



The importance of subcontracting and its relationship with Lean philosophy in automotive industry

S. Sá^a, L. P. Ferreira^{a,b,*}, F. J. G. Silva^{a,b}, J. C. Sá^{a,b}, M. T. Pereira^{a,b}, G. Santos^c

^a ISEP - School of Engineering, Polytechnic of Porto, Portugal;

^b INEGI—Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial, 4200-465 Porto, Portugal;

^c IPCA - Design School, Polytechnic Institute Cavado Ave, Barcelos, Portugal

References

- [1] E. Drohomerski, S. E. Gouveia Da Costa, E. Pinheiro De Lima, and P. A. D. R. Garbuiro, "Lean, six sigma and lean six sigma: An analysis based on operations strategy," *Int. J. Prod. Res.*, vol. 52, no. 3, pp. 804–824, 2014, doi: 10.1080/00207543.2013.842015.
- [2] J. Oliveira, J. C. Sá, and A. Fernandes, "Continuous improvement through 'Lean Tools': An application in a mechanical company," *Procedia Manuf.*, vol. 13, pp. 1082–1089, 2017, doi: 10.1016/j.promfg.2017.09.139.
- [3] P. J. A. Vaz, "A metodologia lean e o seu impacto na produção sustentável," (in Portuguese). MSc. dissertation, Mechanical Engineering Department, University of Coimbra, 2015.
- [4] D. Correia, F. J. G. Silva, R. M. Gouveia, T. Pereira, and L. P. Ferreira, "Improving manual assembly lines devoted to complex electronic devices by applying Lean tools," *Procedia Manuf.*, vol. 17, pp. 663–671, 2018, doi: 10.1016/j.promfg.2018.10.115.
- [5] J. Mourato, L. Pinto Ferreira, J. C. Sá, F. J. G. Silva, T. Dieguez, and B. Tjahjono, "Improving internal logistics of a bus manufacturing using the lean techniques," *Int. J. Product. Perform. Manag.*, 2020, doi: 10.1108/IJPPM-06-2020-0327.
- [6] V. Ferreira, F. J. G. Silva, R. P. Martinho, C. Pimentel, R. Godina, B. Pinto, "A comprehensive supplier classification model for SME outsourcing," *Procedia Manuf.*, vol. 38, pp. 1461–1472, 219, doi: 10.1016/j.promfg.2020.01.141.
- [7] B. Gandhi, S. J. Gorod, A., & Sauser, "Prioritization of outsourcing risks from a systemic perspective," *Strateg. Outsourcing An Int. J.*, vol. 5, no. 1, pp. 39–71, 2012.
- [8] S. Aigbavboa and C. Mbohwa, "The murky waters of outsourcing: Critical risks factors of outsourcing pharmaceutical outbound value chains," *Procedia Manuf.*, vol. 43, pp. 328–335, 2020, doi: 10.1016/j.promfg.2020.02.168.
- [9] O. M. Ikumapayi, S. T. Oyinbo, E. T. Akinlabi, and N. Madushele, "Overview of recent advancement in globalization and outsourcing initiatives in manufacturing systems," *Mater. Today Proc.*, vol. 26, pp. 1532–1539, 2019, doi: 10.1016/j.matpr.2020.02.315.
- [10] E. Nunes, "Setor automóvel vale 5,9% do PIB e emprega 72 mil pessoas" (in Portuguese), 2018. <https://www.dn.pt/dinheiro/setor-automovel-vale-59-do-pib-e-emprega-72-mil-pessoas-9048092.html> (accessed Feb. 10, 2021).
- [11] L. Ciravegna, P. Romano, and A. Pilkington, "Outsourcing practices in automotive supply networks: An exploratory study of full service vehicle suppliers," *Int. J. Prod. Res.*, vol. 51, no. 8, pp. 2478–2490, 2013, doi: 10.1080/00207543.2012.746797.
- [12] S. Li, S. Okoroafo, and B. Gammoh, "The Role of Sustainability Orientation in Outsourcing: Antecedents, Practices, and Outcomes," *J. Manag. Sustain.*, vol. 4, no. 3, pp. 27–36, 2014, doi: 10.5539/jms.v4n3p27.
- [13] G. Grossman and E. Helpman, "Outsourcing in a global economy," *Rev. Econ. Stud.*, vol. 72, no. 1, pp. 135–159, 2005, doi: 10.1111/0034-6527.00327.
- [14] M. Sharpe, "Outsourcing, organizational competitiveness, and work," *J. Labor Res.*, vol. 18, no. 4, pp. 535–549, 1997, doi: 10.1007/s12122-997-1021-8.
- [15] G. Parry and J. K. Roehrich, "Towards the strategic outsourcing of core competencies in the automotive industry: Threat or opportunity?," *Int. J. Automot. Technol. Manag.*, vol. 9, no. 1, pp. 40–53, 2009, doi: 10.1504/IJATM.2009.023585.
- [16] A. Kakabadse and N. Kakabadse, "Outsourcing: Current and future trends," *Thunderbird Int. Bus. Rev.*, vol. 47, no. 2, pp. 183–204, 2005, doi: 10.1002/tic.20048.

