

# JIT and Environmental Performance: an empirical analysis

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## Abstract

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## 1. Introduction

Over the past decade there has been an increase in the research published on the synergies and trade-offs between lean manufacturing and environmental performance (Henao et al., 2019; Abualfaraa et al., 2020; Dieste et al., 2019; Lobo Mesquita et al., 2022; Garza-Reyes, 2015; King and Lenox, 2009).

These combined approaches, often dubbed ‘lean-green’, typically cites the Triple-Bottom-Line concept, which postulates the need for performance in economic growth, environmental preservation, and social responsibility, in order to achieve sustainability (Henao et al., 2019). Motivated by this body of research as well as our interest in sustainability studies, we have decided to study the effect of environmental and lean practices on environmental performance.

Abualfaraa et al. outline several research gaps and opportunities for those interested in lean-green manufacturing. In their Structured Literature Review of articles published between 2000 and 2018, they have identified several research directions in both the synergies and incompatibilities between environmental and lean practices (Abualfaraa et al., 2020). On one line, it is argued that lean practices may work as a catalyst for environmental practices and innovation through its focus on waste reduction and continuous improvement. On the other, the incompatibilities between the two approaches are also studied. Just in time (JIT) practices have been specifically highlighted. For example JIT manufacturing practices such as small lot sizes and high replenishment frequency implies more frequent transportation, higher CO2 emissions and more packaging waste (Dieste et al., 2019).

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Literature reviews also pointed out the need for more quantitative research with a focus on robust, well-defined sustainability metrics (Abualfaraa et al., 2020). Through an empirical analysis of JIT and environmental practices, our goal is to contribute to this research agenda.

## 2. Literature Review

WIP

RQ 1: What effect do lean JIT practices have on environmental practices and environmental performance?

RQ 2: What is the effect of JIT practices on CO<sub>2</sub> emissions and packaging waste?

## 3. Hypothesis

WIP

H1: Environmental practices and JIT practices are complementary: the implementation of JIT practices increases the marginal return of environmental practices on environmental performance and vice versa.

H2: JIT practices negatively moderates the effect of environmental practices on emissions to air and solid waste generation.

## 4. Methods

WIP

Confirmatory factor analysis for establishing legitimacy of 3 bundles

Complementarity of lean JIT/ environmental practices

Moderating effect of lean JIT

## 5. Results

WIP

## 6. Discussion

WIP

Non english speaking literature often filtered out

Different national contexts

Different industries

Critique of tripple bottom line is lack of novelty around the hardest problem, social sustainability

Solutions to the JIT/Green dilemma: They suggest that this can be done by, for example, selecting suppliers from a certain geographic area to enable truckload sharing for delivering or, when small amounts have to be delivered, managing the routes in order to supply multiple customers in the same area.

**BACKLOG:**

- Create skeleton for Lit Review with article references and share with Alessa and Astrid
- Create environmental practice "bundles" using EFA (DONE)
- Run a CFA between JIT and EP - Understand how to properly deal with NA values in CFA
- Run correlations
- Check for complementarity between JIT and EP bundles as per complementarity paper approaches
- See if there is a better way than just dropping all NA rows
- Test moderating effect of JIT on EP bundles as per china paper
- We need to ask the specifics of the likert scale for the JIT measures
- Apply spell check to latex sections before submitting

**References**

- Wadhah Abualfaraa, Konstantinos Salonitis, Ahmed Al-Ashaab, and Maher Ala'raj. Lean-Green Manufacturing Practices and Their Link with Sustainability: A Critical Review. *Sustainability*, 12(3):981, January 2020. ISSN 2071-1050. doi: 10.3390/su12030981. URL <https://www.mdpi.com/2071-1050/12/3/981>.
- Marcos Dieste, Roberto Panizzolo, Jose Arturo Garza-Reyes, and Anthony Anosike. The relationship between lean and environmental performance: Practices and measures. *Journal of Cleaner Production*, 224:120–131, July 2019. ISSN 09596526. doi: 10.1016/j.jclepro.2019.03.243. URL <https://linkinghub.elsevier.com/retrieve/pii/S0959652619309527>.
- Jose Arturo Garza-Reyes. Lean and green – a systematic review of the state of the art literature. *Journal of Cleaner Production*, 102:18–29, September 2015. ISSN 09596526. doi: 10.1016/j.jclepro.2015.04.064. URL <https://linkinghub.elsevier.com/retrieve/pii/S0959652615004394>.
- Rafael Henao, William Sarache, and Iván Gómez. Lean manufacturing and sustainable performance: Trends and future challenges. *Journal of Cleaner Production*, 208:99–116, January 2019. ISSN 09596526. doi: 10.1016/j.jclepro.2018.10.116. URL <https://linkinghub.elsevier.com/retrieve/pii/S0959652618331329>.
- Andrew A. King and Michael J. Lenox. Lean and Green? An Empirical Examination of the Relationship Between Lean Production and Environmental Performance. *Production and Operations Management*, 10(3):244–256, January 2009. ISSN 10591478. doi: 10.1111/j.1937-5956.2001.tb00373.x. URL <https://onlinelibrary.wiley.com/doi/10.1111/j.1937-5956.2001.tb00373.x>.
- Lígia Lobo Mesquita, Fabiane Letícia Lizarelli, Susana Duarte, and Pedro Carlos Oprime. Exploring relationships for integrating lean, environmental sustainability and industry

---

4.0. *International Journal of Lean Six Sigma*, 13(4):863–896, July 2022. ISSN 2040-4166, 2040-4166. doi: 10.1108/IJLSS-09-2020-0145. URL <https://www.emerald.com/insight/content/doi/10.1108/IJLSS-09-2020-0145/full/html>.