

THE IMPLEMENTATION OF  
ENVIRONMENTAL MANAGEMENT SYSTEM  
(EMS) IN CONSTRUCTION PROJECT:  
INVESTIGATION OF SUCCESS FACTORS

SITI MAHARAH BINTI ABDUL KHALIM

MASTER OF SCIENCE

UNIVERSITI MALAYSIA PAHANG



## **SUPERVISOR'S DECLARATION**

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Master of Science.

*ChiaKuang*

---

(Supervisor's Signature)

Full Name : DR. LEE CHIA KUANG

Position : SENIOR LECTURER

Date : 19 JUNE 2021



## STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

A handwritten signature in black ink, appearing to read 'Siti Maharah Binti Abdul Khalim', is written above a horizontal line.

(Student's Signature)

Full Name : SITI MAHARAH BINTI ABDUL KHALIM

ID Number : MPM 18003

Date : 19 JUNE 2021

THE IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT SYSTEM  
(EMS) IN CONSTRUCTION PROJECT: INVESTIGATION OF SUCCESS  
FACTORS

SITI MAHARAH BINTI ABDUL KHALIM

Thesis submitted in fulfillment of the requirements  
for the award of the degree of  
Master of Science

Faculty of Industrial Management  
UNIVERSITI MALAYSIA PAHANG

JUNE 2021

## **ACKNOWLEDGEMENTS**

I would like to say my gratitude to my parents, Abdul Khalim bin Salleh and Parijah binti Nadino who always there to support me mentally and physically throughout my study. To my beloved husband, Mohd Faidhy who are responsible to keep on motivating and give moral support to me. Also a million thanks to the most important person for making sure I manage to finish my thesis, my supervisor, Dr Lee Chia Kuang that always guides and shared his knowledge and lastly to my friends especially Ts. Syamsul Imran for all the good advices. With all the guidance I manage to submit this research and complete my study.

## ABSTRAK

Jumlah aktiviti pembinaan pada masa kini kian meningkat dengan pesat. Hal ini disebabkan oleh pambangunan dan pertumbuhan ekonomi yang semakin pesat. Peningkatan jumlah aktiviti pembinaan akan menyumbang kesan buruk terhadap alam sekitar. Sistem Pengurusan Alam Sekitar (EMS) di dalam industri pembinaan kelihatan jauh ketinggalan berbanding industri lain. Oleh yang demikian, kajian ini bertujuan untuk mengkaji faktor-faktor kejayaan dan membenteng kerangka kerja dalam pelaksanaan EMS dalam industri pembinaan. EMS diperkenalkan di dalam industri pembinaan untuk mengendalikan strategi dan membantu menguruskan alam sekitar dengan lebih baik akibat daripada aktiviti pembinaan. Kajian telah ini merujuk beberapa kajian lepas yang berkait rapat dengan pelaksanaan EMS, industri pembinaan, dan juga pembangunan lestari dalam projek pembinaan. Persampelan bertujuan digunakan untuk mengumpul data-data. Pengumpulan data dilakukan dalam dua fasa. Fasa pertama pengumpulan data telah dilakukan untuk mengenal pasti faktor kejayaan yang mempengaruhi pelaksanaan EMS. Terdapat 50 responden dari kontraktor G1 hingga G7 yang terlibat dalam fasa pertama. Setelah itu, data dianalisis menggunakan Relative Importance Index (RII) sebelum fasa kedua pengumpulan data berlangsung. Hasil dari RII menetapkan faktor kejayaan yang terpilih sahaja akan dimasukkan ke dalam fasa kedua. Soal selidik yang dilakukan pada tahap kedua pengumpulan data adalah untuk mengenal pasti hubungan antara setiap faktor kejayaan. Soalan kaji selidik yang digunakan adalah berdasarkan DEMATEL. DEMATEL telah digunakan untuk menganalisa pengumpulan data kedua dari responden. Dengan menggunakan kaedah DEMATEL, hubungan antara setiap faktor dapat dikenal pasti dan kerangka berdasarkan hubungan dapat dirangka. Faktor-faktor kejayaan yang memberi impak kepada pelaksanaan EMS telah dibuktikan didalam kerangka yang dirangka. Faktor-faktor kejayaan yang didapati memberi impak kepada pelaksanaan EMS ialah pengurusan strategik dan aspek teknikal. Manakala, faktor-faktor bukan kejayaan ialah perubahan organisasi dan aspek luaran dan sosial.