- [17] R. M. Ilyas, D. K. Banwet, and R. Shankar, "Value chain outsourcing - A solution for flex-lean-agile manufacturing," *Int. J. Value Chain Manag.*, vol. 2, no. 2, pp. 227–268, 2008, doi: 10.1504/IJVC.M.2008.017744.
- [18] I. R. Mohammed, R. Shankar, and D. K. Banwet, "Creating flex-lean-agile value chain by outsourcing: An ISM-based interventional roadmap," *Bus. Process Manag. J.*, vol. 14, no. 3, pp. 338–389, 2008, doi: 10.1108/14637150810876670.
- [19] S. R. Swenseth and D. L. Olson, "Trade-offs in lean vs. outsourced supply chains," *Int. J. Prod. Res.*, vol. 54, no. 13, pp. 4065–4080, 2016, doi: 10.1080/00207543.2016.1173251.
- [20] K. Latif, M. N. Ismail, M. Nazri, M. R. M. Nor, and M. I. Qureshi, "Exploring underpinning of outsourcing success: A case of multinational automotive group in Malaysia," *Int. J. Eng. Technol.*, vol. 7, no. 4, pp. 40–46, 2018, doi: 10.14419/ijet.v7i4.28.22387.
- [21] C. Fill and E. Visser, "The outsourcing dilemma: a composite approach to the make or buy decision," *Manag. Decis.*, vol. 38, no. 1, pp. 43–50, 2000, doi: 10.1108/EUM0000000005315.
- [22] C. Harland, L. Knight, and H. Walker, "Outsourcing : assessing the risks and benefits for organisations, sectors and nations," *International Journal of Operations & Production Management*, vol. 25, no. 9, pp. 831–850, 2005, doi: 10.1108/01443570510613929.
- [23] O. Shy and R. Stenbacka, "Partial outsourcing, monitoring cost, and market structure," *Can. J. Econ.*, vol. 38, no. 4, pp. 1173–1190, 2005, doi: 10.1111/j.0008-4085.2005.00320.x.
- [24] J. Du, Y. Lu, and Z. Tao, "Why do firms conduct bi-sourcing?," *Econ. Lett.*, vol. 92, no. 2, pp. 245–249, 2006, <https://doi.org/10.1016/j.econlet.2006.02.005>.
- [25] R. Stenbacka and M. Tombak, "Make and buy: Balancing bargaining power," *J. Econ. Behav. Organ.*, vol. 81, no. 2, pp. 391–402, 2012, doi: 10.1016/j.jebo.2011.12.001.
- [26] L. Laios and S. Moschuris, "An empirical investigation of outsourcing decisions," *J. Supply Chain Manag.*, vol. 35, no. 4, pp. 33–41, 1999, doi: 10.1111/j.1745-493X.1999.tb00054.x.
- [27] G. Calabrese and F. Erbetta, "Outsourcing and firm performance: Evidence from Italian automotive suppliers," *Int. J. Automot. Technol. Manag.*, vol. 5, no. 4, pp. 461–479, 2005, doi: 10.1504/IJATM.2005.008585.
- [28] R. Collins and K. Bechler, "Outsourcing in the chemical and automotive industries: Choice or competitive imperative?," *J. Supply Chain Manag.*, vol. 35, no. 3, pp. 4–11, 1999, doi: 10.1111/j.1745-493X.1999.tb00239.x.
- [29] R. S. Collins, K. A. Bechler, and S. R. I. Pires, "Outsourcing in the automotive industry: From JIT to Modular Consortia," *Eur. Manag. Journal*, vol. 15, no. 5, pp. 498–508, 1997. [https://doi.org/10.1016/S0263-2373\(97\)00030-3](https://doi.org/10.1016/S0263-2373(97)00030-3).
- [30] C. Baden-Fuller, D. Targett, and B. Hunt, "Outsourcing to Outmanoeuvre: Outsourcing Re-defines Competitive Strategy and Structure," *Eur. Manag. J.*, vol. 18, no. 3, pp. 285–295, 2000, doi: 10.1016/S0263-2373(00)00010-4.
- [31] T. Nishiguchi, *Strategic Industrial Sourcing: The Japanese Advantage*. Oxford University Press, 1994.
- [32] S. Palvia, "Global Outsourcing of IT and IT Enabled Services: Impact on US and Global Economy," *J. Inf. Technol. Case Appl. Res.*, vol. 5, no. 3, pp. 37–41, 2014, doi: 10.1080/15228053.2003.10856023.
- [33] G. Yadav, S. K. Mangla, S. Luthra, and S. Jakhar, "Hybrid BWM-ELECTRE-based decision framework for effective offshore outsourcing adoption: a case study," *Int. J. Prod. Res.*, vol. 56, no. 18, pp. 6259–6278, 2018, doi: 10.1080/00207543.2018.1472406.
