Evaluating Critical Success Factors for Implementation of Internet of Things (IoT) Using DEMATEL: A Case of Indonesian Automotive Company

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ABSTRACT

The implementation of technology is used to support the Making Indonesia 4.0 Program in various industrial sectors in Indonesia to achieve optimization of company performance. This is in line with the Indonesian Government Program through the Ministry of Industry, namely Making Indonesia 4.0. In the Making Indonesia 4.0 Program, there are 7 leading manufacturing sectors. The automotive sector is the object of this research because automotive sector is a leading player in the export of Internal Combustion Engines (ICE) and Electrified Vehicles (EVs). The technology discussed in this research is to support the Making Indonesia 4.0 Program, namely the application of the Internet of Things (IoT) to automotive companies. This research aims to evaluate the critical success factor (CSF) of IoT implementation in automotive companies in Indonesia and obtain a relationship from each dimension that becomes an evaluation of the critical success factor (CSF) of IoT implementation in automotive companies in Indonesia. In this research, the validation stage was carried out by 5 panels of experts in Indonesia who have experience and knowledge in the field of IoT application in automotive companies. The results of the research using the DEMATEL method obtained 4 critical success factors (CSF) for IoT implementation in automotive companies in Indonesia which are dispatchers who are the top priority because they have a greater influence. The four dimensions are the Marketing Dimension, Finance Regulation, and Resources. While the other 4 dimensions, namely the Dimensions of Innovation and Ideas and Resources, Operations, People, and Management, Technology became the receiver as the last priority because it received greater influence. The results of this research can be used as a reference for the automotive industry and various other industries in conducting evaluations related to the critical success factor (CSF) of IoT implementation in companies to improve company performance.

ICONETSI, September 21, 22, 2022, Alam Sutera, Tangerang, Indonesia

ACM ISBN 978-1-4503-9718-6/22/09…$15.00
https://doi.org/10.1145/3557738.3557867

CCS CONCEPTS

• **Multiple Criteria Decision Making**; • **Decision Analysis**; • **Technology Information System**; • **Evaluating Critical Success Factors**;

KEYWORDS

Critical Success Factors, Implementation of IoT, Automotive Companies, DEMATEL

ACM Reference Format:
Inaki Maulida Hakim*, Moses Laksono Singgih, and I Ketut Gunarta. 2022. Evaluating Critical Success Factors for Implementation of Internet of Things (IoT) Using DEMATEL: A Case of Indonesian Automotive Company. In *Proceedings of the International Conference on Engineering and Information Technology for Sustainable Industry (ICONETSI), September 21, 22, 2022, Alam Sutera, Tangerang, Indonesia.* ACM, New York, NY, USA, 7 pages. https://doi.org/10.1145/3557738.3557867

1 INTRODUCTION

The Government of Indonesia through the Ministry of Industry has a Making Indonesia 4.0 Initiative Program. Where the Making Indonesia 4.0 Initiative Program aims to implement Industry 4.0 technology in Indonesia. This initiative will be focused on revitalizing the Manufacturing Industry to increase Indonesia's net export contribution to GDP so that the aspiration to become a Global Top 10 GDP can be achieved. The seven sectors in the Manufacturing Industry that are the focus of this initiative are food and beverages, textiles and clothing, automotive, chemical, electronics, and 2 additional sectors, namely the Health sector and the Drugs sector [3]. In this research, the automotive sector was chosen to be the focus of the research because it is one of the sectors that contribute greatly to the economy in Indonesia, namely as the second largest automotive exporter in ASEAN [3].

In the implementation of Industry 4.0 technology through the Making Indonesia 4.0 initiative, there are nine technology pillars: *autonomous robots, simulation, system integration, internet of things, cyber security, cloud computing, additive manufacturing, augmented reality,* and *big data* [8]. One of the technological pillars that are the main layer of the implementation of Industry 4.0 is the internet of things [1]. This makes the internet of things (IoT) a technological pillar that needs to be met first to form an adequate Industry 4.0 ecosystem [1]. Internet of things technology was chosen as the focus of this research. The Internet of Things is a system of interrelated computing devices, mechanical machines, and digital objects equipped with UIDs (Unique Identifiers) and can transfer data over the internet network [5].

