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ARTIFICIAL INTELLIGENCE (AI) USE IN BUSINESS: ARTIFICIAL NEURAL NETWORK MODELLING FOR PREDICTING COST, MINIMISING WASTE AND OPTIMISING RESOURCE UTILISATION IN FURNITURE INDUSTRY**Tolga Yeşil***Department of Management and Organisation, Vocational School of Banaz, Uşak University, 64100 Uşak, Türkiye**E-mail: tolga.yesil@usak.edu.tr**Received 18 March 2025; accepted 11 June 2025; published 30 September 2025*

Abstract. The primary objective of this study is to develop a predictive model for estimating the cost of kitchen cabinets prior to the production process by employing artificial neural networks (ANN). The proposed model is structured with five input parameters related to kitchen cabinet specifications, a hidden layer comprising ten neurons, and a single output node representing the predicted cost. The model was trained using the Neural Fitting Tool available in the MATLAB environment. The MATLAB code and the dataset utilised in the study are also provided for reproducibility. Upon completion of the training phase, the model achieved a coefficient of determination (R-value) of 0.9716. Subsequent testing of the model yielded an R-value of 0.9682, indicating a high level of predictive accuracy. Corresponding regression plots are presented and discussed within the study. This approach demonstrates the potential of ANN-based models to improve cost estimation processes in the furniture manufacturing industry. Furthermore, by enabling data-driven decisions prior to production, such models contribute to sustainability efforts by minimising material waste, optimising resource utilisation, and reducing associated carbon emissions. The study also suggests that the methodology can be expanded by training the network with different types of data relevant to other segments of the furniture industry.

Keywords: AI; sustainability; cost; Artificial Neural Network; business; furniture industry; kitchen cabinet

Reference to this paper should be made as follows: Yeşil, T. 2025. Artificial Intelligence (AI) use in business: Artificial Neural Network modelling for predicting cost, minimising waste and optimising resource utilisation in furniture industry. *Entrepreneurship and Sustainability Issues*, 13(1), 107-117. <http://doi.org/10.9770/x6489289437>

JEL Classifications: Q56, M11, D24

1. Introduction

Making cost calculations before production takes place provides advantages for businesses in the sector. Today, researchers prefer artificial intelligence-based applications as an alternative to traditional methods of cost calculations. There are different studies in various scientific fields based on artificial intelligence. A growing body of literature examines the use of artificial intelligence (AI) across multiple sectors. AI has found widespread application in diverse domains such as finance, logistics, manufacturing, education and many others (Mugunzva & Manchidi, 2024; Pechová et al., 2024; Dubauskas & Išoraitė, 2025; Mabungela et al., 2025).

2. Literature Review

To provide a comprehensive perspective on the multifaceted applications of AI, relevant studies are reviewed in the literature review section.

Trstenjak et al. (2025) investigated the integration of AI within the framework of Industry 5.0, focusing on sustainability, ergonomics, and human factors. Their findings indicate that AI positively contributes to the optimisation of workplace conditions. Similarly, Clark et al. (2025) explored AI-based applications in food waste management, demonstrating that AI can effectively monitor and manage waste processes, significantly reducing food waste.

Naghipour et al. (2024) examined the use of AI in agriculture. They found that their AI model achieved an accuracy rate exceeding 90%, underlining its reliability and potential for broad application in the sector. Corrigan and Ikonnikova (2024) highlighted AI's importance in the mining industry, particularly for its role in reducing carbon emissions and operational costs.

Nazarenko et al. (2024) studied the application of AI in the education sector, supported by a European Union project and an innovation centre, aiming to improve educational outcomes. In the automotive industry, Sontag et al. (2023) emphasised the role of AI-based chatbots in customer relationship management, noting that these tools can simulate expert opinions and engage with customers on topics such as design, thereby enhancing customer interactions.

Na et al. (2023) conducted a comparative study on AI adoption in the construction sector, focusing on South Korea and the United Kingdom. Their research offered insights into cross-cultural perceptions and acceptance of AI technologies. Sardar et al. (2023) developed an AI application for maritime trade using an ant colony optimisation algorithm, which they found effective in reducing human error and increasing productivity.

