

# **Design of an ecotourism value network to optimize organizational sustainability from green engineering.**

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## **Abstract**

This paper shows how to optimize logistics processes in ecotourism companies, because, Colombian ecotourism has shortcomings in implementation, such as lack of integration of the nodes in the value network or ecotourism supply network, due to the operational separation between them; for lack of information management of tourists, high differences in prices and services offered, among others; The receiver nodes made up of hotels (central axes of the network) must be differentiated together with the service providers of the area to be visited (restaurants, merchants, entertainment, guides, among others) and in the external part of the network, the providers of each node, also, the sending nodes (transport, travel agencies and tourists in their place of origin). To solve the disarticulation, it is intended to know how the nodes work in a network, determining connectivity criteria such as information, materials, environmental strategies, among others; then, determine the sustainability management of each actor of the nodes, to know the logistical criteria used and the operational decisions; Also, with the established criteria and sub-criteria, a multi-criteria analysis-type methodology is applied, which, supported by the alternatives chosen by experts, allows the hierarchical tree for the value network and logistics management to be found, and with the payment matrix, to determine a network of optimal ecotourism value; and that it develops green engineering with the use of alternative energies, digital information management, waste recovery, water efficiency in the context of industry 4.0.

## **Keywords**

Logistics Management, Ecotourism, SMEs, Multicriteria Decision Analysis.

## **Introduction**

In the last two decades, research on globalization processes has been generated from a value chain perspective (Gereffi, Humphrey, Kaplinsky, and Sturgeon, 2001; Kaplinsky and Morris, 2001). Gereffi (1994) uses the term global value chains to refer to the international links between companies with global production and distribution systems. In parallel, the tourism industry has been experiencing continuous organizational economic growth and profound diversification, until it is positioned as one of the key drivers of current global socio-economic progress. The importance of the contribution of tourism to world economic activity is completely unquestionable. The World

Tourism Organization estimates its contribution to world GDP at around 5% (UNWTO, 2012). In terms of job creation, its impact would be slightly higher (6-7%), registering more than 235 million jobs - direct and indirect - worldwide (ILO, 2010).

However, the relevance of the role of tourism in achieving economic development is not an issue on which consensus has still been reached by the international community today, with conflicting positions. On the other hand, the tourism industry is characterized by being one of the most diversified and fragmented (Hjalager, 2007; UNWTO, 2010), encompassing both large multinational companies and a high percentage of small and medium-sized enterprises (SMEs). This duality constitutes a structural feature that the tourism sector traditionally presents on a global scale, although it is more pronounced in developing or underdeveloped countries (Morrison and Thomas, 2004; OECD, 2008). A more in-depth analysis of tourist SMEs highlights their higher prevalence of the value network in the receiving areas, their reduced organizational dimension, and the family nature of a high percentage of these (Bastakis, Buhalis, and Butler, 2004; Keller and Bieger, 2004; Wanhill, 2004). Therefore, these traits give them certain strategic and functional weaknesses, which are the ones that justify the recommendation from various international organizations (OECD, 2008; UNCTAD, 2007; UNIDO, 2001) towards their insertion and positioning in global value chains, such as a successful alternative in its integration into a progressively more globalized and competitive economic environment (Tejada, 2013). Also, Colombian tourist SMEs in the last three years has become more important for their numerical growth and for being the object of study for academics, especially those dedicated to tourism and ecotourism activities, due to the opportunity presented in conflict areas. armed, in the territories cleared by the peace agreements, taking advantage of the cultural ecosystem service that these territories provide, and from these resources contribute to the social development of the country, with the difficulties and challenges that entail for its sustainability in the framework of policies governmental.

Additionally, the term organizational sustainability has gained great importance (Bonil, 2013), showing the concern in investigating the factors that involve the term and the conception as such of ecotourism SMEs, such as their code of ethics, (Romero. 2015) where they define the behavior of these organizations regarding economic, social, cultural, political and ecological factors; Government entities such as the Ministry of Commerce, Industry and Tourism have designed the NTS-002 standard for tourism companies based on this concept, all of the above, makes it relevant to apply green engineering for its optimal development.

