**EFFECT OF A DYNAMIC CAPACITY STRATEGY ON A SUSTAINABLE BIOFUEL SUPPLY CHAIN DESIGN**

**Marcela María Morales-Chavez1, William Sarache2, Yasel Costa3**

*1* *Universidad Libre Seccional Pereira. Calle 40 # 7-30, Pereira, Colombia.*

*Email:* [*marcelam.moralesc@unilibre.edu.co*](mailto:marcelam.moralesc@unilibre.edu.co)

*2Universidad Nacional de Colombia. Cra 27 # 64-60, Manizales, Colombia.*

*Email:* [*wasarachec@unal.edu.co*](mailto:wasarachec@unal.edu.co)

*3MIT-Zaragoza Logistics Center. Edificio Náyade 5, C/Bari 55 – PLAZA, 50197 Zaragoza, Spain. Email:* [*ycosta@zlc.edu.es*](mailto:ycosta@zlc.edu.es)

**Abstract**

Supply chain network design (SCND) is a strategic decision aimed to establish the network structure. Decisions such as facilities location, routes selection, materials flows, transportation modes selection, and inventory levels, are part of SCND problem. However, according to the literature review, optimization models considering capacity level as a decision variable (dynamic capacity) are almost non-existent. In real cases, capacity level is a variable that significantly affects the network structure and its economic, environmental and social performance. Consequently, allocating a fixed level of capacity to facilities prevents to analyze its effects on supply chain performance.

Therefore, the aim of this contribution is to present an optimization model to support a biofuel SCND using coffee residues in the Colombian context. The model addresses a dynamic capacity strategy (expansion or closing of facilities), establishing long-term changes in facilities, transportation and inventory decisions and its effect on sustainable performance (economic, environmental and social). When compared with a fixed capacity strategy, a dynamic capacity strategy presents better performance in economic (Net Present Value) and environmental dimensions. However, negative effects in the social dimension (job creation) were observed. The proposed model is a useful and realistic tool to establish long-term investment portfolios to support the development of new supply chains.

**Keywords:** Supply chain network design; biofuels; sustainability; coffee residues; optimization.

**Acknowledgments**

The authors would like to thank Colciencias (Fondo Nacional de Financiamiento para la Ciencia, la Tecnología y la Innovación "Francisco José de Caldas") for its financial support (Project 111971551628).