Gupta et al. (2023) conducted a study involving 26 participants using an AI-powered facial recognition model. The study suggested that this technology could benefit the tourism sector by accurately identifying tourists' needs and enhancing personalised services. Ossa-Cardona (2024) proposed the development of an AI-based decision support system for managerial selection in family businesses. Based on the review of 65 academic articles, her study emphasised that such systems can lead to more objective and data-driven decisions.

In addition, Lopes et al. (2020) developed a deep convolutional neural network model to detect wood knots, utilising a dataset of 921 images. Akyüz et al. (2024) applied machine learning techniques to forecast the forest, paper, and printing index values in Borsa Istanbul. Li et al. (2025) investigated the energy intensity of AI in manufacturing firms in China, analysing annual data from 2006 to 2020. Their study concluded with strategic recommendations for energy savings and emission reduction.

Brunello et al. (2025) explored AI trends in the furniture industry, providing insights into both traditional and robotic manufacturing processes. Dirican (2015) addressed the broader implications of AI and robotic processes for the economy and business. Kaplan and Haenlein (2020) discussed both the opportunities and challenges presented by AI technologies.

Mumali (2022) reviewed 99 scientific publications published between 2011 and 2021, focusing on artificial neural networks applied in manufacturing processes. The study concluded that neural network models offer advantages in terms of cost efficiency and sustainability.

Xin (2025) conducted an empirical study on the impact of AI on financial risk, using data from 2010 to 2023. The findings demonstrated that AI can effectively reduce financial risks within institutions. Camacho et al. (2025) examined the role of AI in cybersecurity risk analysis. In contrast to many studies emphasising the positive aspects of AI, Galaz et al. (2021) also discussed potential systemic risks posed by AI, such as complex ecosystems and rapid climate change.

Baum and Owe (2023) emphasised the necessity of environmental ethics in response to the ethical challenges posed by AI. Several other researchers have explored ethical issues related to AI in various domains: López González et al. (2024) in cybersecurity, Terrones Rodríguez (2022) in sustainability, Savulescu et al. (2024) in medicine, Carillo (2020) in law, Fulmer et al. (2021) in psychology, Jackson et al. (2021) in pathology and laboratory medicine, and Iphofen and Kritikos (2021) in ethical design for digital societies.

Moodaley and Telukdarie (2023) conducted a literature review on AI and sustainability reporting. They emphasised that the intersection of AI and sustainability remains an underexplored area. Their study contributes to the literature by highlighting the significance of AI for advancing sustainability goals. Most studies in the literature focus on the positive contributions of AI in areas such as sustainability, efficiency, and cost reduction.

The common theme across these studies is the contribution of AI-based applications to businesses in terms of sustainability and other operational benefits. In line with this, the present study focuses on modelling kitchen cabinet costs in the furniture manufacturing sector using artificial neural network (ANN) techniques.

The primary objective of this study is to contribute to the extent of research by offering a practical example to estimate the production costs of a business operating in the furniture industry by employing artificial neural networks, a branch of artificial intelligence, prior to the commencement of manufacturing.

Conducting cost estimations before production not only facilitates effective cost management for businesses but also positively impacts sustainability and environmental outcomes.

The findings of this study demonstrate that artificial intelligence contributes to multiple dimensions—both directly and indirectly—benefiting organisational efficiency as well as environmental stewardship. The artificial neural network used in this study is a technique that involves artificial intelligence-based modelling.

3. Methodology

In this study, the dataset outlined in Appendix 1 was developed and analysed using MATLAB software. After importing the data into the model as inputs, an artificial neural network (ANN) was implemented. Mimicking the learning and adaptation mechanisms of human brain neurons, the ANN was trained to accurately model the relationship between input and output variables.

Neural Network Fitting application within the scope of Artificial Neural Networks using MATLAB R2022b version was used to create and solve the model. Kitchen countertop type, countertop type, kitchen cabinet door type, refrigerator slot and pantry are the inputs of the model. The total cost amount constitutes the output of the model. The total cost amount is verified by experts in the field. There are 10 hidden layers in the model. Out of 414 data; 70% of the data was used in the training phase, 15% in the verification of the data and 15% in the testing of the data. The data used in the model are given in Appendix 1. The visual form of the model is in Figure 1. The summary of the model is given in Table 1.