## **1. Methods**

The research has a descriptive scope since it seeks to know the resources and capacities in the tourism value network, with a mixed positivist approach (qualitative-quantitative) to describe the level of organizational sustainability of small ecotourism companies and their respective value network. In this sense, and taking as decision-making tools, four criteria are defined that encompass everything that must be considered in an organization to be sustainable and with which the impact on sustainability can be measured such as Economic, Social, Environmental, Normative. These criteria will be supported by several sub-criteria, for example, Direct economic impact, Indirect economic impact, and dimensions such as, for example, Customers, Suppliers, Employees, Investors, Public Sector, in addition to Competition, International Market, which guarantees the relevance of the data to be obtained through the instruments. An integrated methodology is adopted, starting with a systematic literature review of the PROCOLOMBIA and Ministry of Commerce databases; from which the characterization categories are defined (the type of company, natural attractions, location, infrastructure, size of the company, connectivity, energy, etc.) in terms of resources to identify them, locate resources and capacities with those that count concerning competitors and also identify all the stakeholders that make up the value network.

Then as seen in figure 1, the capabilities of the network are diagnosed to know what the network can do about (Quality-price; Comfort, Quality of rooms, Cleanliness, speed of delivery; Quality of service, among others); This is achieved through the analysis of a series of instruments (interview, direct observation, and survey) to determine both the type of comprehensive management they manage and how this management permeates the areas of the company and the value network stakeholder to analyze how they support and help decision-making to achieve their sustainability; With the results obtained, it will be possible to find the opportunities and threats that the value network of the ecotourism system has, which will be the basis for the criteria to implement in the design of the value network.

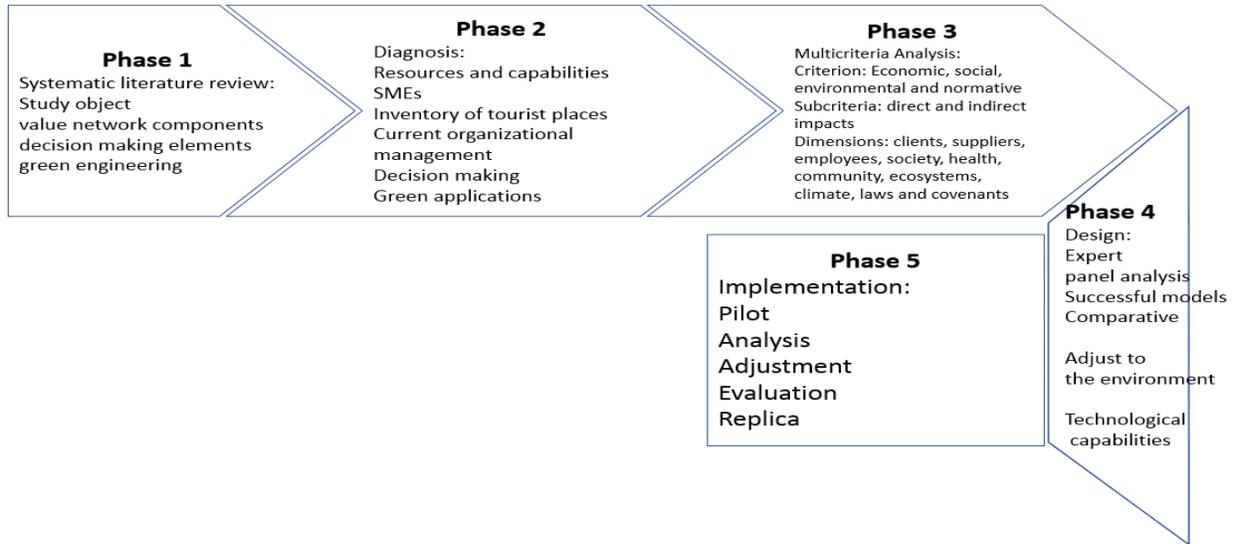


Figure 1. Methodology  
 Source: The Author

Finally, with a Likert-type categorization from a panel of national and international experts on the subject of decision-making in value networks, who will evaluate the most important factors for optimizing the value network of the ecotourism system, the results will reinforce the organizational management criteria and decision-making for the design of a preliminary model for the optimization of the decisions of the ecotourism value network to be based on a multi-criteria analysis methodology to be based on a Saaty scale (2015), the different priorities of The alternatives under each criterion must be synthesized by prioritizing alternatives and criteria (Saaty, 2015), based on which the design of management strategies from green engineering to improve sustainability decisions of the value network of the ecotourism system.

## 2. Theoretical framework:

The investigation deepens the following aspects; the object of study in the department of Cundinamarca in Colombia, then the concept of the tourist system is worked on, to show what the value network consists of and finally how it is articulated with the decision-making models that will allow them to be optimized and support organizational sustainability.