The implementation of the use of IoT technology in the Manufacturing Industry can help the functions of supply chain management, operating efficiency [11], predictive maintenance [17], and inventory optimization [13]. Seeing this function, the application of IoT is projected to increase along with many industries that are already heading towards the application of Industry 4.0. The establishment of a good IoT ecosystem requires the identification of critical success factors (CSFs) so that the application of IoT can support long-term business success [8]. In addition, companies need to evaluate critical success factors (CSF) to control and provide the right decisions and obtain strategies to achieve company performance [11]. Automotive companies in Indonesia already have critical success factors (CSF) in the implementation of IoT technology to support their business activities. However, not all companies evaluate and have the right method for evaluating critical success factors (CSF) in the implementation of IoT technology applied to this company. This research contributes to obtaining the right method for evaluating critical success factors (CSF) in the implementation of IoT technology so that the company has the right priority scale and strategy for the sustainability and achievement of company performance, especially in the automotive sector.

2 LITERATURE REVIEW

This research conducted a literature review to obtain the right method for evaluating critical success factors (CSF). Evaluation of critical success factors (CSF) needs to be carried out to be able to improve company performance and provide input to the company regarding company performance to achieve the company's targets and achievements [8]. Critical success factors (CSF) as an important element in an organization to be able to achieve its goals [7]. Evaluation of critical success factors (CSF) is necessary to achieve success in a business that represents zones of the system that must be given serious attention continuously to achieve better company performance [6].

Some Multiple Criteria Decision Making (MCDM) Methods have their own advantages and disadvantages and characteristics in their use. There are several MCDM methods based on literature studies in this research to evaluate Critical success factors (CSF) among others using the AHP method, the DEMATEL method and the ANP method. In Table 1 below, a literature research related to methods for evaluating critical success factors (CSF) in companies.

Some MCDM methods such as the AHP method have a distinctive feature that the hierarchy formed considers the distribution of goals between the elements in the hierarchical structure but does not assess which elements have a greater influence on the element [21]. Whereas the ANP Method is not widely used because it is complicated [21] and only acquired dependencies between variables [22]. The DEMATEL method is capable of analyzing the mutual influence between various factors [21] and finding complicated cause and effect relationships [16]. In addition, the DEMATEL method can provide alternative ratings and find critical evaluation criteria and measure critical weights [23].

Based on literature studies related to the MCDM method this research uses the Literature Research and DEMATEL Method to evaluate critical success factors (CSF) in automotive companies in Indonesia and get the relationship between factors from complex systems later used for long-term decision making. Some of the advantages of the DEMATEL Method are obtaining a structured model form for evaluating the decision-making process [30] and obtaining visualization of the causal relationships of the sub-system by offering a causal diagram based on an understanding of the character of the problem and expert opinion [31]. Therefore, looking at the advantages of the DEMATEL Method, it is very appropriate to be used in cases and scenarios in this research.

3 METHODOLOGY

In this research, the methodology stage was divided into four parts, namely the first part of collecting critical success factors (CSF) in the implementation of IoT in automotive companies obtained by literature review and expert, the second part of the profile of expert, the third part of the stages in this research and the fourth part of the explanation of the DEMATEL Method used in this research.

3.1 Critical Success Factors (CSF) Dimension

The dimensions used in this research which are critical success factors (CSF) for IoT implementation in automotive companies are further research from researchers based on previous literature reviews [15] consisting of 8 dimensions which are criteria for evaluation indicators in IoT implementation in automotive companies in Indonesia. These dimensions consist of the Marketing Dimension (D1), the Regulatory Dimension (D2), the People and Management Dimension (D3), the Operation Dimension (D4), the Technology Dimension (D5), the Finance Dimension (D6), the Innovation and Ideas Dimension (D7) and the Resource Dimension (D8).

