# Patentometric Profile of Social Water

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## Abstract

*There are regions of the planet that are affected by climatological conditions that cause water scarcity. Thus, innovative techniques have emerged with the purpose of mitigating the reflexes caused by the natural factor: drought. These innovations arise with the objective of capturing, storing and carrying out rainwater treatment for the population. These, called social water technologies, comprise products, techniques or replicable methodologies that are developed specifically to solve the problem of water shortages. The present work aims to analyze the profile of innovations generated by social water technologies through the LATIPAT, INPI and WIPO bases. To search for patents, keywords that were relevant to the research were used and combined with Boolean operators. 907 patents were identified, the largest concentration of deposits in China, justified by the fact that the country adopts development policies that invest in R&D, differentiating itself from other countries. Among the patents analyzed there is a higher concentration of deposits related to the area of human needs and water treatment.*

**Keywords:** patents; social water technologies; drought.

## 1. Introduction

On our planet, more than a billion people do not have access to any type of drinking water (SWYNGEDOUW, 2001). Upon careful analysis, it is clear that water is a resource that enables and sustains life on the planet, be it in the diversity of species (both animals and plants) or in food production. Water is then considered a strategic resource for survival, having economic, ecological and social importance (TUNDISI & TUNDISI, 2005).

In the semi-arid region, based on the rainfall regime, it is possible to draw a scenario for the availability of water in the soil. When the drought comes, the rivers dry up quickly and the groundwater deepens and diminishes, making it impossible to use its waters. Temperatures recorded at the site are high, contributing to an imbalance between the amount of water present and the rate of evapotranspiration. Thus, the accumulated waters tend to evaporate quickly (AB'SÁBER, 1999).

The lack of water leads to production stoppage, consequently to the inability to generate food for the family and the creations. The death of herds affects almost all of the country people and the emigration of the poorest population is the only way out, in addition to human health problems, competition and conflict over the use of water, water privatization, among others (GOMES, 2001; SALATI et al. 2002; DUQUE, 2008).

There is great concern regarding the need to solve the problem of lack of water in the semi-arid region, as the use of social water technologies emerges as a strategy coupled with technological innovations that aim to meet human needs, aimed at capturing, storing and treating rainwater in the semi-arid region.

Technological innovations in favor of the environment directly contribute to the longed for sustainable development, through the treatment of residues generated in the production processes, the reduction of pollutant emission levels and the increase of efficiency during the production of new products (MORAIS, 2014).

Among the topics covered in international agreements, the incentive to technological innovation through its patenting is present and this research aims to analyze the technological innovations that arose from the need to capture, store and carry out rainwater treatment for the population. That lives in an area of climatological vulnerability, precisely the semi-arid region.

## 2. The importance of technological development

Information is the raw material for technological development and takes on a new role as a factor of production that, together with work, raw material and capital, becomes the inducer of essential technological changes for companies that are fighting for their survival (FUJINO, 1994).

The growing recognition of the relevance of science, technology and innovation (ST&I) policies for economic and social development has led several countries to set goals to expand their R&D efforts (MORAIS, 2008).

The Science and Technology (S&T) or Innovation Indicators are tools created to measure a country's innovative performance and develop public policies to increase it, directing support to areas perceived as most important (GRUPP; MOGEE, 2004).

Thus, in general, an indicator can be understood as an aggregate and complete measure that allows describing or evaluating a phenomenon, its nature, its state and its evolution, making it possible to articulate or correlate variables (MARTÍNEZ & ALBORNOZ, 1998).

The patent is an extremely important indicator to analyze the activity and technological production of organizations, therefore instituting one of the oldest forms of protection of intellectual property (MARICATO, NORONHA, FUJINO, 2010).

### *2.1 Defining a Patent*

Patent can be defined as a temporary title granted to those responsible for the invention of new processes, new products or improvements, always intended for industrial activity (JUNGMANN AND BONETTI, 2010).

Patent protection aims to safeguard inventors' rights against competitors who may reproduce and sell inventions without charge with research and development costs and, therefore, achieving lower costs and more competitive prices (INPI, 2018).

Surveys provide information about innovation, but some of them have some limitations, such as lack of objectivity when they are based on interviews or the high costs and high time they can involve. Patent-based research does not have such limitations, as it contains real information about the innovation process (KANG, 2016).