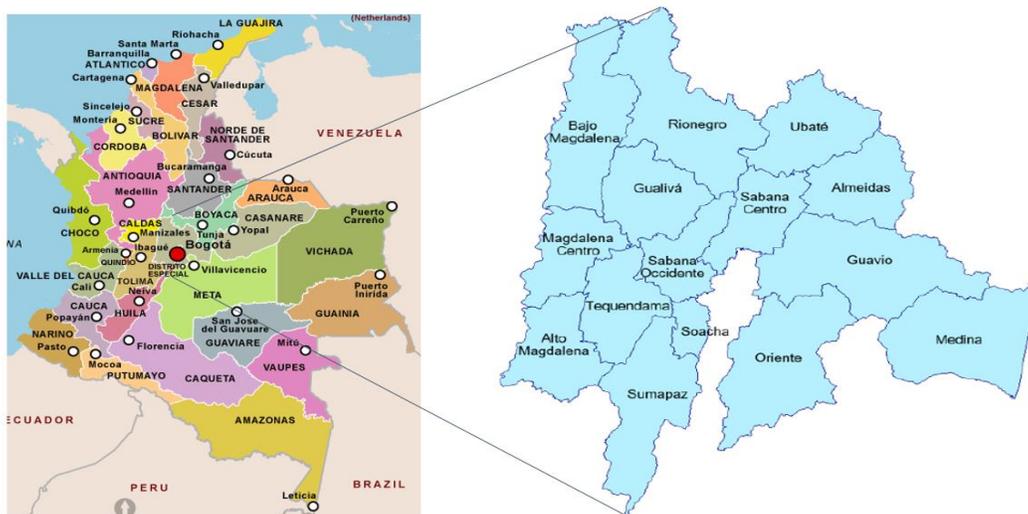


Figure 2. Cundinamarca provinces. Political-administrative division 2017  
 Source: (Camara, 2018)

2.1. **Cundinamarca – Colombia:** The department of Cundinamarca is located on the American continent in the South America area and the only country in this area bathed by the two oceans called Colombia, this department is located in the center of the country and is where the administrative center is established. and national legal with its capital Bogotá. As seen in figure 2; This department has 116 municipalities, which are divided into 15 provinces called: Almeidas, Alto Magdalena, Bajo Magdalena, Gualivá, Guavio, Magdalena Centro, Medina, Oriente, Rionegro, Sabana Centro, Sabana Occidente, Soacha, Sumapaz, Tequendama and I located. This department maintains its ancestral provinces because it has been the cradle of various civilizations since prehistory. The first indications indicate that this area was populated 12,000 years ago, by primitive men who were dedicated to hunting and gathering, from the Magdalena River valley, who had their settlement in the rocky shelters of Tequendama.

Archaeological studies indicate that Cundinamarca was populated by Muisca tribes of the Chibcha linguistic family three thousand years ago, in what is known as the Classic period. These were farmers who centuries later were invaded by other peoples of Caribbean origin, from the north of the country and where the national government system and agricultural expansion were established.

2.2. **Ecotourism:** The term ecotourism was coined by Ceballos, who since 1971 worked in the planning and development of sustainable tourism in all its aspects. Ceballos-Lascuráin defines it as:

"The execution of a trip to relatively undisturbed or contaminated natural areas, with the specific objective of studying, admiring and enjoying the panorama with its wild plants and animals, and also any cultural manifestation (past and present) found in these areas, which leads to participation and socioeconomically beneficial of the local populations"(Ceballos, 1998).

The relationship between tourism and ecology is: to make leisure and recreation a moment to enjoy and enjoy, to maintain and respect nature; Publicize without damaging the environment. Ecotourism also proposes new alternatives to tourists based on sustainable development, seeking recreation and education through observation and study of natural values, producing a minimal impact on natural ecosystems (Aguera, 2013). A significant part of the income generated by these ecotourism activities goes to the promotion and conservation of the natural areas in which it is carried out. The World Tourism Organization (WTO) defines it as: "all forms of tourism in which the main motivation of the tourist is the observation and appreciation of nature and contribute to the conservation of the natural environment and cultural heritage with the least possible negative impact "(UNWTO, 2002). The organization also recognizes that, in addition to actively contributing to the conservation of the natural and cultural heritage, ecotourism includes local and indigenous communities in its planning, development, and operation, thus better serving independent travelers, as well as Organized trips for small groups.

Ecotourism considers the principles of sustainable tourism concerning the economic, social and environmental impacts of tourism; But it differs from the general concept of sustainable tourism in that it actively contributes to the conservation of natural and cultural heritage, includes indigenous communities that contribute to their well-being, interprets the destination's natural and cultural heritage for visitors, and lends itself to low flow. of visitors. Sustainable development is linked to the social development of the area to be conserved, so sustainable tourism is applied to all forms of tourism and all kinds of destinations, including mass tourism and the different segments. The principles of sustainability refer to the environmental, economic, and socio-cultural aspects of tourism development and the balance that they must have in the long term. Therefore, sustainable tourism must guarantee the optimal use of natural resources, respect the socio-cultural authenticity of the host communities, and guarantee socio-economic benefits for all stakeholders (Choi, 2005).