- [34] M. G. Jacobides, J. P. MacDuffie, and C. J. Tae, "Agency, structure, and the dominance of OEMs: Change and stability in the automotive sector," *Strateg. Manag. J.*, vol. 37, no. 9, pp. 1942–1967, 2016, doi: 10.1002/smj.
- [35] R. Ulewicz, "Outsourcing quality control in the automotive industry," *MATEC Web Conf.*, vol. 183, pp. 1–6, 2018, doi: 10.1051/mateconf/201818303001.
- [36] S. K. Fixson, Y. Ro, and J. K. Liker, "Modularisation and outsourcing: Who drives whom? a study of generational sequences in the US automotive cockpit industry," *Int. J. Automot. Technol. Manag.*, vol. 5, no. 2, pp. 166–183, 2005, doi: 10.1504/IJATM.2005.007181.
- [37] J. K. Roehrich, "Outsourcing: Management and Practice within the Automotive Industry" in: *Build To Order: The Road to the 5-Day Car*, G. Parry and A. Graves (Eds.), Springer, 2008, pp. 75–97, https://doi.org/10.1007/978-1-84800-225-8_5.
- [38] A. Goto and H. Odagiri, *Innovation in Japan*. Clarendon Press, Oxford, 1997.
- [39] M. Caputo and F. Zirpoli, "Supplier involvement in automotive component design: Outsourcing strategies and supply chain management," *Int. J. Technol. Manag.*, vol. 23, no. 1–3, pp. 129–154, 2002, doi: 10.1504/ijtm.2002.003002.
- [40] C. M. Guimarães and J. C. de Carvalho, "Outsourcing in healthcare through process modularization- A lean perspective," *Int. J. Eng. Bus. Manag.*, vol. 4, no. 1, pp. 1–12, 2012, doi: 10.5772/51886.
- [41] K. Aziz, M. Awais, Q. Rahat, S. S. U. Hasnain, and I. Shahzadi, "Impact of outsourcing on lean operations I Pakistani healthcare industry," *Int. J. Eng. Inf. Syst.*, vol. 1, no. 1, pp. 116–123, 2017.
- [42] T. S. H. Teo and A. Bhattacharjee, "Knowledge transfer and utilization in IT outsourcing partnerships: A preliminary model of antecedents and outcomes," *Inf. Manag.*, vol. 51, no. 2, pp. 177–186, 2014, doi: 10.1016/j.im.2013.12.001.
- [43] S. Lahiri, B. L. Kedia, and D. Mukherjee, "The impact of management capability on the resource-performance linkage: Examining Indian outsourcing providers," *J. World Bus.*, vol. 47, no. 1, pp. 145–155, 2012, doi: 10.1016/j.jwb.2011.02.001.
- [44] C. Machado Guimarães and J. Crespo de Carvalho, "Strategic outsourcing: a lean tool of healthcare supply chain management," *Strateg. Outsourcing An Int. J.*, vol. 6, no. 2, pp. 138–166, 2013, doi: 10.1108/SO-11-2011-0035.
- [45] A. M. Aamer, "Outsourcing in non-developed supplier markets: a lean thinking approach," *Int. J. Prod. Res.*, vol. 56, no. 18, pp. 6048–6065, 2018, doi: 10.1080/00207543.2018.1465609.
- [46] T. Goldsby, S. Griffis, and A. Roath, "Modeling lean, agile, and leagile supply chain strategies," *J. Bus. Logist.*, vol. 27, no. 1, pp. 57–80, 2006, <https://doi.org/10.1002/j.2158-1592.2006.tb00241.x>.
- [47] H. L. Corêa and N. Slack, "Framework to analyse flexibility and unplanned change in manufacturing systems," *Comput. Integr. Manuf. Syst.*, vol. 9, no. 1, pp. 57–64, 1996, doi: 10.1016/0951-5240(95)00038-0.
- [48] P. Cordeiro, J. C. Sá, A. Pata, M. Gonçalves, G. Santos, and F. J. G. Silva, "The Impact of Lean Tools on Safety—Case Study," *Stud. Syst. Decis. Control*, vol. 277, pp. 151–159, 2020, doi: 10.1007/978-3-030-41486-3_17.
- [49] O. Ehret and P. Cooke, "Conceptualising aerospace outsourcing: Airbus UK and the lean supply approach," *Int. J. Technol. Manag.*, vol. 50, no. 3–4, pp. 300–317, 2010, doi: 10.1504/IJTM.2010.032678.
- [50] V. Blijleven, Y. Gong, A. Mehra, and K. Koelemeijer, "Critical success factors for Lean implementation in IT outsourcing relationships: A multiple case study," *Inf. Technol. People*, vol. 32, no. 3, pp. 715–730, 2019, doi: 10.1108/ITP-01-2016-0002.