## ABSTRACT

The number of construction activities nowadays increased rapidly due to consequently urbanization and economic growth. The increased number of construction activities will cause adverse and huge impacts on the natural environment. Compare to other industries, it is far behind in the implementation of the Environmental Management System (EMS). This research aims to investigate the success factors and proposed a framework for the implementation of EMS in the construction industry. EMS introduced control strategies and have the proper management to address environmental issues caused by construction activities. This research reviewed some of the past studies related to EMS, the construction industry, and also sustainable development in construction projects. The data collected using purposive sampling. The data collection were done in two phases. The first phase of data collection was done to identify the success factors influencing the implementation of EMS. There were fifty (50) respondents from G1 until G7 contractors involved in the first phase of data collection. After that, the data were analyzed using the Relative Importance Index (RII) before the second phase of data collection took place. The result from RII established selected success factors to be included in the second phase of data collection. Questionnaires survey from the second phase of data collection were done to identify the interrelationship among each of the success factors. There were twenty-five (25) respondents who participated in this data collection. The questionnaires survey was designed based on DEMATEL questionnaires. DEMATEL was used to analyze the second data collection from respondents. By using the DEMATEL method, the interrelationship among each factor could be identified and a framework based on the relationship was proposed. The success factors underpinning the implementation of EMS are evidenced from the results of the framework. The success factors identified to have significant impact towards the implementation of EMS are management approach and technical aspects. Meanwhile non-success factors are organizational change and external and social aspects.

## TABLE OF CONTENT

<b>DECLARATION</b>	
<b>TITLE PAGE</b>	
<b>ACKNOWLEDGEMENTS</b>	<b>ii</b>
<b>ABSTRAK</b>	<b>iii</b>
<b>ABSTRACT</b>	<b>iv</b>
<b>TABLE OF CONTENT</b>	<b>v</b>
<b>LIST OF TABLES</b>	<b>ix</b>
<b>LIST OF FIGURES</b>	<b>x</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xi</b>
<b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Introduction	1
1.2 Research Problem	3
1.3 Research Questions	4
1.4 Research Objectives	5
1.5 Significance of Study	5
1.5.1 To the researcher	5
1.5.2 To the organization and decision makers	5
1.6 Scope of study	6
1.7 Operational Definition	6
1.8 Summary	8
<b>CHAPTER 2 LITERATURE REVIEW</b>	<b>9</b>
2.1 Introduction	9
2.2 Construction industry	9
2.2.1 Malaysian construction industry	10



2.3	Sustainable development	11
2.4	Sustainable construction	12
2.5	ISO 14001	13
2.6	Environmental Management System (EMS)	15
2.6.1	Challenges in EMS implementation	16
2.6.2	Environmental pollution in Malaysian construction industry	16
2.7	Success factors in implementing EMS	18
2.8	Summary of past studies	20
2.9	Gap analysis	26
2.10	Summary	27
<b>CHAPTER 3 METHODOLOGY</b>		<b>28</b>
3.1	Introduction	28
3.2	Variables	30
3.3	Research design	30
3.3.1	Systematic review	33
3.4	Research strategies	45
3.4.1	Questionnaires survey	45
3.5	Population and sample	46
3.5.1	Population	46
3.5.2	Sample	47
3.5.3	Purposive sampling	48
3.5.4	Reliability test	48
3.6	Data collection	49
3.6.1	Approach data collection	49
3.6.2	Format of data collection	50

3.6.3	Experts	50
3.6.4	Preparation	51
3.6.5	Pilot test	52
3.7	Analysis method	53
3.7.1	Relative Importance Index (RII)	53
3.7.2	Decision Making Trial and Evaluation Laboratory (DEMATEL)	53
3.7.3	Respondent validate model	57
3.8	Summary	58
<b>CHAPTER 4 DATA ANALYSIS</b>		<b>59</b>
4.1	Introduction	59
4.2	Evaluation	60
4.2.1	Relative Importance Index	60
4.2.2	The Average Matrix Z / Direct Relation Matrix	62
4.2.3	Normalized Direct Relation Matrix, D	63
4.2.4	Total Relation Matrix, T	64
4.2.5	Sums of rows and columns of Matrix, T	65
4.2.6	Threshold value, $\alpha$	69
4.2.7	Impact – Relation Map	70
4.2.8	Summary of the Impact Relation Map (IRM)	71
4.2.9	Summary of the interrelationship among Management Approach, Organizational Change, External and Social Aspects, and Technical Aspects	75
4.3	Framework for success factor in the implementation of EMS	76
4.4	Summary	78