Table 1. Model Summary

Data division	Random
Training algorithm	Levenberg-Marquardt
Performance	Mean Squared Error
Layer Size:	10
Training data observations (%70)	290
Validation data observations (%15)	62
Test data observation (%15)	62

Source: Created by the author

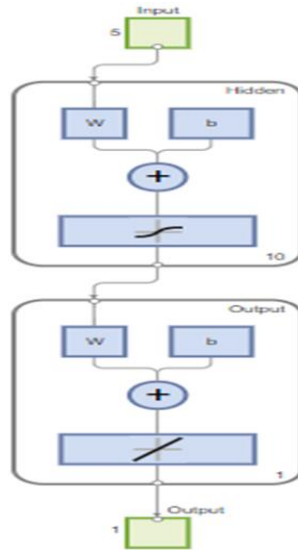


Fig. 1. The Artificial Neural Network Model

Source: Created by the author using MATLAB software

Limitations. In the fictional example presented within the methodology section of this study, the cost estimation model for kitchen cabinets can be further refined and expanded to achieve a more detailed and realistic structure. However, to enhance the model's accuracy and practical applicability, collaboration with expert academicians and professionals specialised in furniture production is deemed essential. This necessity represents one of the primary limitations of the current study.

Moreover, in today's market, where consumer preferences are highly diverse and virtually limitless, personalised production has become increasingly prominent. This trend requires cost estimation models to be adaptable to individual customer needs and product customisations. Consequently, general models must evolve into more flexible systems that accommodate personalised variables.

This study highlights the strategic importance of integrating artificial neural networks into the early stages of production planning, particularly in terms of advancing sustainable manufacturing practices. By enabling predictive cost analysis prior to production, such AI-driven approaches contribute to more efficient resource utilisation, waste reduction, and environmentally conscious decision-making in the furniture industry.

4. Results

When the model created through artificial neural networks for estimating the cost of kitchen cabinets was analysed in MATLAB program, the training results were obtained (see Table 2).

Table 2. Training Results

	Observation	MSE*	R**
Training	290	2.2052e+07	0.9716
Validation	62	1.0819e+07	0.9816
Test	62	1.7767e+07	0.9776

Source: Created by the author using MATLAB software

* MSE: Mean Squared Error **R: Correlation coefficient

When the training results in Table 2 are analysed, the regression graphs of the test results are presented in Figure 2 and Figure 3. The best validation performance was realised at the 25th iteration. As a result of training the data, the training R values were above 0.97. This value shows that the model is well-trained. The distribution of the data in the regression graph in Figure 2 reflects the visualisation of the training of the model.