3.2 Profile Expert

Experts in this research consisted of 5 people who had different professions and backgrounds. Experts come from academics, practitioners in manufacturing, instructors, and the ministry of industry who become coordinators in the field of industry 4.0. Expert profiles are in table 2 below.

3.3 Research Stages

The stages in this research are divided into 4 stages. The first stage is to identify the critical success factors (CSF) of IoT implementation in automotive companies based on literature studies in previous research. The second stage is to do a consensus with experts. The third stage evaluates the questionnaire that has been filled out by experts and processes the data from the questionnaire results using the DEMATEL Method stages described in sub-chapter 3.4. Furthermore, the fourth stage of this research validates the results of processing with the DEMATEL Method to see the results of processing expert assessment data by looking at the threshold value and then making conclusions and recommendations for the results of the research.

Table 1: Literature Review For Evaluating Critical Success Factors (CSF)

No	Author	Method				Research Aim
		Literature Review	***AHP***	**DEMATEL**	**ANP**	
1	Abidin et al., 2012	-	-	-	√	*Determining and Ranking CSF Vendor Automotive in Malaysia*
2	Nilashi et al, 2014	-	-	√	√	*Evaluation of Critical Success Factors in Construction Projects*
3	Gandi et al., 2014	-	-	√	-	*Evaluating Critical Success Factors for Green Supply Chain*
4	Kumar, et al., 2015	-	√	-	-	*Evaluation of Critical Factors for Technology Transfer Process*
5	Wan & Zeng, 2015	√	-	-	-	*Key Success Model Factors for Innovation Application of IoT*
6	Kiani Mavi and Standing C,2018	-	-	√	√	*Evaluation Critical Success Factors Project Management in Construction Industry*
7	Huang et al., 2019	√	-	-	-	*Evaluation of Critical Success Factors for ERP System Implementation in Sustainable Corporations*
8	Singh and Sarkar, 2020	-	-	√	-	*Evaluating Priority CSF in Indian Automotive Industry*
9	Li et al,2020	-	-	√	-	*Analyzing Critical Success Factors in China Textile Industry*
10	This Research, 2022	√	-	√	-	*Evaluating Critical Success Factors in Indonesian Automotive Company*

Table 2: Profile of Expert

No Expert	Expert	Qualification	Year of Experience
1	Professor	Doctor	34
2.	Advisor	Master	31
3.	Head of IT	Master	7
4.	Coordinator of IR 4.0	Master	13
5.	General Manager	Master	25

3.4 The Stage of the DEMATEL Method

Decision-Making Trial and Evaluation Laboratory (DEMATEL) is one of the MCDM methods that can be used in solving causal relationship problems between factors. This method was invented at the Battelle Memorial Institute in Geneva in 1972 as a procedure for analyzing the structure of the problem and developing causal relationships between factors [20]. In its development, DEMATEL is increasingly used to visualize the structure of complex causal relationships using diagrams that can show strength.

The following are the stages of the DEMATEL method based on [20] namely:

1. Building a matrix of direct influence (by assessing the relationship between one criterion, i, against another criterion, j, as a a_ij using a scale of 0 – 4, with 0 worth "no effect", 1 worth "little influence", 2 worth "quite influential", 3 worth "influential", and 4 worth "very influential".

2. Carrying out the process of normalization of the matrix of direct influence, S, using equations (1) and (2)

$$\boldsymbol{S} = m \times \boldsymbol{A} \tag{1}$$

$$m = min\left[\frac{1}{max_i \sum_{j=1}^{n} |a_{ij}|}, \frac{1}{max_j \sum_{i=1}^{n} |a_{ij}|}\right] \tag{2}$$

3. Obtaining the matrix of total direct influences, T, using equations (3) and (4) where I is the identity matrix. The matrix of the total direct influences is obtained from the following equation:

$$\begin{aligned}\boldsymbol{T} &= S + S^2 \ldots + S^q \\ &= S\left(I + S + S^2 \ldots + S^{k-1}\right)(I - S)(I - S)^{-1} \\ &= S\left(I - S^q\right)(I - S)^{-1}\end{aligned} \tag{3}$$