<b>CHAPTER 5 CONCLUSION AND RECOMMENDATIONS</b>	<b>79</b>
5.1 Introduction	79
5.2 Conclusion	79
5.2.1 Objective 1 – To identify the success factors influencing the implementation of EMS in construction project	80
5.2.2 Objective 2 – To explore the interrelationship among the identified factors influencing implementation of EMS	81
5.2.3 Objective 3 – To propose a framework for enhancing the implementation of EMS in construction project	81
5.3 Limitations and recommendation for future research	82
<b>REFERENCES</b>	<b>83</b>
<b>APPENDICES</b>	<b>91</b>

## REFERENCES

- Abdullah, H., & Chan, F. C. (2010). The Implementation of ISO 14001 Environmental Management System. *Asian Social Science*, 6(3), 100–107. <https://doi.org/10.5539/ass.v6n3p100>
- Abidin, N. Z., Yusof, N., & Afandi, N. D. (2015). Exploring developers' expectation on green construction. *Advances in Environmental Biology*, 9(3), 75–78. Retrieved from <https://www.thefreelibrary.com/Exploring+developers%27+expectation+on+green+construction.-a0417570345>
- Aghili, N., Hosseini, S. E., Mohammed, A. H., & Zainul Abidin, N. (2019). Management criteria for green building in Malaysia; Relative important index. *Energy Sources, Part A: Recovery, Utilization and Environmental Effects*, 41(21), 2601–2615. <https://doi.org/10.1080/15567036.2019.1568634>
- Aigbavboa, C., Ohiomah, I., & Zwane, T. (2017). Sustainable Construction Practices: “A Lazy View” of Construction Professionals in the South Africa Construction Industry. *Energy Procedia*, 105, 3003–3010. <https://doi.org/10.1016/j.egypro.2017.03.743>
- Alrazi, B., De Villiers, C., & Van Staden, C. J. (2015). A comprehensive literature review on, and the construction of a framework for, environmental legitimacy, accountability and proactivity. *Journal of Cleaner Production*, 102, 44–57. <https://doi.org/10.1016/j.jclepro.2015.05.022>
- Anderson, J. E., Wulfhorst, G., & Lang, W. (2015). Energy analysis of the built environment - A review and outlook. *Renewable and Sustainable Energy Reviews*, 44, 149–158. <https://doi.org/10.1016/j.rser.2014.12.027>
- Ann, G. E., Zailani, S., & Wahid, N. A. (2006). A study on the impact of Environmental Management System (EMS) certification towards firms' performance in Malaysia. *Management of Environmental Quality: An International Journal*, 17(1), 73–93. <https://doi.org/10.1108/14777830610639459>
- Aravind, D., & Christmann, P. (2011). Decoupling of Standard Implementation from Certification: Does Quality of ISO 14001 Implementation Affect Facilities' Environmental Performance? *Business Ethics Quarterly*, 21(1), 73–102. Retrieved from [https://www.researchgate.net/publication/261296481\\_Decoupling\\_of\\_Standard\\_Implementation\\_from\\_Certification\\_Does\\_Quality\\_of\\_ISO\\_14001\\_Implementation\\_Affect\\_Facilities'\\_Environmental\\_Performance](https://www.researchgate.net/publication/261296481_Decoupling_of_Standard_Implementation_from_Certification_Does_Quality_of_ISO_14001_Implementation_Affect_Facilities'_Environmental_Performance)
- Arimura, T. H., Darnall, N., Ganguli, R., & Katayama, H. (2016). The effect of ISO 14001 on environmental performance: Resolving equivocal findings. *Journal of Environmental Management*, 166, 556–566. <https://doi.org/10.1016/j.jenvman.2015.10.032>