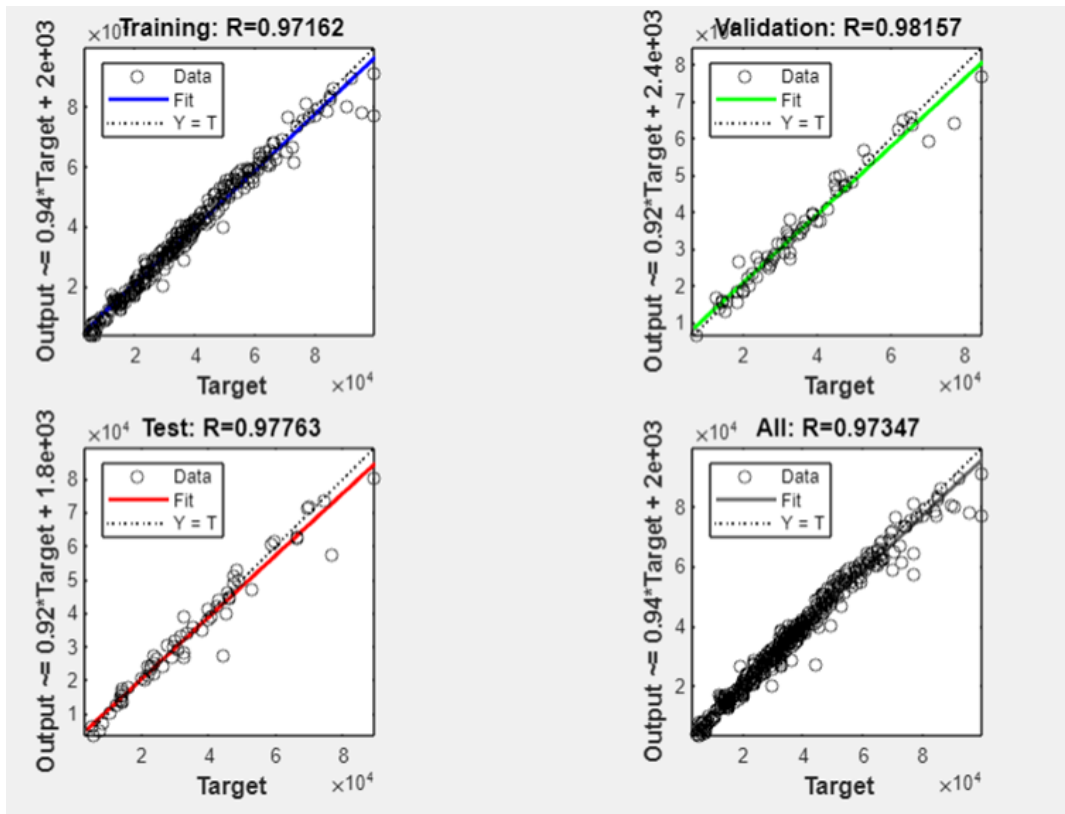


Fig. 2. Training Result Graph

Source: Created by the author using MATLAB software

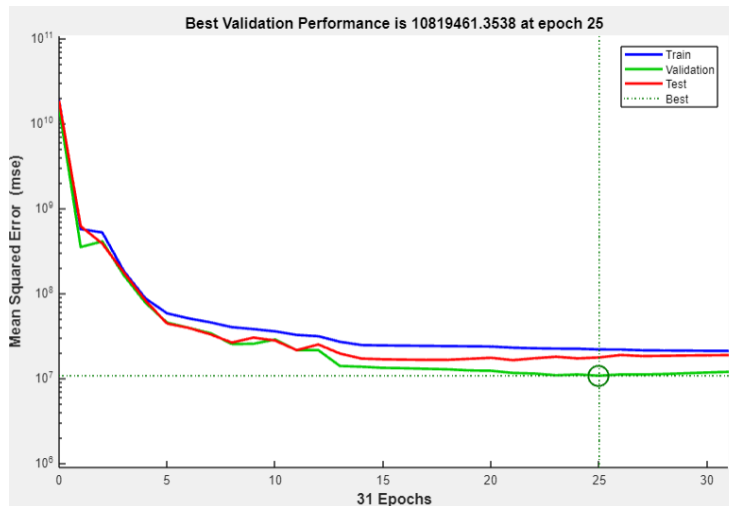
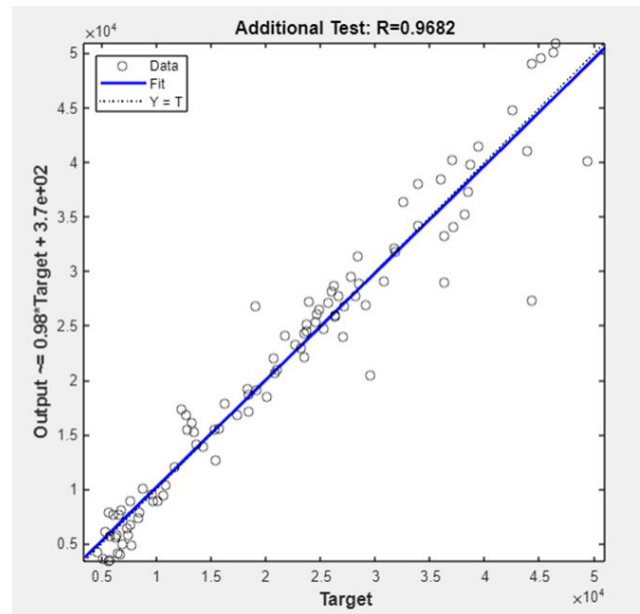


Fig. 3. Training Performance Graph

Source: Created by the author using MATLAB software

MATLAB program codes are available in Appendix 1. After the model training was completed, the relevant model was tested in the MATLAB program Neural Fitting Tools application with 100 data. As a result of the test, the R value was determined as 0.9682. The regression graph of the relevant test result is shown in Figure 4. It shows that the prediction results are highly consistent in the model.