2.3. **Tourism Value Network:** As studied in the previous component, tourism includes several social and economic components, therefore, the tourism value network is defined as the set of economic activities interrelated with each other and linked to a tourist event. Friedrichs (2003) adds that the tourist product turns out as shown in figure 3; interaction with the consumer, who is taken to the production area, in other words, to the tourist destination or protected area in the case of ecotourism, to enjoy it.

As in the other value networks, the distribution of value between each of the components of this must be differentiated and, on the other hand, the connection between them, also, the complexity of the network must be understood, which is perceived in the variety of providers for the same site, which may be connected to one or more tourism products. A clear example in Colombia is the city of Cartagena, which is a multiproduct destination since it has a great local offer to those who want to know the beach and its international interest in the historical, adventure and nature aspects; Some of the neighboring municipalities are of a type of product, be it a beach or gastronomic, on the

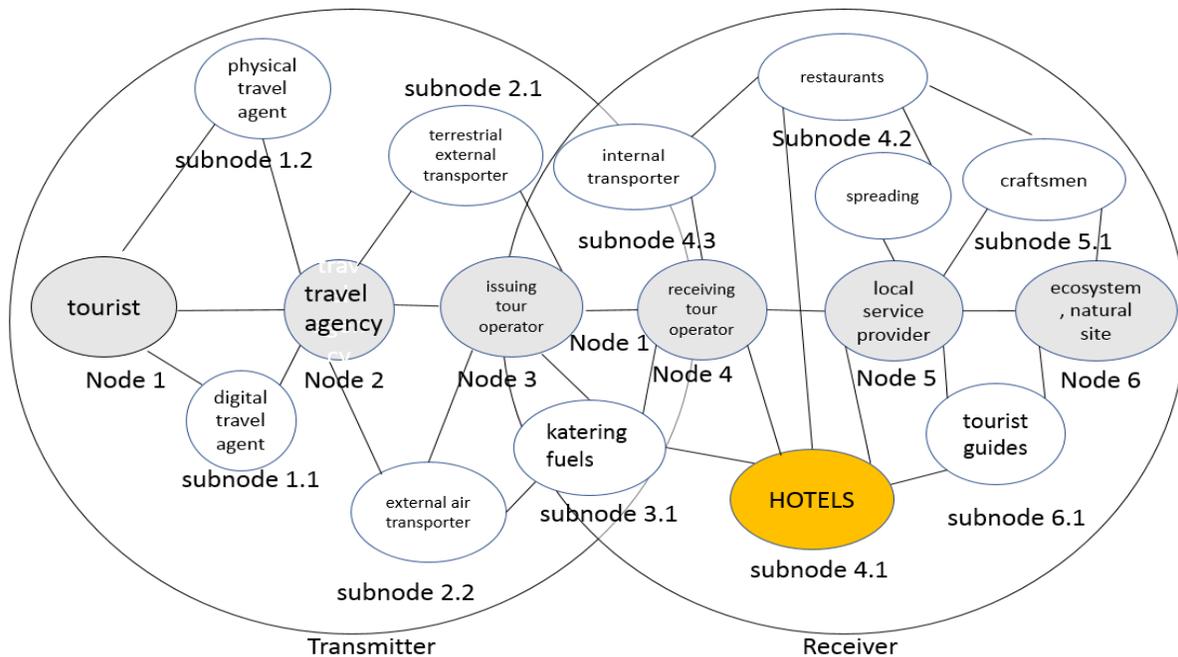


Figure 3. Tourist Value Network.  
 Source: The Author

another hand, most show the need to configure the tourist product provided, even if it has the support of the state. (Alvarado, 2017). In figure 3, it shows the first level of the value network, where node 1 begins with the tourist in their country or city of origin and node 6 in the protected area of destination. Node 1 with the need to have life experience connects with the second node which is the travel agency (for the study, node 1 of distribution), This node is also complex because the interaction can be individual, group, independent or wholesale, physical or digital with the tour operator; the next node has to do with external transport, that is, who takes the tourist from the origin to the arrival in the country or city to visit (node 3 or second of distribution), in this node internal transport must be taken into account or related services, such as transportation from home to the external transportation system, be it the airport, the port or the inter-municipal bus terminal, including, if necessary, the exchange offices to obtain foreign currency or the money handled by the destination country, if applicable ; Also, the node of legal procedures and procedures that the tourist must do to move to the place to visit (passports, vaccinations, permits and income taxes) must be taken into account.