- Arimura, T. H., Hibiki, A., & Katayama, H. (2008). Is a voluntary approach an effective environmental policy instrument? A case for environmental management systems. *Journal of Environmental Economics and Management*, 55, 281–295. <https://doi.org/10.1016/j.jeem.2007.09.002>
- Azapagic, A. (2004). Developing a framework for sustainable development indicators for the mining and minerals industry. *Journal of Cleaner Production*, 12, 639–662. [https://doi.org/10.1016/S0959-6526\(03\)00075-1](https://doi.org/10.1016/S0959-6526(03)00075-1)
- Bakkens, W. (2003). Realizing the sector's potential for contributing to sustainable development. In *UNEP Industry and Environment* (Vol. 26).
- Bansal, P., & Roth, K. (2000). Why Companies Go Green: A Model of Ecological Responsiveness. *Academy of Management Journal*, 43(4), 717–736.
- Beard, C., & Rees, S. (2000). Green teams and the management of environmental change in a UK county council. *Environmental Management and Health*, 11(1), 27–38. <https://doi.org/10.1108/09566160010314161>
- Beltràn, J., Munuzuri, J., Rivas, M., & Gonzalez, C. (2010). Metrological management evaluation based on ISO 10012: An empirical study in ISO 14001 certified Spanish companies. *Energy*, 35, 140–147.
- Borman, M., & Janssen, M. (2013). Reconciling two approaches to critical success factors: The case of shared services in the public sector. *International Journal of Information Management*, 33, 390–400. <https://doi.org/10.1016/j.ijinfomgt.2012.05.012>
- Bosse, G., Breuer, J. P., & Spies, C. (2006). The resistance to changing guidelines - what are the challenges and how to meet them. *Best Practice and Research: Clinical Anaesthesiology*, 20(3), 379–395. <https://doi.org/10.1016/j.bpa.2006.02.005>
- Buchanan, E. A., & Hvizdak, E. E. (2009). Online Survey Tools: Ethical and Methodological Concerns of Human Research Ethics Committees. *Journal of Empirical Research on Human Research Ethics: An International Journal*, 4(2), 37–48. <https://doi.org/10.1525/jer.2009.4.2.37>
- Camara, M., Jamil, N. R., & Abdullah, A. F. (2019). Impact of land uses on water quality in Malaysia: A review. *Ecological Processes*, 8(10), 1–10. <https://doi.org/10.1186/s13717-019-0164-x>
- Campos, L. M. S., De Melo Heizen, D. A., Verdinelli, M. A., & Miguel, P. A. C. (2015). Environmental performance indicators: A study on ISO 14001 certified companies. *Journal of Cleaner Production*, 99, 286–296. <https://doi.org/10.1016/j.jclepro.2015.03.019>
- Campos, L. M. S., Trierweiller, A. C., Spenassato, D. C., Bornia, A. C., & Selih, J. (2014). Barriers for Implementation of EMS: A study in the Construction Industry of Brazil and Slovenia. *Production and Operations Management Society, POMS 25th Annual Conference*, 1–10. Retrieved from [http://www.pomsmeetings.org/ConfProceedings/051/FullPapers/Final Full length Papers/051-0434.pdf](http://www.pomsmeetings.org/ConfProceedings/051/FullPapers/Final%20Full%20length%20Papers/051-0434.pdf)