**Fig. 4.** Additional Test Regression

Source: Created by the author using MATLAB software

In this study, the dataset was constructed and analysed using MATLAB software (see Appendix 1). Once the data were loaded into the model as inputs, the artificial neural network (ANN) was executed. Similar to the learning and adaptation processes of neurons in the human brain, the ANN was trained to achieve the targeted relationship between input and output values. Upon completion of the training phase, the model was tested and demonstrated a high level of consistency, yielding a strong correlation coefficient ($R = 0.9682$), as illustrated in Figure 4.

Conclusions

In this study, an artificial neural network (ANN) model was developed to estimate the cost of kitchen cabinets prior to the production process. The model utilises five distinct input variables—kitchen model, worktops, cabinet door, refrigerator slot, and pantry—and includes a hidden layer with ten neurons. The output of the model is the predicted total cost. Visual representations of the model architecture and associated regression graphs are included in the study. The MATLAB codes used for model development and training are also provided.

The model achieved a coefficient of determination (R) of 0.9716 during the training phase, demonstrating a high level of fit between predicted and actual values. Following training, the model was tested with independent data, yielding an R value of 0.9682. These results confirm the model's high predictive accuracy and reliability.

Beyond cost estimation, the model offers practical utility in decision-making processes such as profit margin analysis, break-even point calculations, and overall financial planning in furniture manufacturing operations. By enabling accurate pre-production cost assessments, this approach supports improved resource allocation and waste reduction.

From a sustainability perspective, the integration of artificial intelligence (AI) into production planning contributes to more efficient material usage and lower carbon emissions. As highlighted by Vaio et al. (2020) and Enholm (2022), AI-driven tools in industrial applications enhance organisational value while aligning with sustainable development goals (SDGs). The use of predictive modelling in the furniture industry, as demonstrated in this study, represents a meaningful step toward smart manufacturing and sustainability-driven business practices.

Future research can build upon this model by incorporating additional input parameters or expanding its application to other furniture types. The continued development of AI-based systems in manufacturing will play a critical role in achieving economic and environmental sustainability across the sector. As highlighted in the literature review, the use of artificial intelligence across various sectors today provides significant advantages.

This study emphasises the positive aspects of implementing artificial intelligence within the furniture manufacturing industry. It is posited that industries adapting AI applications while prioritising sustainability within ethical standards are more likely to achieve success.