Patents can enable various economic gains, mainly through royalties from the initial payment or access fee to technologies, fixed payments, transfer of know-how, technical assistance and, finally, penalties and indemnities (QUINTELA, 2013).

Patentiometry is a competitive intelligence tool in science and innovation, used for quantitative and qualitative analysis of patents in the field of technology (SUNG, et al., 2014). Metric used for the study of patent indicators with the purpose of identifying innovation and technology activities in countries, through technological information contained in patent documents (MORAIS; GARCIA, 2014).

## 3. Methodology

This research is configured in a descriptive study from a patentometric perspective, where the characteristics and profiles of patents related to social water technologies are described, deposited in the database with LATIPAT[1], National Institute of Industrial Property - INPI and World Intellectual Property Organization - WIPO.

Data collection was performed in January 2020, using relevant keywords, combined using Boolean operators. The words used in Portuguese and English were: technology, social, collection, storage, treatment, water and rain (Table 1).

[1] LATIPAT is an Espacenet database, with patent documents in Spanish and Portuguese and can be found at lp.espacenet.com.

Table 01 - Keywords used in the construction of the string

| Keywords in Portuguese | Keywords in English |
|---|---|
| Tecnologia | Technology |
| Social | Social |
| Captação | Fundraising |
| Armazenamento | Storage |
| Tratamento | Treatment |
| Água | Water |
| Chuva | Rain |

Source: Prepared by the authors (2020).

After elaborating the general string, searches were carried out on three patent bases, LATIPAT, INPI and WIPO (Figure 1). These bases were used due to their degree of reliability, the latter being justified for analysis, for obtaining the resource of data extraction in addition to having its scope at an international level.

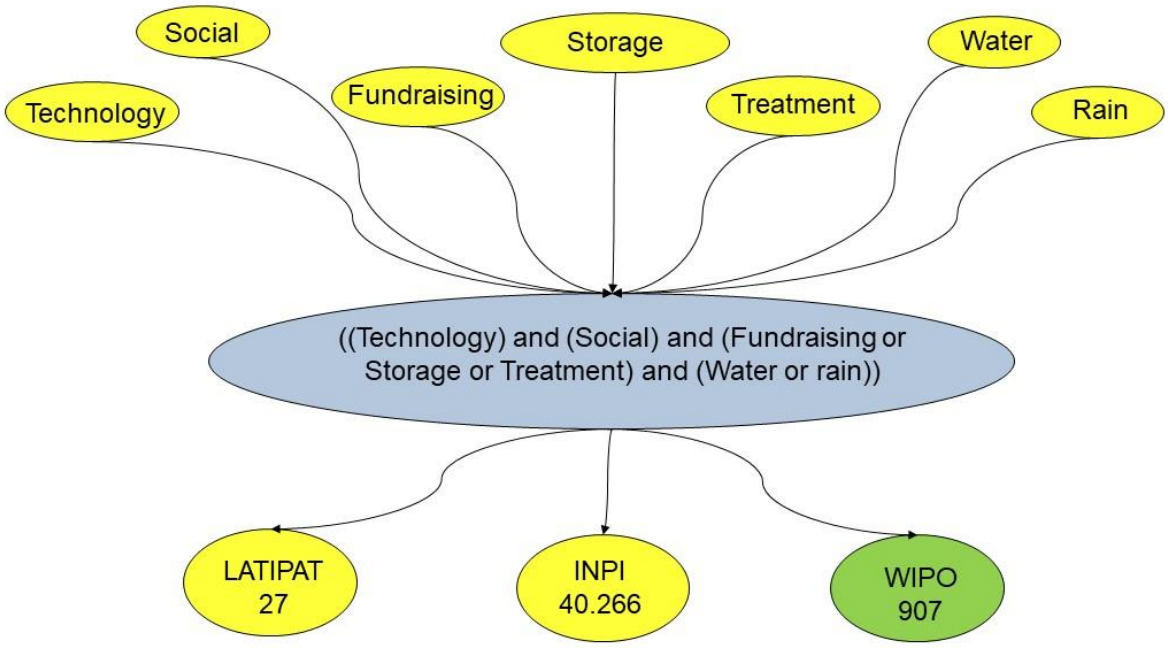


Figure 1. Methodological structure for patent search

Source: Prepared by the authors (2020).