Where $q \rightarrow \infty,\ S^q = [0]_{n \times n}$, then

$$\boldsymbol{T} = \boldsymbol{S}(I - \boldsymbol{S})^{-1} \tag{4}$$

4. Counting the sum of the rows and columns of the matrix T, where the vectors R (5) and D (6) present the sum of each row and column.

$$\boldsymbol{R} = [R_i]_{n \times 1} = \left[\sum_{j=1}^{n} t_{ij}\right]_{n \times 1} \tag{5}$$

$$\boldsymbol{D} = [D_j]_{n \times 1} = \left[\sum_{i=1}^{n} t_{ij}\right]_{1 \times n} \tag{6}$$

5. R_i expresses the sum of the i-th row in the T matrix and shows the direct and indirect effects of criterion i on other criteria. Meanwhile, D_j shows the amount of direct and indirect effects received by criterion j from other criteria. When i=j, the summationR_i and D_j gives an index of both accepted and given levels of influence. In addition, if $(R_i - D_j)$ has a positive value, it indicates that other factors are affected by factor i. But if $(R_i - D_j)$ is negative, then factor i is affected by other factors.

6. Building a causal diagram by mapping the results $(R_i + D_j,\ R_i - D_j)$. Before building the diagram, it is necessary to determine the threshold value for the degree of influence where only factors in the T matrix have a value greater than the threshold value that will be shown in the diagram.

4 RESULT AND DISCUSSION

This research used the stages of the DEMATEL method, it began with determining the evaluation scale using a scale of 0-4. A value of 0 means that it has no influence or interaction. Value 2 has a moderate influence, value 3 has a strong interaction influence, and value 4 has a very strong interaction influence [23]. Furthermore, matrix calculations are carried out to obtain causal relationships between dimensions that are critical success factors (CSF) for IoT implementation in automotive companies. After calculating the matrix, a network relationship map (NRM) is built to get the relationship between dimensions.

4.1 DEMATEL Processing Results

The results of data processing are based on a recapitulation of expert opinions to obtain a Dematel Diagraph. Before obtaining the Diagraph DEMATEL is built on the value $(d_i + r_j)$ and $(d_i - r_j)$ of each criterion and subcriteria. The value $(d_i + r_j)$ indicates the degree of relationship between criteria and sub-criteria, where the higher the value indicates a stronger relationship [30]. While the value $(d_i - r_j)$ indicates the magnitude of the influence of a sub-criteria or criterion on sub-criteria or other criteria [30].

The calculation results (D-R) show the strength of influence between risk events. A positive value (D-R) indicates that the risk event has a greater influence than other risk events [16] and can be assumed to be the top priority, and is called a dispatcher. A negative (D-R) value means that the risk event receives a greater influence and can be assumed to be the last priority, called the receiver. The calculation results (D+R) show the strength of the relationship between risk events [16]. A greater value (D+R) means a larger relationship [21]. Figure 1 below shows the Diagraph DEMATEL.

Figure 1 shows the DEMATEL Diagraph obtained by looking at the values (D+R) and (D-R). The horizontal direction indicates the importance and the vertical direction indicates the relationship. For example, in the marketing dimension (D1) the value (D +R) is 3,812 and the value (D-R) is 0.110, this is because the D-R value is positive for the Marketing Dimension (D1) to be a dispatcher. This means that the Marketing Dimension (D1) has interests that are

Table 3: Calculation Result (D+R) and (D-R)

Dimension		D	R	D+R	D-R	Conclusion
Marketing	D1	1.961	1.851	3.812	0.110	dispatcher
Regulation	D2	2.173	1.980	4.153	0.192	dispatcher
People and Management	D3	2.125	2.268	4.393	-0.143	receiver
Operation	D4	2.128	2.317	4.445	-0.189	receiver
Technology	D5	2.140	2.323	4.463	-0.183	receiver
Finance	D6	2.204	1.904	4.108	0.300	dispatcher
Innovation and Ideas	D7	2.226	2.393	4.618	-0.167	receiver
Resource	D8	2.144	2.065	4.209	0.079	dispatcher