References

- Akyüz, İ., Polat, K., Bardak, S. & Ersen, N. (2024). Prediction of values of Borsa Istanbul forest, paper and printing index using machine learning methods. *Bioresources*, 19(3), 5141-5157. <https://doi.org/10.15376/biores.19.3.5141-5157>
- Baum, S. & Owe, A. (2023). Artificial intelligence needs environmental ethics. *Ethics, Policy & Environment*, 26(1), 139-143. <https://doi.org/10.1080/21550085.2022.2076538>
- Brunello, A., Fabris, G., Gasparetto, A., Montanari, A., Saccomanno, N., & Scalera, L. (2025). A survey on recent trends in robotics and artificial intelligence in the furniture industry. *Robotics and Computer-Integrated Manufacturing*, 93, 1-25. <https://doi.org/10.1016/j.rcim.2024.102920>
- Camacho, J.M., Couce-Vieira, A., Arroyo, D., & Insua, D.R. (2025). A cybersecurity risk analysis framework for systems with artificial intelligence components. *International Transactions in Operational Research* <https://doi.org/10.1111/itor.70049>
- Carillo, M.R. (2020). Artificial intelligence: From ethics to law. *Telecommunications Policy*, 44(6), 101937 <https://doi.org/10.1016/j.telpol.2020.101937>
- Clark, Q.M., Kanavikar, D.B., Clark, J., & Donnelly, P.J. (2025). Exploring the potential of AI-driven food waste management strategies used in the hospitality industry for application in household settings. *Frontiers in Artificial Intelligence*, 7. <http://doi.org/10.3389/frai.2024.1429477>
- Corrigan, C.C. & Ikonnikova, S.A (2024). A review of the use of AI in the mining industry: Insights and ethical considerations for multi-objective optimisation. *Extractive Industries and Society*, 17. <http://doi.org/10.1016/j.exis.2024.101440>
- Dirican, C. (2015). The impacts of robotics, artificial intelligence on business and economics. *Procedia - Social and Behavioral Sciences*, 195, 564-573. <http://doi.org/10.1016/j.sbspro.2015.06.134>
- Dubauskas, G., & Išoraitė, M. (2025). Banking development peculiarities: blockchain, artificial intelligence (AI) and cybersecurity issues. *Entrepreneurship and Sustainability Issues*, 12(3), 61-72. <https://doi.org/10.9770/x7965543644>
- Enholm, I.M., Papagiannidis, E., Mikalef, P. & Krogstie, J. (2022). Artificial intelligence and business value: a literature review. *Information System Frontiers*, 24, 1709-1734. <http://doi.org/10.1007/s10796-021-10186-w>
- Fullmer, R., Davis, T., Costello, C. & Joerin, A. (2021). The Ethics of Psychological Artificial Intelligence: Clinical Considerations, *Counseling and Values*, 66(2), 131-144. . <http://doi.org/10.1002/cvj.12153>
- Galaz, V., Centeno, M., Callahan, P., Causevic, A., Patterson, T., Brass, I., Baum, S., Farber, D., Fischer, J., Garcia, D., McPhearson, T., Jimenez, D., King, B., Larcey, P., & Levy, K. (2021). Artificial intelligence, systemic risks, and sustainability. *Technology in Society*, 67. <https://doi.org/10.1016/j.techsoc.2021.101741>
- Gupta, S., Modgil, S., Lee, C.K., & Sivarajah, U. (2023). The future is yesterday: Use of AI-driven facial recognition to enhance value in the travel and tourism industry. *Information Systems Frontiers*, 25(3), 1179-1195. <http://doi.org/10.1007/s10796-022-10271-8>
- Iphofen, R., & Kritikos, M. (2021). Regulating artificial intelligence and robotics: ethics by design in a digital society. *Contemporary Social Science*, 16(2), 170-184. <https://doi.org/10.1080/21582041.2018.1563803>
- Jackson, B., Ye, Y., Crawford, J., Becich, M., Roy, S., Botkin, J., Baca, M. & Pantanowitz, L. (2021). The Ethics of Artificial Intelligence in Pathology and Laboratory Medicine: Principles and Practice. *Academic Pathology*, 8. <http://doi.org/10.1177/2374289521990784>
- Kaplan, A. & Haenlein, M. (2020). Rulers of the world, unite! The challenges and opportunities of artificial intelligence. *Business Horizons*, 63(1), 37-50. <http://doi.org/10.1016/j.bushor.2019.09.003>