The fourth node has to do with the visit site, who is going to contribute to the experience that the tourist is going to achieve and then replicate when they return, from the internal transport, already included in the previous node, these service nodes rotate Around the accommodation node or hotels, who are the ones previously contacted better known as local tour operators, around this is node 5, which are the related services including internal transportation (either to the hotel and to all sites). to visit), the gastronomic or restaurant service in all possible categories from street vendors to large gourmet places and the commercial component that has to do with gift items or reminders to be carried by tourists and node 6 includes not only the protected area but the excursion service or guides who are responsible for maintaining the environmental sustainability of the territory in May visited. (Alvarado, 2017)

How to get perceive each of the nodes have their value network that needs specific inputs and services and at the same time contribute to economic and social growth with employment and integration, but always leaving aside the

environmental component in mitigation, preservation and conservation, this being, as said before, the essence of the business.

2.4. **Decision making:** The tourist value network in each of its nodes must have a clear process, type, quality, and quantity in making decisions at each of the connectors, as can be seen in figure 4. You can see the mesh of connections between the network and the strategies of each component, such as the logistical and cross-functional guidelines to show that the network must be interconnected for optimal operation with a balance between efficiency and effectiveness.

Therefore, the decision models were sought, the following references were taken into account as follows: For decision models in a value network or supply chain, NARASIMHAN and MAHAPATRA must be taken into account, who classify the decision models according to The decisive problems in each node of the network, these models determine them at a strategic, tactical and operational level according to the needs of the node.

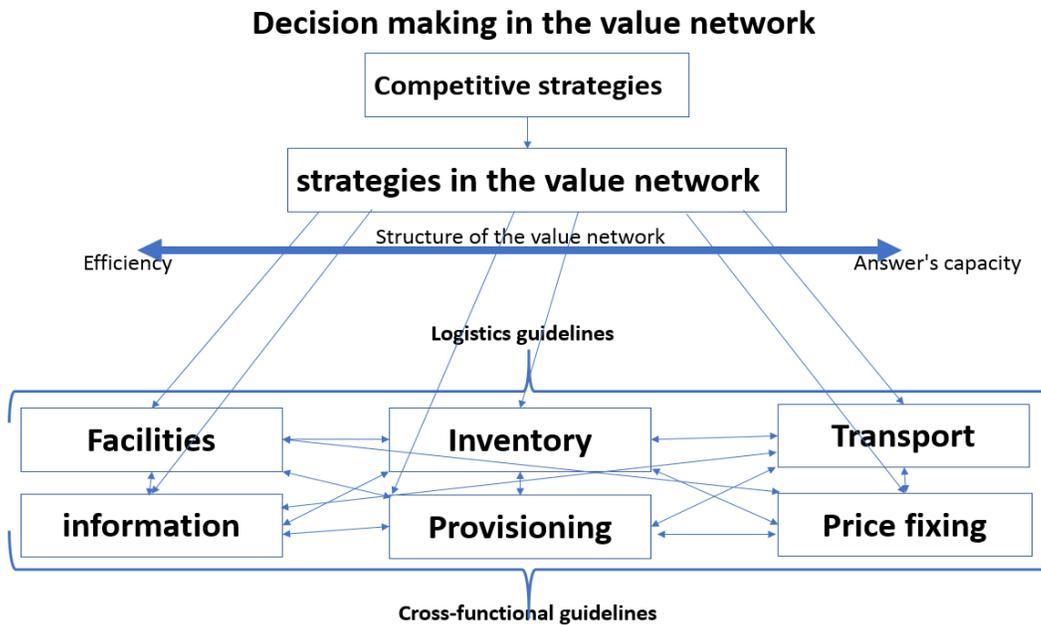


Figure 4. Decision making in the value network  
 Source: Krajewski, 2008

### **Expected results**

To ensure that sustainability in ecotourism SMEs type companies is completely completed, the entire value network of the tourism system must initially be identified from the moment of entry, such as who demands the service, such as the ecotourist, to the last member of this network as it is responsible for the natural area to visit as shown in figure 3.

Each of the nodes described above must improve their organizational processes in such a way, such as the processes of travel agencies, near and far transport systems, the support services they provide on-site to visit, education, protection and recovery of the area visited and finally the return of the visitor, all the blocks must integrate environmental sustainability and components of green engineering into their processes in their activities, as shown in figure 5. For the case study in Cundinamarca (which could be that of any state or department in Latin America), it should be known how the management model is that, according to previous research, is very simple and insipient, more guided by empiricism than by organizational theory, Also, that the communities are not part of the industry and

those who protect or guide the natural area do not have the necessary knowledge to provide environmental education and conservation (starting with the use of other languages).

