



EL EMPRENDIMIENTO SOCIAL COMO ELEMENTO CLAVE EN LA TRANSFORMACIÓN HACIA UN NUEVO SISTEMA ENERGÉTICO BASADO EN ECONOMÍAS DE HIDRÓGENO

Jossie Esteban Garzón Baquero, Daniela Bellon Monsalve

**Universidad de Santander
Bucaramanga, Colombia**

Abstract

The modern world grows according to a model based on fossil fuels; a model that presents serious sustainability problems. Likewise, this study seeks to illustrate one of the new alternative energy schemes that could replace fossil fuels in the future: hydrogen. This transformation will lead to significant social impacts. Social entrepreneurship can integrate socio-economic agents and help them implement new forms of energy innovation, which will open spaces for new business models.

This study conceptualizes the connotations of the hydrogen economy in a current context, its implications for society, and its synergy with social entrepreneurship. It shows the role of social entrepreneurship as a key element in the implementation of the hydrogen economy, as well as the way in which and how the processes and models used to manage these undertakings play a vital role in the present and future economies.

Keywords: social entrepreneurship; company; innovation; hydrogen economy; hydrogen energy

Resumen

El mundo moderno crece de acuerdo con un modelo basado en combustibles fósiles; un modelo que presenta serios problemas de sostenibilidad. Así mismo, este estudio busca ilustrar uno de los nuevos esquemas de energías alternativas que podrían reemplazar a los combustibles fósiles en el

futuro: el hidrógeno. Esta transformación dará lugar a importantes impactos sociales. El emprendimiento social puede integrar agentes socioeconómicos y ayudarlos a implementar nuevas formas de innovación energética, que abrirán espacios para nuevos modelos de negocio.

El presente estudio conceptualiza las connotaciones de la economía del hidrógeno en un contexto actual, sus implicaciones para la sociedad y su sinergia con el emprendimiento social. Muestra el papel del emprendimiento social como elemento clave en la implementación de la economía del hidrógeno, así como la forma en qué y cómo los procesos y modelos utilizados para gestionar estos emprendimientos juegan un papel vital en las economías presentes y futuras.

Palabras clave: *emprendimiento social; empresa; innovación; economía del hidrógeno; energía del hidrógeno*

1. Introduction

The search for different energy alternatives that satisfy both the population's energy demand and the need to mitigate the social and environmental impact of current energy supply systems has been studied for decades (Valero, 2010). This search is based on three main elements which are i) political stimuli from net energy importing nations, ii) environmental concerns as expressed by the Kyoto Protocol, and iii) diminishing hydrocarbon reserves, especially of petroleum (Roberts, 2004).

As for hydrogen, it was promoted as a clean and promising energy vector for the future, as an answer to that search (Moliner, Lazaro, & Suelves, 2016); and hence emerges the concept "Hydrogen Economy", which implies a new business structure, prompting a new system of socio-economic relationships that would be brought along by a transition from fossil fuels to hydrogen. However, its implementation is conditioned to a mentality not based on the generation of profitability, but on the promotion of projects that maximize the benefit of this new energy regime, from both environmental and social perspectives.

This is how the concept of entrepreneurship is integrated into the equation; but for this, it is not possible to simply apply the traditional definition of entrepreneurship, "the engine of nations' economic growth" (Audretsch & Keilbach, 2004), making the interpretation of its point of view from a social aspect, a must. (Acosta Véliz, Coronel Pérez, & Jiménez Cercado, 2018) define social entrepreneurship as an innovative form of approaching a social problem where the market economy cannot, where there is insufficient or non-existent public administrative action, or where there is room in the market for intensification or improvement of services to achieve social goals.

In this context, the present study proposes a transformation of fossil fuel economies to a new model that uses hydrogen as an energy vector; and suggests that this transformation can best be undertaken through synergy with social entrepreneurship, which aims for social and environmental development, and the resolution of socio-economic problems by means of sustainable strategies (Acosta Véliz et al., 2018).



2. Relationship between social entrepreneurship and the hydrogen economy

Hydrogen is the most abundant elements in the universe, energetically speaking it is practically unlimited and it does not produce harmful CO₂ emissions when burned; however, it is rarely to found in a free state, which implies the need to develop a whole production, storage and conversion system that facilitates its implementation (Valero, 2010). These characteristics make hydrogen a perfect fuel upon which to base a new economy; an economy in which markets and institutions are sustainable¹.