- Lopes, D. J. V., Bobadilha, G. & Grebner, K. M. (2020). A Fast and robust artificial intelligence technique for wood knot detection. *Bioresources*, 15(4), 9351-9361. <https://bioresources.cnr.ncsu.edu/resources/a-fast-and-robust-artificial-intelligence-technique-for-wood-knot-detection/>
- López González, A., Moreno, M., Moreno Román, A. C., Hadfeg Fernández, Y., & Cepero Pérez, N. (2024). Ethics in Artificial Intelligence: an Approach to Cybersecurity. *Inteligencia Artificial*, 27(73), 38- 54. <https://doi.org/10.4114/intartif.vol27iss73pp38-54>
- Li, H., Lu, Z., Z. Z., & Tanasescu, C. (2025). How does artificial intelligence affect manufacturing firms' energy intensity? *Energy Economics*, 141, 1-9. <http://doi.org/10.1016/j.eneco.2024.108109>
- Mabungela, A. B., Nyusani, S., & Mthlane, N. (2025). Impact of AI use on postgraduate students: a systematic review. *Insights into Regional Development*, 7(2), 158-170. <https://doi.org/10.70132/z4973888974>
- Moodaley, W., & Telukdarie, A. (2023). Greenwashing, sustainability reporting, and artificial intelligence: a systematic literature review. *Sustainability*, 15(2), 1481. <https://doi.org/10.3390/su15021481>
- Mumali, F. (2022). Artificial neural network-based decision support systems in manufacturing processes: A systematic literature review, *Computers & Industrial Engineering*, 165, 1-20. <http://doi.org/10.1016/j.cie.2022.107964>
- Mugunzva, F. I., & Manchidi, N. H. (2024). Re-envisioning the artificial intelligence-entrepreneurship nexus: a pioneering synthesis and future pathways. *Insights into Regional Development*, 6(3), 71-84. <https://doi.org/10.70132/k5546584395>
- Na, S.G., Heo, S., Choi, W., Kim, C. & Whang, S.W. (2023). Artificial Intelligence (AI)-Based technology adoption in the construction industry: a cross national perspective using the technology acceptance model. *Buildings*, 13(10), <http://doi.org/10.3390/buildings13102518>
- Naghipour, M., Ling, L.S., & Connie, T. (2024). A Review of AI techniques in fruit detection and classification: analysing data, features and ai models used in agricultural industry. *International Journal of Technology*, 15(3), 585-596. <http://doi.org/10.14716/ijtech.v15i3.6404>
- Nazarenko, A.A., Zamiri, M., Sarraipa, J., Figueiras, P., Jardim-Goncalves, R., & Moalla, N. (2024). Integration of AI use cases in training to support industry 4.0. *Journal of Advances in Information Technology*, 15(3), 397-406. <http://doi.org/10.12720/jait.15.3.397-406>
- Ossa-Cardona, J.L (2024). Decision-making in the selection processes of managerial successors in business families and its influence with the use of cutting-edge technologies such as AI: a systematic review of the literature. *Journal of Family Business Management*, 15(2), 393-417. <http://doi.org/10.1108/JFBM-08-2024-0186>
- Pechová, J., Volfová, H., & Jírová, A. (2024). From interaction to integration: leveraging AI in enhancing team communication and task efficiency. *Entrepreneurship and Sustainability Issues*, 11(4), 276-292. [https://doi.org/10.9770/jesi.2024.11.4\(17\)](https://doi.org/10.9770/jesi.2024.11.4(17))
- Sardar, A., Anantharaman, M., Garaniya, V., & Khan, F. (2023). Optimisation of Daily Operations in the Marine Industry Using Ant Colony Optimization (ACO)-An Artificial Intelligence (AI) Approach. *Transnav-International Journal on Marine Navigation and Safety of Sea Transportation*. 17(2), 289-295. <http://doi.org/10.12716/1001.17.02.04>
- Savulescu, J., Giubilini, A., Vandersluis, R. & Mishra, A. (2024). Ethics of artificial intelligence in medicine. *Singapore Medical Journal*, 65(3), 150-158. <http://doi.org/10.4103/singaporemedj.SMJ-2023-279>
- Sonntag, M., Mehmman, J., & Teuteberg, F (2023). Deriving trust-supporting design knowledge for AI-based chatbots in customer service: a use case from the automotive industry. *Journal of Organizational Computing and Electronic Commerce*, 33(3-4), 178-210. <http://doi.org/10.1080/10919392.2023.2276631>
- Terrones Rodríguez, A.L. (2022). Ética para la inteligencia artificial sostenible. *Arbor*, 198(806), a683. <https://doi.org/10.3989/arbor.2022.806013>
- Trstenjak, M., Opetuk, T., Dukic, G., & Cajner, H. (2025). Use of Artificial Intelligence (AI) in the Workplace Ergonomics of Industry 5.0. *Tehnicki Glasnik-Technical Journal*, 19(2), 335-340. <http://doi.org/10.31803/tg-20250105140152>
- Xin, W. (2025). The impact of corporate artificial intelligence on financial risk: Evidence from China. *Financial Research Letters*, 81, <https://doi.org/10.1016/j.frl.2025.107435>
- Vaio, A. D., Palladino, R., Hassan, R., & Escobar, O. (2020). Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review. *Journal of Business Research*, 121, 283-314. <http://doi.org/10.1016/j.jbusres.2020.08.019>