- Cary, J., & Roberts, A. (2013). The limitations of environmental management systems in Australian agriculture. *Journal of Environmental Management*, 92, 878–885. <https://doi.org/10.1016/j.jenvman.2010.10.055>
- Chan, A. P. C., Darko, A., Olanipekun, A. O., & Ameyaw, E. E. (2018). Critical barriers to green building technologies adoption in developing countries: The case of Ghana. *Journal of Cleaner Production*, 172, 1067–1079. <https://doi.org/10.1016/j.jclepro.2017.10.235>
- Chavan, M. (2005). An appraisal of environment management systems: A competitive advantage for small businesses “A” listed. *Management of Environmental Quality: An International Journal*, 16(5), 444–463. <https://doi.org/10.1108/14777830510614321>
- Chen, Z., Li, H., & Hong, J. (2004). An integrative methodology for environmental management in construction. *Automation in Construction*, 13, 621–628. <https://doi.org/10.1016/j.autcon.2004.04.006>
- Chin, K. S., Chiu, S., & Tummala, V. M. R. (1999). An evaluation of success factors using the AHP to implement ISO 14001-based EMS. *International Journal of Quality and Reliability Management*, 16(4), 341–361.
- Cobbinah, P. B., Black, R., & Thwaites, R. (2011). Reflections on the six decades of development: Evaluation and future research. *Journal of Sustainable Development in Africa*, 13(7), 134–149.
- Cresswell, J. W., & Plano Clark, V. L. (2011). *Plano Designing and Conducting mixed method research (2nd Ed.* Thousand Oaks, CA: Sage.
- Darus, N., Haron, Z., Mohd Bakhori, S. N., Bakhori, M., Lim, M. H., Jahya, Z., & Abdul Hamid, M. F. (2015). Construction noise annoyance among the public residents. *Jurnal Teknologi*, 74(4), 19–26. <https://doi.org/10.11113/jt.v74.4604>
- De Magalhães, R. F., Danilevicz, Â. de M. F., & Saurin, T. A. (2017). Reducing construction waste: A study of urban infrastructure projects. *Waste Management*, 67, 265–277. <https://doi.org/10.1016/j.wasman.2017.05.025>
- De Oliveira Naves, F., Salgado, E. G., & Beijo, L. A. (2017). Analysis of the Environmental Management System based on ISO 14001 on the American continent. *Journal of Environmental Management*, 199, 251–262. <https://doi.org/10.1016/j.jenvman.2017.05.049>
- De Schrijver, R. F. M. (2009). *Developing a strategy for green procurement in the Civil Engineering Construction Industry*. Retrieved from <https://pdfs.semanticscholar.org/8c6f/f2d75a9578beb9aef157e620277f29a92244>.
- Delmas, M. A. (2002). The diffusion of environmental management standards in Europe and in the United States: An institutional perspective. *Policy Sciences*, 35, 91–119. <https://doi.org/10.1023/A>

- Ding, G. K. C. (2008). Sustainable construction-The role of environmental assessment tools. *Journal of Environmental Management*, 86, 451–464. <https://doi.org/10.1016/j.jenvman.2006.12.025>
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Farouq, M. M., Lawan, U. F., Garba, N., Anwar, F. H., Baba, Z. B., Labbo, M. S., & Aliyu, D. S. (2017). Implementation of Environmental Management System in Construction Industry : A Review. *Journal of Mechanical and Civil Engineering*, 14(5), 33–38. <https://doi.org/10.9790/1684-1405043338>
- Fortunski, B. (2008). Does the environmental management standard ISO 14001 stimulate sustainable development? An example from the energy sector in Poland. *Management of Environmental Quality*, 19(2), 204–212. <https://doi.org/10.1108/14777830810856582>
- Gangoells, M., Casals, M., Forcada, N., & Macarulla, M. (2014). Analysis of the implementation of effective waste management practices in construction projects and sites. *Resources, Conservation and Recycling*, 93, 99–111. <https://doi.org/10.1016/j.resconrec.2014.10.006>
- Green Project Management. (2012). Retrieved from [www.greenprojectmanagement.org](http://www.greenprojectmanagement.org)
- Haron, Z., Yahya, K., & Jahya, Z. (2012). Prediction of noise pollution from construction sites at the planning stage using simple prediction charts. *Energy Education Science and Technology Part A: Energy Science and Research*, 29(2), 989–1002.
- Hu, A. H., & Hsu, C. W. (2010). Critical factors for implementing green supply chain management practice: An empirical study of electrical and electronics industries in Taiwan. *Management Research Review*, 33(6), 586–608.
- Iatridis, K., & Kesidou, E. (2016). What Drives Substantive Versus Symbolic Implementation of ISO 14001 in a Time of Economic Crisis? Insights from Greek Manufacturing Companies. *Journal of Business Ethics*, 148(4), 859–877. <https://doi.org/10.1007/s10551-016-3019-8>
- Ismail, R., Said, I., Mohd Muzni, S. S., & Mohd Shafiei, M. W. (2015). The Implementation of Environmental Management in Malaysian Construction Project. *Australian Journal of Basic and Applied Sciences*, 9(7), 349–353.
- Khan, R. A., Liew, M. S., & Ghazali, Z. Bin. (2014). Malaysian Construction Sector and Malaysia Vision 2020: Developed Nation Status. *Procedia - Social and Behavioral Sciences*, 109, 507–513. <https://doi.org/10.1016/j.sbspro.2013.12.498>
- King, A. A., Lenox, M. J., & Terlaak, A. (2005). The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. *Academy of Management Journal*, 48(6), 1091–1106. <https://doi.org/10.5465/AMJ.2005.19573111>