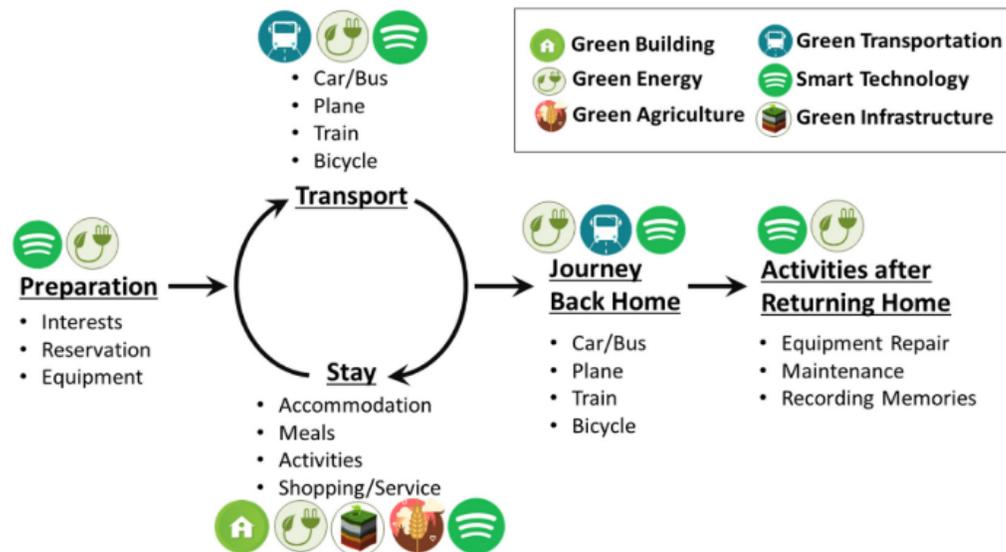


Figure 5. Decision points in the value network from green engineering  
Source: Pan, 2018

The research aims to provide the engineering tools necessary to ensure that the entire value network contributes to environmental sustainability and manages to optimize its internal and external decision-making processes, thus achieving business durability even in off-peak seasons.

## References

- Avendaño-Prieto, G., Mosquera-Laverde, W. E., & Vásquez-Bernal, O. A. (2019). Analysis of organizational management and supply chains in ecotourism companies of Lejanías, Uribe and Mesetas (Meta-Colombia). IEOM meeting. Chek Republic.
- Alderete, M., & Gutiérrez, L. (2013). TIC y productividad en las industrias de servicios en Colombia. *Lecturas de Economía*, (77), 163-188.
- Angel, M. F., & Pulido, D. U. (2010). El éxito de las pymes en Colombia: un estudio de casos en el sector salud. *Estudios gerenciales*, 77-96.
- Barba-Romero, S., & Pomerol, J.-C. (1997). *Decisiones Multicriterio. Fundamentos Teóricos y Utilización Práctica*. Alcalá, España: Universidad de Alcalá de Henares.
- Bastakis, C., Buhalis, D. y Butler, R. (2004): "The Perception of Small and Medium-Sized Tourism Accommodation Providers on the Impacts of the Tour Operator's Power in Easter Mediterranean", *Tourism Management*, 25(2), 151–170.
- Belton, V., & Stewart, T. (2002). *Multiple Criteria Decision Analysis. An Integrated Approach*. Kluwer Academic Publisher.
- Berrío, J. G. R. (2006). ¿Gestión del conocimiento o gestión de la información? *TecnoLógicas*, (16), 59-82.
- Beltrán A. Torres E. (2004) *Pymes. Un reto a la competitividad*. Universidad Externado. Bogotá.
- Bermúdez T. González P. (2008). Una aproximación al modelo de toma de decisiones usado por los gerentes de las micro, pequeñas y medianas empresas ubicadas en Cali, Colombia desde un enfoque de modelos de decisión e indicadores financieros y no financieros. *Revista de Contaduría Universidad de Antioquía* No. 52 páginas 131 a 154. Universidad de Antioquía. Medellín.
- Bonil, J., Junyent, M., & Pujol, R. M. (2010). [3] Educación para la Sostenibilidad desde la perspectiva de la complejidad. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, 198-215.