Appendix 1. Input and Output Data Table

Input Data A: Kitchen Models* B: Kitchen Worktops** C: Cabinet Door*** D: Refrigerator Slot**** E: Pantry*****						Output Data F: Cost (Turkish Liras)	Input Data A: Kitchen Models* B: Kitchen Worktops** C: Cabinet Door*** D: Refrigerator Slot**** E: Pantry*****						Output Data F: Cost (Turkish Liras)	Input Data A: Kitchen Models* B: Kitchen Worktops** C: Cabinet Door*** D: Refrigerator Slot**** E: Pantry*****						Output Data F: Cost (Turkish Liras)
A	B	C	D	E		F	A	B	C	D	E		F	A	B	C	D	E		F
1	1	1	2	2		13629	2	1	1	2	2		35920	3	1	1	2	2		20381
1	2	1	2	2		15746	2	2	1	2	2		40154	3	2	1	2	2		23345
1	3	1	2	2		18447	2	3	1	2	2		45556	3	3	1	2	2		27126
1	4	1	2	2		19141	2	4	1	2	2		46943	3	4	1	2	2		28097
1	5	1	2	2		23594	2	5	1	2	2		55849	3	5	1	2	2		34331
1	6	1	2	2		19105	2	6	1	2	2		66872	3	6	1	2	2		42047
1	1	2	2	2		15315	2	1	2	2	2		39569	3	1	2	2	2		22941
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1	6	2	2	2		30791	2	6	2	2	2		70521	3	6	2	2	2		44607
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1	1	2	1	2		5312	2	1	2	1	2		29566	3	1	2	1	2		12938
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1	1	3	2	1		23798	2	1	3	2	1		40077	3	1	3	2	1		31923
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1	2	4	2	1	27168	2	2	4	2	1	47732	3	2	4	2	1	37263
1	2	5	2	1	45202	2	2	5	2	1	81264	3	2	5	2	1	63328
1	2	6	2	1	37166	2	2	6	2	1	66322	3	2	6	2	1	51713
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1	3	4	2	1	28248	2	3	4	2	1	51513	3	3	4	2	1	39424
1	3	5	2	1	46282	2	3	5	2	1	85045	3	3	5	2	1	65488
1	3	6	2	1	38246	2	3	6	2	1	70103	3	3	6	2	1	53874
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1	4	5	2	1	46559	2	4	5	2	1	86016	3	4	5	2	1	66043
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1	6	5	1	1	23802	2	6	5	1	1	65981	3	6	5	1	1	40030
1	6	6	1	1	20066	2	6	6	1	1	55340	3	6	6	1	1	32716

* (1): Linear Type (2): Parallel Type (3): L Type

** (1):Chipboard (2):Mdf Lam (3): High-gloss (4):Membrane (5): Solid / Veneer (6): Lacquer

*** (1): Laminate (2): Solid (3):Granit (4): Quartz (5):Marble (6):Corian

****(1): available (2): unavailable

***** (1): available (2): unavailable

Appendix 2. MATLAB Program Code

```
% Solve an Input-Output Fitting problem with a Neural Network
% Script generated by Neural Fitting app
% Created 21-Feb-2025 20:37:25
%
% This script assumes these variables are defined:
%
% input - input data.
% output - target data.
x = input;
t = output;
% Choose a Training Function
% For a list of all training functions type: help nntrain
% 'trainlm' is usually fastest.
% 'trainbr' takes longer but may be better for challenging problems.
% 'traincg' uses less memory. Suitable in low memory situations.
trainFcn = 'trainlm'; % Levenberg-Marquardt backpropagation.
% Create a Fitting Network
hiddenLayerSize = 10;
```

```
net = fitnet(hiddenLayerSize,trainFcn);
% Setup Division of Data for Training, Validation, Testing
net.divideParam.trainRatio = 70/100;
net.divideParam.valRatio = 15/100;
net.divideParam.testRatio = 15/100;
% Train the Network
[net,tr] = train(net,x,t);
% Test the Network
y = net(x);
e = gsubtract(t,y);
performance = perform(net,t,y)
% View the Network
view(net)
% Plots
% Uncomment these lines to enable various plots.
%figure, plotperform(tr)
%figure, plottrainstate(tr)
%figure, ploterrhist(e)
%figure, plotregression(t,y)
%figure, plotfit(net,x,t)
```

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