- Kitchenham, B. A., Pfleeger, S. L., Pickard, L. M., Jones, P. W., Hoaglin, D. C., El Emam, K., & Rosenberg, J. (2002). Preliminary guidelines for empirical research in software engineering. *IEEE Transactions on Software Engineering*, 28(8), 721–734. <https://doi.org/10.1109/TSE.2002.1027796>
- Kumar, A., Kaviani, M. A., Bottani, E., Dash, M. K., & Zavadskas, E. K. (2018). Investigating the role of social media in polio prevention in India: a Delphi-DEMATEL approach. *Kybernetes*, 47(5), 1053–1072. <https://doi.org/10.1108/K-06-2017-0210>
- Lauesen, S., & Vinter, O. (2001). Preventing requirement defects: An experiment in process improvement. *Requirements Engineering*, 6, 37–50. <https://doi.org/10.1007/PL00010355>
- Lee, C. W. (2008). Green suppliers with Environmental Performance in the supply chain perspective. *Journal of Asia Pasific Management Review*, 13(4), 731–745.
- Liyin, S., Hong, Y., & Griffith, A. (2006). Improving environmental performance by means of empowerment of contractors. *Management of Environmental Quality: An International Journal*, 17(3), 242–250.
- Marcelino-Sádaba, S., González-Jaen, L. F., & Pérez-Ezcurdia, A. (2015). Using project management as a way to sustainability. From a comprehensive review to a framework definition. *Journal of Cleaner Production*, 99, 1–16. <https://doi.org/10.1016/j.jclepro.2015.03.020>
- Martens, M. L., & Carvalho, M. M. (2017). Key factors of sustainability in project management context: A survey exploring the project managers' perspective. *International Journal of Project Management*, 35, 1084–1102. <https://doi.org/10.1016/j.ijproman.2016.04.004>
- Mavi, R. K., Golsefid-Alavi, M., Hessami, H. Z., Shekaf, S. M., & Soleimani-Nezhad, N. (2012). Evaluation and Ranking of Success Factors and Benefits of ISO 14001-Based EMS Implementation Using the TOPSIS Method. *Journal of Applied Environmental and Biological Sciences*, 2(8), 419–427.
- Mazzi, A., Toniolo, S., Mason, M., Aguiari, F., & Scipioni, A. (2016). What are the benefits and difficulties in adopting an environmental management system? The opinion of Italian organizations. *Journal of Cleaner Production*, 139, 873–885. <https://doi.org/10.1016/j.jclepro.2016.08.053>
- Monzon, A., & Bayart, C. (2018). Workshop Synthesis: Web-based surveys, new insight to address main challenges. *Transportation Research Procedia*, 32, 167–173. <https://doi.org/10.1016/j.trpro.2018.10.030>
- Muhammad Rooshdi, R. R. R., Abd Majid, M. Z., Sahamir, S. R., & Ismail, N. A. A. (2018). Relative importance index of sustainable design and construction activities criteria for green highway. *Chemical Engineering Transactions*, 63, 151–156. <https://doi.org/10.3303/CET1863026>



