent scalable production models of community-based redistributed manufacturing?", Production Planning and Control, Taylor & Francis, Vol. 30 No. 7, pp. 540-554.

Isbahi, M. B., Zuana, M. M. M. ., & Mariana, E. R. . (2022). The Technology Strategy in Website Communication Media in Improving Business Activities. *Majapahit Journal of Islamic Finance and Management*, *1*(2), 126–138. https://doi.org/10.31538/mjifm.v1i2.17

Issaoui, Y., Khiat, A., Bahnasse, A. and Ouajji, H. (2021), "Toward smart logistics: engineering insights and emerging trends", Archives of Computational Methods in Engineering, Vol. 28, pp. 3183-3210.

Isfitazli Tody, et al(2023)," Manpower Planning and Allocation in Warehousing Area: A Multi-Objective Optimization Approach using Goal Programming and Particle Swarm Optimization Methods" https://www.researchgate.net/publication/373038972_Manpower_Planning_and_All ocation_in_Warehousing_Area_A_Multi-Objective_Optimization_Approach_using_Goal_Programming_and_Particle_Swarm_Optimization_Methods Grinold (1977) in Holm (2008)

Junaidi, J. (2023). The Effect of Financial Literacy, Access to Capital, and Interest in Using E-Commerce on SMEs Performance (Study of SMEs in Blitar). *Indonesian Interdisciplinary Journal of Sharia Economics (IIJSE)*, *6*(2), 1109-1121. https://doi.org/10.31538/iijse.v6i2.3453

Kamali, A. (2019), "Smart warehouse vs. traditional warehouse – review", CiiT International Journal of Automation and Autonomous System, Vol. 11 No. 1, pp. 9-16.

Kaur, J. and Awasthi, A. (2018), "A systematic literature review on barriers in green supply chain management", International Journal of Logistics Systems and Management, Vol. 30 No. 3, pp. 330-348, doi: 10.1504/IJLSM.2018.10013872.

Kembro, J., Eriksson, E. and Norrman, A. (2022), "Sorting out the sorting in omnichannel retailing", Journal of Business Logistics. doi: 10.1111/jbl.12305.

Kembro, J. and Norrman, A. (2019), "Exploring trends, implications, and challenges for logistics information systems in omnichannels: Swedish retailers' perception", International Journal of Retail and Distribution Management, Vol. 47 No. 4, pp. 384-411.

Kosmol, T., Reimann, F., Kaufmann, L. (2019), "You'll never walk alone: why we need a supply chain practice view on digital procurement", Journal of Purchasing and Supply Management, Vol. 25 No. 4, 100553.

Kumar, R., Singh, R.K. and Dwivedi, Y.K. (2020), "Application of industry 4.0 technologies in SMEs for ethical and sustainable operations: analysis of challenges", Journal of Cleaner Production, Vol. 275, p. 124063.

Mahroof, K. (2019), "A human-centric perspective exploring the readiness toward smart warehousing: the case of a large retail distribution warehouse", International Journal of Information Management, Vol. 45, pp. 176-190.

Mahroof, K. (2019), "International journal of information management a human-centric perspective exploring the readiness towards smart warehousing: the case of a large retail distribution warehouse", International Journal of Information Management, Vol. 45, pp. 176-190, available at: https://doi.org/10.1016/j.ijinfomgt.2018.11.008

MH&L (2020), "Warehouse automation investment up due to COVID-19", available at: https://www. mhlnews.com/warehousing/article/21136484/warehouse-automation-invest-up-due-to-covid19 (accessed 15 May 2021).

Minashkina, D. and Happonen, A. (2020), "Decarbonizing warehousing activities through digitalization and automatization with WMS integration for sustainability supporting operations", Proceedings of the 7th International Conference on Environment Pollution and Prevention (ICEPP), p. 158, doi: 10.1051/e3sconf/202015803002.

Nguyen, T., Li, Z.H.O.U., Spiegler, V., Ieromonachou, P. and Lin, Y. (2018), "Big data analytics in supply chain management: a state-of-the-art literature review", Computers and Operations Research, Vol. 98, pp. 254-264.

Nimawat, D. and Gidwani, B.D. (2021), "Identification of cause and effect relationships among barriers of Industry 4.0 using decision-making trial and evaluation laboratory method", (in press), Benchmarking: An International Journal. doi: 10.1108/BIJ-08-2020-0429.

Qi, Y., Mohiuddin, A., & Duan, Y. (2020). Evidence-based decision-making in the retail industry. Journal of Retail Management, 23(3), 219–234

Queiroz, M.M., Pereira, S.C.F., Telles, R. and Machado, M.C. (2019), "Industry 4.0 and digital supply chain capabilities: a framework for understanding digitalisation challenges and opportunities", (in press), Benchmarking: An International Journal. doi: 10.1108/BIJ-12-2018-0435.

Rancati, G. and Maggioni, I. (2023), "Neurophysiological responses to robot–human interactions in retail stores", Journal of Services Marketing, Vol. 37 No. 3, pp. 261-275.

Reiser, C. (2020), "Investing in warehouse automation? Who isn't", available at: https://logisticsviewpoints.com/2020/07/08/warehouse-automation-investment (accessed 15 May 2021).

Roozen, I., Raedts, M. and Yanycheva, A. (2023), "Are retail customers ready for service robot assistants?", International Journal of Social Robotics, Vol. 15 No. 1, pp. 15-25.

Saberi, Z. (2021). Data-driven decision-making for online retail operations in sourcing, distribution, and assortment personalization (Doctoral dissertation, UNSW Sydney). Available from UNSW Works: https://unsworks.unsw.edu.au/server/api/core/bitstreams/65740110-af3a-44b3-8fda1f5db401a3d0/content

Song, C.S. and Kim, Y.K. (2022), "The role of the human-robot interaction in consumers' acceptance of humanoid retail service robots", Journal of Business Research, Vol. 146, pp. 489-503.

Taboada, I. and Shee, H. (2021), "Understanding 5G technology for future supply chain management", International Journal of Logistics Research and Applications, Vol. 24 No. 4, pp. 392-406, doi: 10. 1080/13675567.2020.1762850.

van Geest, M., Tekinerdogan, B. and Catal, C. (2021), "Design of a reference architecture for developing smart warehouses in Industry 4.0", Computers in Industry, Vol. 124, 103343, pp. 1-21.

Wu, Q., Xie, N. and Zheng, S. (2021), "Integrated cross-supplier order and logistic scheduling in cloud manufacturing" (in press), International Journal of Production Research. doi: 10.1080/00207543. 2020.1867921.

White, T. B., Petrovan, S. O., Booth, H., Correa, R. J., Gatt, Y., Martin, P. A., Newell, H., Worthington, T. A., & Sutherland, W. J. (2022). Determining the economic costs and benefits of conservation actions: A decision support framework. Conservation Science and Practice, 4(12) e12840. https://doi.org/10.1111/csp2.12840

Winkelhaus, S. and Grosse, E.H. (2020), "Logistics 4.0: a systematic review toward a new logistics system", International Journal of Production Research, Vol. 58 No. 1, pp. 18-43.

Zhang, D., Pee, L.G. and Cui, L. (2021), "Artificial intelligence in e-commerce fulfillment: a case study of resource orchestration at Alibaba's smart warehouse", International Journal of Information Management, Vol. 57, 102304.