This new “hydrogen economy” must be supported by a social base. Per (Hoffmann & Mirza, 2002), hydrogen technologies will be applied to transportation, as well as the independent generation and domestic use of electricity; this implies some major benefits, such as reducing the impact of climate change, decreasing the dependence on petroleum, production of new geopolitical realities, supplying energy to vulnerable communities outside energy grids, among others (Solano, 2004), (Scipioni, Manzardo, & Ren, 2017).

Hydrogen economy will involve a systematic infrastructure, including the production, storage, transport, and usage of energy from hydrogen (Chen & Hsu, 2018; Pudukudy, Yaakob, Mohammad, Narayanan, & Sopian, 2014). Said infrastructure consists of three main parts, which are hydrogen production, its transformation into electricity and heat using fuel cells and finally, an end use that extends to both mobile and stationary applications.

The hydrogen economy implementation presents a set of challenges that are being gradually overcome in each of the key links towards its implementation; Nevertheless, there remains an important barrier, related to tendency towards investment in fossil fuels, and the lack of policies that promote and facilitate the research, development, and implementation of new technologies for clean energy, which would help make hydrogen a competitive option (Sperling & Cannon, 2004). Thus, the strategy that would allow for a reduction in the gap between the fossil fuel economy and the hydrogen economy must integrate the triple helix of the state, private industry, and academia.

Within this triple helix, a common denominator appears, which connects and facilitates work among the players, the concept of entrepreneurship. From an economic perspective, entrepreneurship has always sought a relationship between economic development and the profit motive; authors such as (Say, 1821) describes it as an intermediary between capital and labour, (Fritsch, 2017) ties it to innovation and considers it the basis of the economy, (Varela, 1998) entrepreneurship as opportunities that require inputs such as financial and human resources, a definition which is broadened by (Formichella, 2015) to describe the concept as the action of creating or improving a product or service. Additionally, the social and human sciences have provided their point of view upon entrepreneurship (Guzmán, A; Trujillo, 2008). In this sense, entrepreneurship is clearly based on elements such as leadership, innovation, vision, creativity, and opportunity; while the concept of

¹ Sustainability must be understood as an articulated discipline of knowledge and as a new way of rethinking the human relationship with nature; based on the totality of the economic, social, environmental, and value dimensions; leading to a global revolution in survival with the planet (Zarta Ávila, 2018).



social entrepreneurship adds other elements such as social transformation, impact, sustainability, and sustainable development.

Authors such as (Escamilla, S; Alonso, N; Plaza, 2017; Garzón & Bellon, 2021) describe social entrepreneurship as a way to obtain resources for non-profit organizations; others such as (Shane, S., & Venkataraman, 2000) describe it as a sequential process, in which the entrepreneur creates, detects, and exploits an opportunity (R. Roberts & Woods, 2005) when rethinking this process as the construction, evaluation, and pursuit of opportunities; but through a lens of transformative vision and social change. From this, social entrepreneurship begins to shape towards all economic activity that tends to create value in its approach to social challenges, creating a truly lasting impact that has nothing to do with profit, but rather with producing significant changes in real communities (Becker, Kunze, & Vancea, 2017; Surie, 2017), (Austin, Stevenson, & Wei-Skillern, 2012), (Simón Moya, Sastre Sánchez, & Revuelto Taboada, 2015).

In the specific case of projects related to the diffusion of renewable energy technologies, which include the implementation of the hydrogen economy, it has been noted that developing economies possess certain common characteristics, such as a deficiency or lack of incentive for innovation on the part of government entities, as well as low demand for renewables given lack of knowledge in the market, which makes new projects considerably riskier, and slows the adoption of solutions (Walsh, 2012). In these cases, the role of social entrepreneurship assumed by NGOs or by academia becomes fundamental in the success of the diffusion of this kind of innovation (Balachandra, Kristle Nathan, & Reddy, 2010).

Even then, to be an entrepreneur in this new hydrogen economy requires a form of entrepreneurship that distances itself from competitive capitalism, and which, according to (Dees, 1998), can contribute to resolving some of the social problems generated by the capitalist economic system. The requirement for this is focused on entrepreneurial activity that exhibits a philosophy based on producing goods and services that serve the goals of the population.

The above allows the authors to establish a clear connection between social entrepreneurship as a tool for the hydrogen-based energy transition; a relation that integrates the triple helix and focuses the social entrepreneur as a transversal and fundamental axis of the process, as will be seen later. In the current study, the entrepreneur is defined as the individual who takes advantage of opportunities and puts them into practice, with an impact upon society in the creation of jobs and income. It is also a person who demonstrates a desire to make a positive social change in society, exhibits high work performance and dedication, and whose contributions are aimed towards the construction of a denser social fabric and a society in harmony with the state and the environment.