- Murmura, F., Liberatore, L., Bravi, L., & Casolani, N. (2018). Evaluation of Italian Companies' Perception About ISO 14001 and Eco Management and Audit Scheme III: Motivations, Benefits and Barriers. *Journal of Cleaner Production*, *174*, 691–700. <https://doi.org/10.1016/j.jclepro.2017.10.337>
- Nalini, G., & Bonnie, F. D. (2004). Motivating employees for environmental improvement. *Industrial Management & Data Systems*, *104*(4), 364–372.
- Naude, M., Quaddus, M., Rowe, A. L., & Nowak, M. (2011). Adoption of environmental standards in Australia: Focus on ISO 14001. *The International Journal of Sustainable Development and World Ecology*, *18*(5), 1–8.
- Nguyen, Q. A., & Hens, L. (2015). Environmental performance of the cement industry in Vietnam: the influence of ISO 14001 certification. *Journal of Cleaner Production*, *96*, 362–378. <https://doi.org/10.1016/j.jclepro.2013.09.032>
- Opoku, A., & Ahmed, V. (2014). Embracing sustainability practices in UK construction organizations: Challenges facing intra-organizational leadership. *Built Environment Project and Asset Management*, *4*(1), 90–107. <https://doi.org/10.1108/BEPAM-02-2013-0001>
- Osman, W. N., Udin, Z. M., & Salleh, D. (2012). Adoption Level of Sustainable Construction Practices: A Study on Malaysia's Construction Stakeholders. *The Journal of Southeast Asian Research*, *2012*, 1–6. <https://doi.org/10.5171/2012.270273>
- Padma, P., Ganesh, L. S., & Rajendran, C. (2008). A study on the ISO 14000 certification and organizational performance of Indian manufacturing firms. *Benchmarking: An International Journal*, *15*(1), 73–100. <https://doi.org/10.1108/14635770810854353>
- Papke-Shields, K. E., & Boyer-Wright, K. M. (2017). Strategic planning characteristics applied to project management. *International Journal of Project Management*, *35*, 169–179. <https://doi.org/10.1016/j.ijproman.2016.10.015>
- Ratiu, P., & Mortan, M. (2014). Dynamics of Certified Environmental Management Systems: ISO 14001 and EMAS in Romania. *Annales Universitatis Apulensis Series Oeconomica*, *16*(1), 198–211. Retrieved from <https://ideas.repec.org/a/alu/journal/v1y2014i16p18.html>
- Ristić, V., Maksin, M., Nenković-Riznić, M., & Basarić, J. (2018). Land-use evaluation for sustainable construction in a protected area: A case of Sara mountain national park. *Journal of Environmental Management*, *206*, 430–445. <https://doi.org/10.1016/j.jenvman.2017.09.080>
- Rowley, J. (2014). Designing and using research questionnaires. *Management Research Reviews*, *37*(3), 308–330. <https://doi.org/10.1108/MRR-02-2013-0027>
- Saadi, N., Ismail, Z., & Alias, Z. (2016). A review of construction waste management and initiatives in Malaysia. *Journal of Sustainability Science and Management*, *11*(2), 101–114.

- Salim, H. K., Padfield, R., Hansen, S. B., Mohamad, S. E., Yuzir, A., Syayuti, K., ... Papargyropoulou, E. (2018). Global trends in environmental management system and ISO14001 research. *Journal of Cleaner Production*, *170*, 645–653. <https://doi.org/10.1016/j.jclepro.2017.09.017>
- Sambasivan, M., & Fei, N. Y. (2008). Evaluation of critical success factors of implementation of ISO 14001 using analytic hierarchy process (AHP): a case study from Malaysia. *Journal of Cleaner Production*, *16*, 1424–1433. <https://doi.org/10.1016/j.jclepro.2007.08.003>
- Sayre, D. (1996). Inside ISO 14000: the competitive advantage of environmental management. *Delray Beach, FL: St. Lucie Press*.
- Shafii, F., & Othman, M. Z. (2005). Sustainable Building and Construction in South-East Asia. *Conference on Sustainable Building South East Asia*, 11–13. Retrieved from [http://www.irbnet.de/daten/iconda/CIB\\_DC23383.pdf](http://www.irbnet.de/daten/iconda/CIB_DC23383.pdf)
- Shieh, J. I., & Wu, H. H. (2016). Measures of consistency for DEMATEL method. *Communications in Statistics: Simulation and Computation*, *45*, 1–10. <https://doi.org/10.1080/03610918.2013.875564>
- Siew, R. Y. J. (2015). A review of corporate sustainability reporting tools (SRTs). *Journal of Environmental Management*, *164*, 180–195. <https://doi.org/10.1016/j.jenvman.2015.09.010>
- Singh, N., Jain, S., & Sharma, P. (2015). Motivations for implementing environmental management practices in Indian industries. *Ecological Economics*, *109*, 1–8. <https://doi.org/10.1016/j.ecolecon.2014.11.003>
- Srdić, A., & Šelih, J. (2011). Integrated quality and sustainability assessment in construction: A conceptual model. *Technological and Economic Development of Economy*, *17*(4), 611–626. <https://doi.org/10.3846/20294913.2011.603177>
- Susil, K. S., Warnakulasuriya, B. N. F., & Arachchige, B. J. H. (2016). Critical Success Factors: En Route for Success of Construction Projects. *International Journal of Business and Social Science*, *7*(3), 27–37. Retrieved from [www.ijbssnet.com](http://www.ijbssnet.com)
- Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*, 1273–1296. <https://doi.org/10.1007/s11165-016-9602-2>
- Thomson, C., & El-Haram, M. (2014). Potential and implications of sustainability action plans: Lessons from the Greater Middlehaven Regeneration Project. *Built Environment Project and Asset Management*, *4*(1), 108–122. <https://doi.org/10.1108/BEPAM-11-2012-0053>
- Thornton, R. (2000). ISO 14001 certification mandate reaches automobile industry. *Environmental Quality Management*, *10*(1), 89–93.
- Vílchez, V. F. (2017). The dark side of ISO 14001: The symbolic environmental behavior. *European Research on Management and Business Economics*, *23*, 33–39. <https://doi.org/10.1016/j.iedeen.2016.09.002>