- Cámara de comercio de Bogotá (2015). Balance de la economía Bogotana, 2010-2014 y primer semestre del 2015. Recuperado de [http://camara.ccb.org.co/documentos/4737\\_Balance\\_de\\_la\\_economia\\_bogotana\\_Parte\\_1.pdf](http://camara.ccb.org.co/documentos/4737_Balance_de_la_economia_bogotana_Parte_1.pdf)
- Cardona, C., & Bonilla, E. (2015). Los factores limitantes de la internacionalización de las pymes textil, cuero, calzado e industria marroquinera colombianas. *Revista Caribeña de Ciencias Sociales*, (2015\_11).
- Codina, A. (1996). El "modelo" o teoría del cambio. [http://www.degerencia.com/articulo/el\\_modelo\\_o\\_teor%C3%ADa\\_del\\_cambio](http://www.degerencia.com/articulo/el_modelo_o_teor%C3%ADa_del_cambio).
- Correa, M. E., Abramovay, R., Gatica, S., & Van Hoof, B. (2013). Nuevas empresas, nuevas economías: Empresas B en Sur América.
- Eusko, J. (2008). Gobierno Vasco. Euskadi. [En línea]. [Citado el: 29 de Mayo de 2012.] [http://www.ogasun.ejgv.euskadi.net/r51-341/es/contenidos/informacion/guia\\_estandares\\_tecnologicos/es\\_6876/adjuntos/4.%20Anexo%20Metodolog%C3%ADa%20de%20Gesti%C3%B3n%20del%20Cambio%20para%20proyectos%20PLATEA.pdf](http://www.ogasun.ejgv.euskadi.net/r51-341/es/contenidos/informacion/guia_estandares_tecnologicos/es_6876/adjuntos/4.%20Anexo%20Metodolog%C3%ADa%20de%20Gesti%C3%B3n%20del%20Cambio%20para%20proyectos%20PLATEA.pdf).
- Fernández, E. O. (2015). SEO: Clave para el crecimiento de las Pymes. *Opción*, 31(6), 652-675.
- Gamez, A., Morales, M. y Ramirez, C. (2018). Estado del arte sobre problemáticas financieras de las pymes en Bogotá, Colombia y América Latina. *Económicas CUC*, 39(2), 77-94. DOI: <http://dx.doi.org/10.17981/econuc.39.2.2018.05>
- Gaskill, L., Van Auken, H. y Manning, R. (1993): "A factor analytic study of the perceived causes of small business failure". *Journal of Small Business Management*, vol. 34, n. 4, pp. 18-31.
- Gereffi, G. (1994): "The Organization of Buyer-driven Global Commodity Chains: How U.S. Retailers Shape Overseas Production Networks", in G. Gereffi, & M. Korzeniewicz (Eds.), *Commodity Chains and Global Capitalism* (pp. 95-122), London, Praeger.
- Gereffi, G., Humphrey, J., Kaplinsky, R. y Sturgeon, T.J. (2001): "Introduction: Globalisation, Value Chains, and Development", *IDS Bulletin*, 32(3), 1-8
- Hederich, C.A. (2015). Situación y necesidades de la pequeña y mediana empresa. *Civilizar Revista electrónica de difusión científica*. Universidad Sergio Arboleda Bogotá. Recuperado de <http://www.usergioarboleda.edu.co/civilizar>
- Hernández S. R, Fernández C. (2015). Metodología de la investigación. Mac Graw Hill. Colombia.
- Hernández, A., Marulanda, C. E., & López, M. (2014). Análisis de Capacidades de Gestión del Conocimiento para la Competitividad de PYMES en Colombia. *Información tecnológica*, 25(2), 111-122.
- Hjalager, A-M. (2007): "Stages in the Economic Globalization of Tourism", *Annals of Tourism Research*, 34 (2), 437-457
- Hiatt, J. (2006). *A Model for Change in Business, Government, and our Community: How to Implement Successful Change in Our Personal Lives and Professional Careers*. Colorado: Prosci Research. 978-1-930885-50-9.
- Ilo (2010): *Developments and Challenges in the Hospitality and Tourism Sector*, Global Dialogue Forum for the Hotels, Catering, Tourism Sector, Geneva.
- Jeston, J. y NESLIS, J. (2008). *Business Process Management (Practical Guidelines to Successful Implementations)*. 2da. Burlington : Elsevier Ltd, 978-0-75-068656-3.
- Kotter, J. P. (1996). *Leading Change*. [ed.] Harvard Business Review Press. 1st edition. ISBN-10: 0875847471 • ISBN-13: 978-0875847474.
- Leyva López, Juan Carlos (2011) *Análisis multicriterio para la toma de decisiones métodos y aplicaciones* Editorial: Plaza y Valdés, S.A. de C.V.
- Méndez, C. (2009). *Tecnologías y herramientas de gestión. Caso Grandes, medianas y pequeñas empresas en Bogotá*. Editorial Universidad del Rosario. Bogotá.
- Morrison, A. y Thomas, R. (2004): *SMEs in Tourism: An International Review*, Arnhem, ATLAS
- OCDE (2008): *Enhancing the role of SMEs in the global value chains*, Paris, OECD.
- Olano, E. B. (2017). El postconflicto una oportunidad para impulsar el comercio justo en Colombia. *Observatorio de la Economía Latinoamericana*, (227).
- OMT (2012): *Panorama OMT del turismo internacional*, Edición 2012, Madrid, OMT.
- Porter, M.E. (1980). *Competitive strategy*. New York, NY: Free Press/Simon and Schuster.
- Quintero Reatiga, J. S. (2018). *Las PYMES en Colombia y las Barreras para su Desarrollo y Perdurabilidad*. Bogotá, Colombia: Universidad Militar Nueva Granada.
- Rivera, H. y Malaver, M. (2011 a). *La investigación en la Facultad de Administración de la Universidad del Rosario: Pasado, presente y futuro*. Documento de Investigación N° 100. Bogotá, Colombia: Facultad de Administración, Universidad del Rosario