3. Methodology

The present study is descriptive and of qualitative analysis. It answers the question, “how can fossil fuel economies be transformed to hydrogen economies through social entrepreneurship? An in-depth examination has been made of the concepts of “social entrepreneurship” and “hydrogen economy” through secondary sources. The study concludes with a proposal based upon cooperative work between social entrepreneurship and the hydrogen economy to move beyond fossil fuel economies.

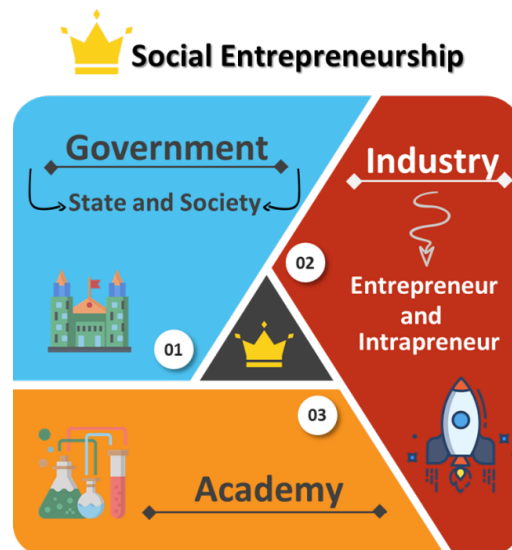


4. Social entrepreneurship as a tool for transformation to hydrogen economy

Geoffrey Edwin Hall Ballard, founder of Ballard Power Systems, supported the need for joint efforts with the government, academia, and industry, for the transition of a fossil fuel economy to a hydrogen economy to be possible² (Ballard, 2008). However, experience has shown that this joint effort must be based on social entrepreneurship, to generate ideas of multidisciplinary origin that result in structuration of business plans with higher chances of accessing public and/or private resources, creating sustainable companies with a greater impact upon any economy.

The proposal is based on the idea that it is possible to transform current fossil fuel economies through multidisciplinary array of interdisciplinary ventures, which effectively respond to energy needs, while considering the conditions of the economy and its ecosystem. This implies promoting the formation of entrepreneurs with a social sense, as well as the generation of knowledge that increases the possibilities of the ventures to last over time. For (Gómez R. & Mitchell, 2014), scientific and technological strategies that revolve around human management, the creation of new knowledge, the dynamic and innovative social entrepreneurship all supported by robust institutions and the state, and a competitive environment conducive to business development, are key in this kind of transitions.

Thus, the proposal developed is based on the above, and takes its basis in the state (both its government and the population that benefits), industry (entrepreneur and intrapreneur) and academia, focusing social entrepreneurship as a transversal axis, as presented in Figure 1, where each actor plays a fundamental role in the transition from fossil fuel-based economies to hydrogen-based economies.



² "It will take a combined effort of academia, government, and industry to bring about the change from a gasoline economy to a hydrogen economy. The forces are building, and progress is being made. It is of major importance that a change of this magnitude is not forced on unwilling participants, but that all of us work together for an economically viable path to change." — Geoffrey Ballard (1932-2008).



Figure 1. Key players in the transition of a fossil fuel economy to a hydrogen economy. Source: Authors.

According to the proposal presented in figure 1, the fundamental actors in the process play a specific role, and each role considers social entrepreneurship in a transversal manner, recognizing that this economy must be oriented towards those who are interested in creating firms with a social impact. According to (Gámez & Garzón, 2016), entrepreneurs who create firms are key agents of the economy, because they drive technological change, wealth generation, and job creation. Entrepreneurship is a way of life and is the ideal basis of the proposal in this study.

In this context, the first role is played by the state, which is made up of two agents: the government and society. In reference to the first agent, this is the one that must establish clear directives towards promoting the use of hydrogen as a fuel; making it necessary to form institutions and ministries in developing action plans that promote research into, production, and commercialization of hydrogen as a fuel. In this respect, the powers of the state must be aimed towards the adoption of hydrogen in the different sectors of the economy, through different strategies that promote social entrepreneurship, so that everything is aligned with the National Development Plan and the world development objectives.

