Evaluation of the Relation between Lean Manufacturing, Industry 4.0, and Sustainability

Adriana Freires de Araújo

Orientadores: Drª Leonilde Varela (DPS-UMinho) e Drº Paulo Ávila (ISEP-IPP)
2020/2021

University of Minho
School of Engineering

Abstract: Nowadays, Lean Manufacturing (LM) [1,2], Industry 4.0 (I4.0) [3], and Sustainability are important concerns for companies and society, namely, the influence of these two production philosophies in the three main sustainability pillars: economic, environmental, and social, and no work was found in the literature, which has motivated its exploration [4].

Knowledge of these potential correlations can influence important decisions for the industrial companies and its stakeholders. Moreover, the uncertainty is large, and few concerns are now appearing from different sides of the society, namely about employment issues.

According to the literature review done in this work, these relations are not well known and are dispersed by different sustainability's criteria.

To address this gap, this research proposes a structural equation model, with six hypotheses, to quantitatively measure the effects of LM and I4.0 in Sustainability. To statistically validate such hypotheses, 252 valid questionnaires were collected from industrial companies of Iberian Peninsula (Portugal and Spain). Results show that: (1) it is not conclusive that LM is correlated with any of the sustainability pillars; and (2) I4.0 shows a strong correlation with the three sustainability pillars. These results can contribute as an important decision support for the industrial companies and its stakeholders, even because not all the results are in line with other opinions and studies.
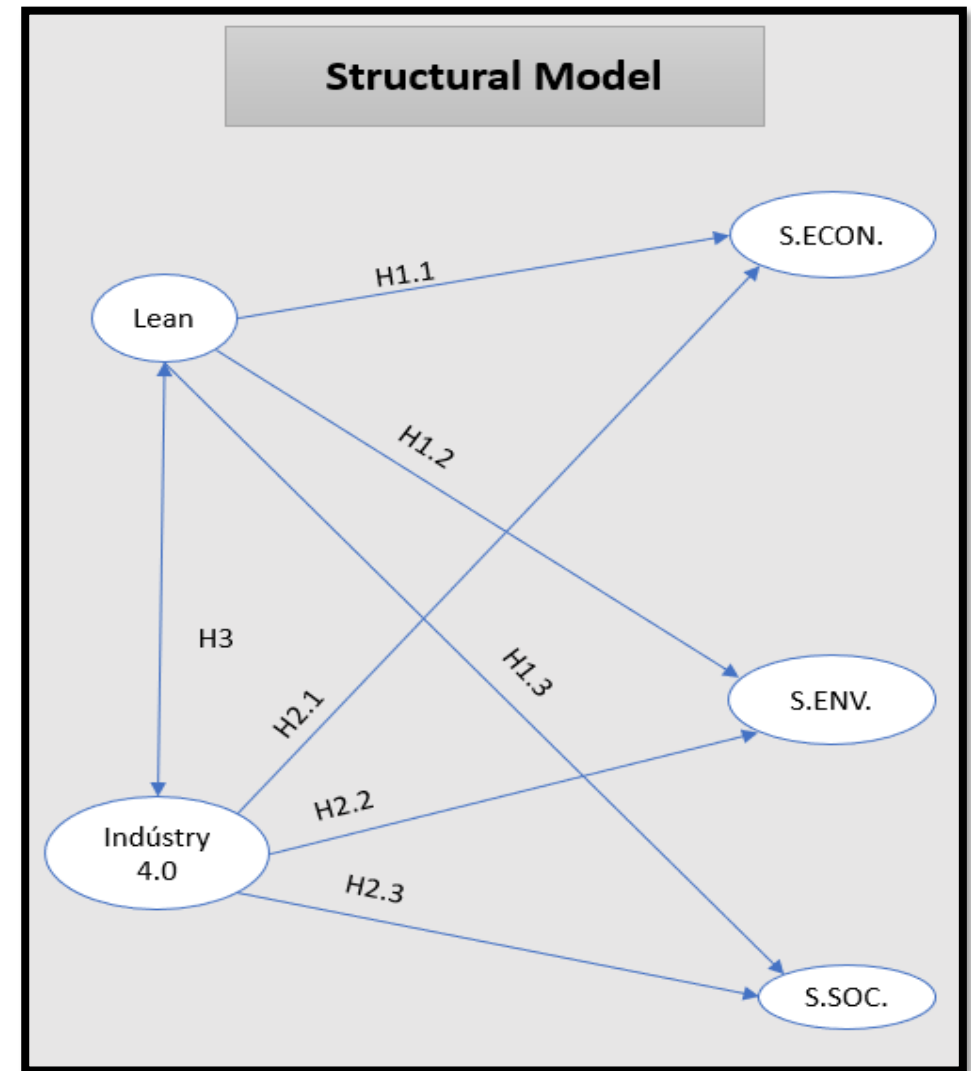
Fig. 1. Proposed structural model, Source: [4]

References

[1] Araújo, A. F., Varela, M. L., Gomes, M. S., Barreto, R. C., & Trojanowska, J. (2018). Development of an intelligent and automated system for lean industrial production, adding maximum productivity and efficiency in the production process. In Advances in Manufacturing (pp. 131-140). Springer.

[2] Araújo, M., Amaral, G., Varela, L., Machado, J., & Trojanowska, J. (2017, September). Improving Productivity and Standard Time Updating in an Industrial Company – A Case Study. In: Gheorghe G. (eds). Lecture Notes in Networks and Systems, Vol. 20, 220-228, Springer. DOI: https://doi.org/10.1007/978-3-319-63091-5_25.

[3] Schumacher, A., Erol, S., & Sihn, W. (2016). A maturity model for assessing I4.0 readiness and maturity of manufacturing enterprises. Procedia Cirp, 52, 161-166.

[4] Varela, L., Araújo, A., Ávila, P., Castro, H., & Putnik, G. (2019). Evaluation of the Relation between Lean Manufacturing, Industry 4.0, and Sustainability. Sustainability, 11(5), 1439. MDPI.