- Romero, L. A. P., Castrillon, M. A. G., & Mares, A. I. (2015). Código de ética empresarial para las Pymes: marco de referencia para la sostenibilidad y responsabilidad social empresarial (RSE). *Revista ESPACIOS* | Vol. 36 (Nº 02).
- Rojas, A. Grillo C. y Mosquera W. (2013)., Estudio exploratorio sobre el manejo de la información y la aplicación de las TICS para la toma de decisiones en las pequeñas empresas de Bogotá. Universidad Cooperativa de Colombia. Bogotá. 2013.
- Rubio, C. P. (2012). Gestión estratégica organizacional aplicada a las pymes constructoras en Colombia.
- Ruiz M, J., RUIZ S, C. MARTÍNEZ L, I., PELÁEZ I, (1999). Modelo para la gestión del cambio organizacional en las Pymes. En: Congreso Nacional de la Asociación Científica de Economía y Dirección de la Empresa (ACEDE) (9º: 1999: Burgos). Empresa y Mercado: Nuevas Tendencias, IX Congreso Nacional de la Asociación Científica de Economía y Dirección de la Empresa (ACEDE), Burgos 1999.
- Saaty, T. L., & Ergu, D. (2015). When is a decision-making method trustworthy? Criteria for evaluating multi-criteria decision-making methods. *International Journal of Information Technology & Decision Making*, 14(06), 1171-1187.
- Spillman, J. y J. Parnell (2006). "Marketing Resources and Firm Performance Among SMEs." *European Management Journal* Vol. 24, Nos. 2-3, pp. 236-245. Elsevier.
- Stokes, D. (1998): *Small business management. A case study approach*, Letts Educational ed., London. 3 edition.
- Tejada G. P; Moreno, P. (2013). Contribución de las pymes turísticas al desarrollo. *Revista de economía mundial*, págs. 103-119
- Torres, M. H., & Robaina, D. A. (2013). Enfoques para la gestión del cambio organizacional. *Alta dirección*, 47(279), 11-17.
- Vásquez-Bernal, O. A., & Cortés-Aldana, F. (2014). La certificación de los profesionales de ingeniería: Un análisis multicriterio innovador. En J. Saravia Arenas, P. R. Herrera Capdevilla, & P. Amar Sepulveda (Edits.), *Experiencias internacionales emergentes en gestión tecnológica y de la innovación para el desarrollo territorial* (págs. 1-18). Barranquilla, Atlantico, Colombia: Universidad Simon Bolivar.
- Vásquez-Bernal, O. A., & Mosquera-Laverde, W. E. (2018). Impact of integrated management systems on organizations and the impact of road projects on biodiversity in Colombia. *World Trans. on Engng. and Technol. Educ*, 16(1), 47-53.
- Vega, R. (2011). *Pymes: reflexiones para la pequeña y mediana empresa en Colombia*. Editorial Politécnico Grancolombiano, Bogotá.
- Velasco M. 2006. Caracterización de las pymes de Bogotá mediante el uso de información secundaria. Universidad Santo Tomas. Bogotá.
- Vásquez-Bernal, O. A., & Cortés-Aldana, F. (2014). La certificación de los profesionales de ingeniería: Un análisis multicriterio innovador. En J. Saravia Arenas, P. R. Herrera Capdevilla, & P. Amar Sepulveda (Edits.), *Experiencias internacionales emergentes en gestión tecnológica y de la innovación para el desarrollo territorial* (págs. 1-18). Barranquilla, Atlantico, Colombia: Universidad Simon Bolivar.

## **Biographies**

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