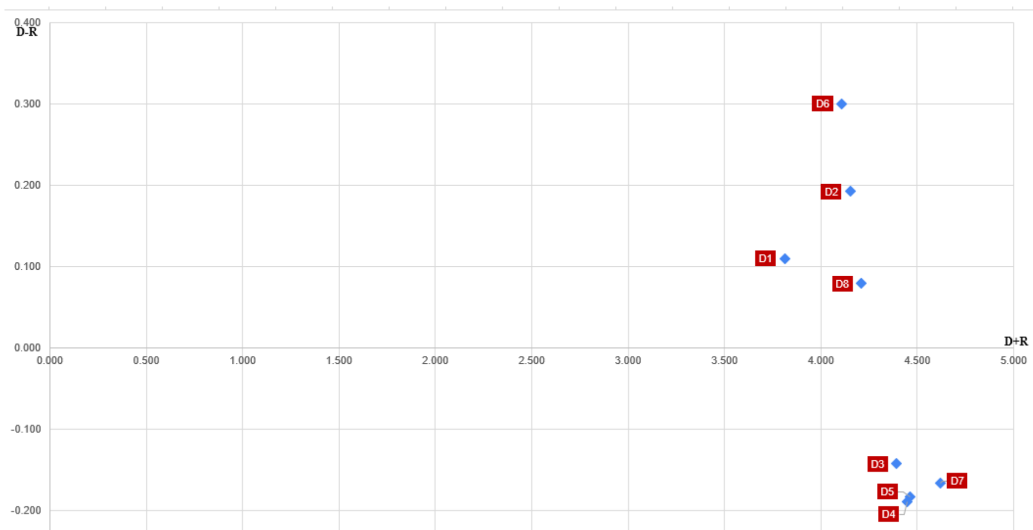

Figure 1: Diagraph DEMATEL

priorities and has a strong relationship to influence other dimensions. Meanwhile, in the People and Management (D3) Dimension of calculation using the DEMATEL Method, a value (D + R) was obtained, namely 4,393 and a value (D-R) of -0.143. In the People and Management (D3) Dimension, the value (D-R) is negative, meaning that the People and Management (D3) Dimension has a less strong relationship so that it becomes a receiver so that it is influenced by other dimensions that have a strong relationship. In addition, the People and Management (D3) dimension is also not a top priority for companies.

The results showed that 4 dimensions become dispatchers, namely the Dimensions of Marketing, Regulation, Finance, and Resources. This is because these 4 dimensions based on expert opinions are the most important and are a priority in determining the critical success factors (CSF) of IoT implementation in automotive companies in Indonesia. The company in evaluating the performance of the activities of each department has its dimensions or criteria. Important criteria for companies are used to be the company's priority in determining strategies and evaluation materials regularly [28] to minimize the occurrence of risks [27].

Whereas the other 4 dimensions, namely the Dimensions of People and Management, Operation, Technology and Innovation, and Ideas, become receivers. According to experts, these four dimensions are strongly influenced by internal and external factors of the company. External factors such as demand from customers who want products of good quality [10] and prompt delivery [12] and internal factors such as the selection of the right technology in the application of Industry 4.0 to support the government. There are several things to consider including technology identification, technology utilization, and technology protection [12]. All of these factors are considered by the management team to make the right strategic decisions in achieving optimization of company performance achievements [18].