- [51] F.J.G. Silva, K. Kirytopoulos, L.P. Ferreira, J.C. Sá, G. Santos, M.C. Nogueira, "The three pillars of sustainable development and agile project management: How do they influence each other," *Corp. Soc. Responsib. Environ. Manag.*, vol. 29, 2022. Accepted for publication. doi: 10.1002/csr.2287.
- [52] F.J.G. Silva, R.M. Gouveia, *Cleaner Production: Toward a Better Future*; Cham, Switzerland: Springer Nature Publishing, 2020, ISBN-13 978-3030231675.
- [53] P. Teixeira, A. Coelho, P. Fontoura, J.C. Sá, F.J. Silva, G Santos, and L.P. Ferreira, "Combining lean and green practices to achieve a superior performance: The contribution for a sustainable development and competitiveness—An empirical study on the Portuguese context," *Corporate Social Responsibility and Environmental Management*. Accepted for publication, 2022, doi: 10.1002/csr.2242.
- [54] P. Teixeira, J.C. Sá, F.J.G. Silva, L.P. Ferreira, G. Santos, and P. Fontoura, "Connecting lean and green with sustainability towards a conceptual model," *Journal of Cleaner Production*, vol. 322, no. 129, pp. 47, 2021. doi: 10.1016/J.JCLEPRO.2021.129047.