- Waris, M., Liew, M. S., Khamidi, M. F., & Idrus, A. (2014). Environmental implications of onsite mechanization in the Malaysian construction industry. *WIT Transactions on Ecology and the Environment*, *181*, 147–158. <https://doi.org/10.2495/EID140131>
- Wulandari, R. S., Soemirat, J., & Rahardyan, B. (2012). Analysis of success factors of ISO 14001 implementation - A case study in a cement company in Indonesia. *2012 Southeast Asian Network of Ergonomics Societies Conference: Ergonomics Innovations Leveraging User Experience and Sustainability, SEANES 2012*. <https://doi.org/10.1109/SEANES.2012.6299561>
- Yahaya, I., & Zainul Abidin, N. (2020). The implementation of environmental practices by Malaysian contractors. *International Journal of Integrated Engineering*, *12*(4), 310–318.
- Yeong, L. S., & Putuhena, F. J. (2015). Green building technology initiatives to achieve construction quality and environmental sustainability in the construction industry in Malaysia. *Management of Environmental Quality An International Journal*, *26*(2), 233–249. Retrieved from [https://www.researchgate.net/publication/276377441\\_Green\\_building\\_technology\\_initiatives\\_to\\_achieve\\_construction\\_quality\\_and\\_environmental\\_sustainability\\_in\\_the\\_construction\\_industry\\_in\\_Malaysia](https://www.researchgate.net/publication/276377441_Green_building_technology_initiatives_to_achieve_construction_quality_and_environmental_sustainability_in_the_construction_industry_in_Malaysia)
- Yusof, N., Awang, H., & Iranmanesh, M. (2017). Determinants and outcomes of environmental practices in Malaysian construction projects. *Journal of Cleaner Production*, *156*, 345–354. <https://doi.org/10.1016/j.jclepro.2017.04.064>
- Zailinawati Abu Hassan, Schattner, P., & Mazza, D. (2006). Doing A Pilot Study: Why Is It Essential? *Malaysian Family Physician*, *1*, 70–73.
- Zolfagharian, S., Nourbakhsh, M., Irizarry, J., Ressang, A., & Gheisari, M. (2012). Environmental impacts assessment on construction sites. *Construction Research Congress 2012: Construction Challenges in a Flat World, Proceedings of the 2012 Construction Research Congress*, 1750–1759. <https://doi.org/10.1061/9780784412329.176>
- Zutshi, A., & Creed, A. (2015). An international review of environmental initiatives in the construction sector. *Journal of Cleaner Production*, *98*, 92–106. <https://doi.org/10.1016/j.jclepro.2014.06.077>
- Zutshi, A., & Sohal, A. (2004a). A study of the environmental management system (EMS) adoption process within Australasian organisations - 2. Role of stakeholders. *Technovation*, *24*, 371–386. [https://doi.org/10.1016/S0166-4972\(02\)00115-3](https://doi.org/10.1016/S0166-4972(02)00115-3)
- Zutshi, A., & Sohal, A. S. (2004b). Adoption and maintenance of environmental management systems: Critical success factors. *Management of Environmental Quality: An International Journal*, *15*(4), 399–419. <https://doi.org/10.1108/14777830410540144>