4.2 Network Relationship Map (NRM)

The result of data processing using DEMATEL is the Network Relationship Map (NRM). After getting the values (D +R) and (D-R) and then creating a DEMATEL Diagraph, a Network Relationship Map (NRM) can be created, with the arrow direction represented by the

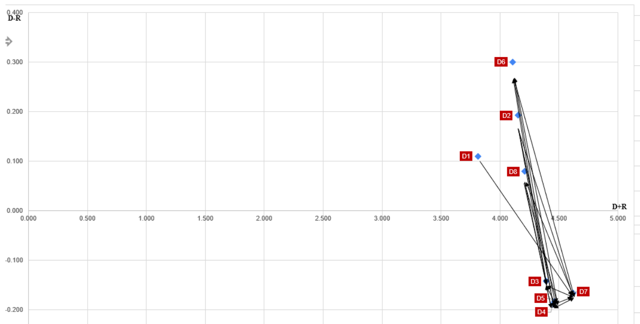

Figure 2: Network Relationship Map (NRM)

value on the matrix that exceeds the threshold value. The Threshold Value is the threshold value of a parameter to form a network [28]. In this research, the Global Threshold Value was obtained, which was 0.274. After that make sure the threshold value in the next stage makes the network relationship map (NRM). DEMATEL Method is the valid method for knowing the relationship between factors. We can analyze the relationship between each dimension with the other. We can make the decision and make strategy based on calculating DEMATEL Method. In this research, the network relationship map (NRM) is shown in Figure 2 below.

Figure 2 shows the position of each dimension that forms the network on the Network Relationship Map (NRM). The results showed that the Innovation and Ideas (D7) Dimension had the strongest relationship when compared to the other 7 dimensions. This is because the Innovation and Ideas (D7) Dimension has the largest value (D + R) when compared to the other 7 dimensions. In addition, the Innovation and Ideas (D7) Dimension is also a priority and reason for companies to switch to using IoT to support their business processes towards digitalization. This is done by the company to obtain effective and efficient business processes so that it can achieve optimal company performance (4) and company sustainability (20).

The Finance dimension (D6) has the strongest influence when compared to the other 7 dimensions. The Finance Dimension (D6) has a value (D-R) that has a positive value and the value is the largest when compared to the other 3 dimensions that have a positive value. The Finance Dimension (D6) affects the implementation of the Making Indonesia 4.0 (3) Program so that the financial aspect is considered by the company to use technology 4.0 in its business processes. The company considers from the financial condition of the company whether it has allocation and financial planning to purchase technology 4.0 devices (15) in addition to that it is also needed for employee training and system maintenance costs (15) and most importantly the company considers in implementing technology 4.0 to help its business processes whether it has an impact on the company is related to profit for the company because it is for the sustainability of the company [19].

5 CONCLUSION AND RECOMMENDATION

This research has been carried out starting from a literature review in identifying the dimensional criteria that become critical success factors (CSF) for IoT implementation in automotive companies in Indonesia. There are 8 dimensions, namely the Marketing Dimension (D1), the Regulation Dimension (D2), the People and Management Dimension (D3), the Operation Dimension (D4), the Technology Dimension (D5), the Finance Dimension (D6), the Innovation and Ideas Dimension (D7) and the Resources Dimension (D8).

In the dimension innovation and ideas (D7) have the strongest relationship when compared to the other 7 dimensions balanced with strong relationships and interests due to value. The Finance dimension (D6) has the strongest influence when compared to the other 7 dimensions. The results of this research can be an evaluation for other automotive companies to get a critical success factor (CSF) for IoT implementation in automotive companies. The novelty in this research is to identify the ciritcal success factors for the implementation of IoT in Indonesian Automotive Companies that have not been carried out in previous study. In addition, a practical contribution from this research is to obtain critical success factors for IoT implementation can be used in automotive companies and other manufacturing sectors in evaluating and designing performance indicators so as to improve caompany performance in the long term.

Suggestions and recommendations for the next research are that this research has not included sub-dimensions that are sub-criteria in evaluating critical success factor (CSF) and also has not determined the priority scale on each dimension and sub-dimension accompanied by testing using quantitative methods to obtain optimal results.

ACKNOWLEDGMENTS

This research was funded by PUSLAPDIK and LPDP. The authors also acknowledgments great thanks for the experts for suggestion to improve quality and content of this research.