The second agent of the state is society, since it is ultimately the people who will become the end users of each of the technologies linked to the implementation of the hydrogen economy. Society's role must be dynamic and continually evolve over time, so that they can become not only consumers, but also drivers of change through entrepreneurship or intrapreneurship³, promoting social consciousness in all their activities.

The second role in Figure 1 involves the industry, which should be linked, through social entrepreneurship strategies, to the strengthening of global initiative known as the Hydrogen Council, which strives to position hydrogen among the solutions for a transition to a clean, low-carbon energy system. The investment process must be continuous to increase the role of hydrogen in the energy mix of the future, through policies and support programs in concert with individual governments, recognizing that actions on the part of the business are required to make the commitment a reality (ONU, 2015).

Finally, the third role corresponds to the academy, from three fundamental elements, which are: i) Strengthening implementation prospects through the identification of potential and opportunities in each region; ii) Research, development, and innovation, given that academia enjoys the intellectual and human capital, and the laboratory infrastructure for systemic and integrated development based on fundamental engineering and economic analysis; and iii) Training and education, taking the first to mean each person learning about the world around them, and the second being about the sociocultural collective that surrounds and affects each of us, within this last element is linked training in social entrepreneurship and support from the academy in this aspect. Figure 2 shows the articulation of the above-mentioned elements, highlighting the importance of their progressive and sequential execution.

³ Intrapreneurship is here defined as an entrepreneurial activity carried out in an already-existing organization (Trujillo Dávila & Guzmán Vásquez, 2008).





Figure 2. Fundamental elements of the role of academia. Source: Authors.

5. Discussion

The current analysis is based on the transition of fossil fuel economies to hydrogen economies by means of social entrepreneurship and could be replicated for other types of clean energy. A pilot program remains to be undertaken with various social ventures to identify the factors that support the process of consolidation of business ideas in clean economies around the world, considering both growth and sustainability. Evaluation processes for the implementation of these social ventures should be implemented in fossil fuel economies, helping determine how to drive the transition to a hydrogen economy. The depth of the shortcomings detected by the great powers are not well known, nor how they have been corrected. Neither is it yet clear the impact of existing ventures and their relationship with the business fabric of the hydrogen economy posited by the current study. Social entrepreneurship and the hydrogen economy are areas to be explored to determine if a relationship exists. The current study has analyzed business creation; however, social entrepreneurship can be studied in a world that is still in the process of constructing environmental protection scenarios and requires entrepreneurs who set forth and embody these values and propose new forms of environmental innovation (Gámez Gutiérrez & Garzón Baquero, 2017).

It is to be hoped that, in the medium term, industry and academia will contribute to forming strategies that strengthen the development of new hydrogen economies around the world; without neglecting sustainable development and emphasizing the human being as a key link in the evolutionary chain (Latorre, 2019).

6. Conclusions

The hydrogen economy represents a viable opportunity to replace that of fossil fuels in the medium to long term. The great powers of the world are showing considerable interest in implementing and



enjoying the benefits thereof. Nevertheless, this will only be possible with the support of the three primary axes of each country; the state (including the government and society, as the ultimate end user), an industry which highlights the social entrepreneur as its principal agent, and of course academia, to lead and orient the required processes, interdisciplinary work, and collaborative networks.

In proposing such a drastic transition as that of a fossil fuel economy changing to hydrogen, it is necessary to give weight not only to the economic and financial costs of the projects that will make it possible, but also to consider other social costs, to make it a viable transition. It is in this sense that the role of social entrepreneurship plays a fundamental and essential role, which must be supported by academia, existing industry, and the state, in a joint effort for a sustainable economy that will guarantee the energy supply, decrease wealth inequality, and promote the efficient use of resources and an environment with lower levels of pollution.

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Sobre los autores

- **Jossie Esteban Garzón Baquero:** Magister en Ciencias de la Educación y Especialista en Pedagogía y Docencia Universitaria de la Universidad de San Buenaventura y Administrador de Empresas de la Universidad de la Salle. Profesor e investigador E-mail: jos.garzon@mail.udes.edu.co. ORCID: <https://orcid.org/0000-0001-9470-7581>
- **Daniela Bellon Monsalve:** Estudiante de doctorado en sciences de l'énergie et des matériaux, de la Université du Québec à Trois-Rivières, Canadá, Magíster en Sistemas Energéticos Avanzados e Ingeniera Industrial de la Universidad de Santander UDES. Profesora e investigadora. E-mail: dan.bellon@mail.udes.edu.co. ORCID: <https://orcid.org/0000-0001-8374-108X>

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