REFERENCES

[1] M. Hermann, T. Pentek, and B. Otto, "Design Principles for Industrie 4.0 Scenarios," in *Proc. HICSS*, Hawaii, USA, 2016, pp. 3928–3937.

[2] Kumar R., Singh R K. & Shankar R. (2015). Critical success factors for the implementation of supply chain management in Indian small and medium enterprises and their impact on performance. *IIMBManagement Review*.

[3] Kemenrian Perindustrian (2020).Kemenprin Andalkan 7 Sektor Industri Selamatkan Pertumbuhan Ekonomi Kuartal II. ttps://www.erdeka.com/uang/kemenperin-andalkan-7-sektor-industri-ini-selamatkan-pertumbuhan-ekonomi-kuartal-ii.html. (access on 10 June 2022).

[4] Attaran, M. (2012). Critical success factors and challenges of implementing RFID in supply chain management. *Journal of Supply Chain and Operations Management*, *10*(1), 144–167.

[5] B, R. R. (2018). A Comprehensive Literature Review on Data Analytics in IIoT (Industrial Internet of Things). *Helix*, *8*(1), 2757–2764. Htt ps://doi.org/10.29042/2018-2757-2764.

[6] Finney, S., & Corbett, M. (2014). ERP Implementation: A Compilation and Analysis of Critical Success Factors. *Business Process Management Journal, 13*(3), 329–347.

[7] Freund, Y. P. (1994). Critical Success Factors. *Planning Review*, *16*(4), 20–23.

[8] Kementrian Perindustrian (2018*).Empat Strategi Indonesia Masuk Revolusi Industri 4.0* http://www.kemenperin.go.id/artikel/17565/Eat (access on 9 March 2019).

[9] Ju, J., Kim, M. S., & Ahn, J. H. (2016). Prototyping Business Models for IoT Service. *Procedia Computer Science*, *91*(Itqm),882–890.

[10] Kumar, S., Luthra, S., Haleem, A., Mangla, S. K., & Garg, D. (2015). Identification and evaluation of critical factors to technology transfer using AHP approach. *InternationaStrategic Management Review*, *3*(1–2), 24–42.

[11] Kiba-Janiak, M. (2016). Key Success Factors for City Logistics from the Perspective of Various Groups of Stakeholders. *Transportation Research Procedia*, *12*(June 2015), 557–569.

[12] Wan, J., & Zeng, M. (2015). Research on Key Success Factors Model for Innovation Application of Internet of Things with Grounded Theory. *WHICEB 2015 Proceedings*, 647–654.

[13] Sadique, K. M., Rahmani, R., & Johannesson, P. (2018). Towards security on internet of things: Applications and challenges in technology. *Procedia Computer Science*, *141*, 199–206. https://doi.org/10.1016/j.procs.2018.10.168.

[14] Talib, M. S. A., Hamid, A. B. A., & Thoo, A. C. (2015). Critical success factors of supply chain management: A literature survey and Pareto analysis. *EuroMed Journal of Business*, *10*(2), 234–263.

[15] Hakim, I. M., Singgih, M. L., & Gunarta, I. K. (2021). Critical success factors for implementation of internet of things (IoT) in automotive companies: A literature review. In *Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management, 2021,* pp. 5199-520.

[16] Gandhi, S., Mangla, S.K., Kumar, P., Kumar, D. Evaluating factors in implementation of successful green supply chain management using DEMATEL: a case research. International Strategic Management Review, 2015.

[17] Landherr, M., Schneider, U., & Bauernhansl, T. (2016). The Application Center Industrie 4.0 - Industry-driven Manufacturing, Research and Development. *Procedia CIRP*, *57*, 26–31.

[18] Nah .F.F., & Lau.L.J. (2001). Critical Factors For Successful Implementation Of Enterprise Systems. Business Process Management Journal, Vol. 7 No. 3, 2001,pp. 285-296. MCB University Press, 1463-7154.Emerald Library.

[19] Huang.Y.S., Chiu.A.A.,Chao.P.C & Arniati.A.(2019). Critical Success Factors in Implementing Enterprise Resource Planning Systems for Sustainable Corporations. pp 11,6785. mdpi.com/journal/sustainability.

[20] Yang, J.L. and Tzeng, G.H. 2011. An integrated MCDM technique combined with DEMATEL for a novel cluster-weighted with ANP method. *Expert Systems with Applications*. 38, 3 (2011), 1417–1424. DOI:https://doi.org/10.1016/j.eswa.2010.07.048.

[21] Zhao, G., Irfan Ahmed, R., Ahmad, N., Yan, C., & Usmani, M.S. (2021). Prioritizing critical success factors for the sustainable energy sector in China: A DEMATEL approach. *Energy Strategy Reviews*, *35*(November 2020), 100635. https://doi.org/10.1016/j.esr.2021.100635.

[22] Yang, C. L., & Huang, R. H. (2011). Key success factors for online auctions: Analysis of auctions of fashion clothing. *Expert Systems with Applications*, *38*(6), 7774–7783. https://doi.org/10.1016/j.eswa.2010.12.130.

[23] Yang, J. L., & Tzeng, G. H. (2011). An integrated MCDM technique combined with DEMATEL for a novel cluster-weighted with ANP method. *Expert Systems with Applications*, *38*(3), 1417–1424.https://doi.org/10.1016/j.eswa.2010.07.048.

[24] Abidin, A. S. Z., Muslimen, R., & Yusuff, R. M. (2012). Determining and ranking of CSFs for design capabilities development in Malaysian automotive vendors. *Advanced Materials Research*, *433–440*, 2212–2218. https://doi.org/10.4028/www.scientific.net/AMR.433-440.2212.

[25] Chen, F. H., Hsu, T. S., & Tzeng, G. H. (2011). A balanced scorecard approach to establish a performance evaluation and relationship model for hot spring hotels based on a hybrid MCDM model combining DEMATEL and ANP. *International Journal of Hospitality Management*, *30*(4), 908–932. https://doi.org/10.1016/j.ijhm.2011.02.001.

[26] Hsu, C. W., & Yeh, C. C. (2017). Understanding the factors affecting the adoption of the Internet of Things. *Technology Analysis and Strategic Management*, *29*(9), 1089–1102. https://doi.org/10.1080/09537325.2016.1269160

[27] Li, Y., Barrueta Pinto, M. C., & Diabat, A. (2020). Analyzing the critical success factor of CSR for the Chinese textile industry. *Journal of Cleaner Production*, *260*, 120878. https://doi.org/10.1016/j.jclepro.2020.120878.

[28] Nilashi, M., Zakaria, R., Ibrahim, O., Majid, M. Z. A., Zin, R. M., & Farahmand, M. (2015). MCPCM: A DEMATEL-ANP-Based Multi-criteria Decision-Making Approach to Evaluate the Critical Success Factors in Construction Projects. *Arabian Journal for Science and Engineering*, *40*(2), 343–361. https://doi.org/10.1007/s13369-014-1529-1.

[29] Singh, P. K., & Sarkar, P. (2020). A framework based on fuzzy Delphi and DEMATEL for sustainable product development: A case of Indian automotive industry. *Journal of Cleaner Production*, *246*, 118991. https://doi.org/10.1016/j.jclepro.2019.118991

[30] Supeekit, T., Somboonwiwat, T., & Kritchanchai, D. (2016). DEMATEL-modified ANP to evaluate internal hospital supply chain performance. *Computers and Industrial Engineering*, *102*, 318–330. https://doi.org/10.1016/j.cie.2016.07.019.

[31] Kiani Mavi, R., & Standing, C. (2018). Critical success factors of sustainable project management in construction: A fuzzy DEMATEL-ANP approach. *Journal of Cleaner Production*, *194*.

[32] Tseng, M. L., (2008), "Application of ANP and DEMATEL to evaluate the decision making of municipal solid waste management in Metro Manila", *Environment Monitoring Assessment* (156), *page* 181-197.