In order to obtain more accurate results in the research, all the patents found indexed in the base of WIPO were analyzed. The extracted data were exported to the Microsoft Excel software, making it possible to standardize and organize the information through graphs with the names of the inventors, institutions, countries, IPC code and years that patent deposits were made.

## 4. Results and Discussion

907 patents on social water technologies were identified. Although this term was initially discussed in India and spread to other countries in other years, approximately 98% of these patents were filed by China, with 2% remaining for other countries, including the United States with 4 patents, the Republic of Korea with 3 patents, India with 2 patents, Canada remaining with 1 patent and 1 patent via PCT (FIGURE 2).

China's success in the large amount of patent filings is closely related to the promotion of market forces, well-illustrated by the liberalization of agriculture, the permission for rural businesses to function, the liberalization of foreign trade, and the reforms of the business system and financial. Such measures aroused the potential for entrepreneurship and made it possible to address the economic difficulties in effect during the central planning period. In addition, they favored the direction of the economy towards sectors with higher productivity, allowing the exploitation of comparative advantages to other countries (JACQUES, 2012).

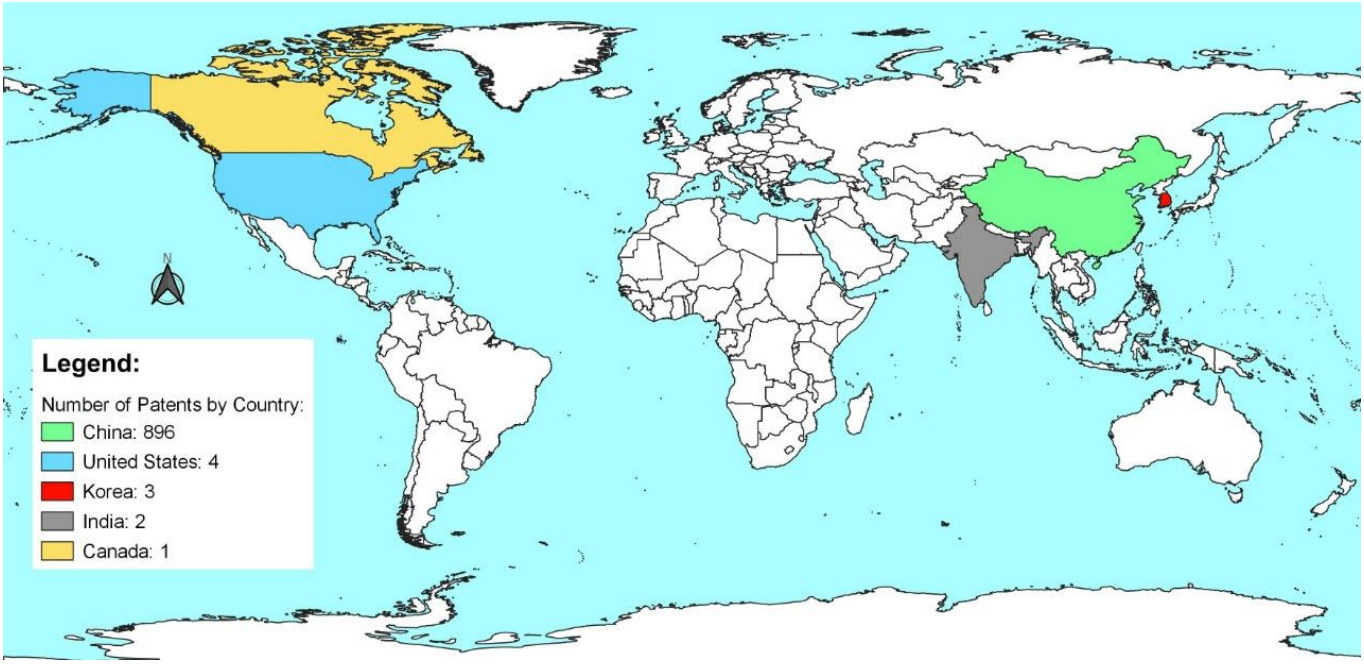


Figure 2. Countries depositing patent applications in Social Water Technologies

Source: Prepared by the authors (2020).

The effort to advance in the industrial and technological field leads to a central question: the effectiveness of industrial policy measures in the current stage of capitalism. The situation found in several sectors is that of absolute leadership of large multinational companies, which have a strong brand, control large market fractions and invest heavily in R&D. In several indicators, such as sales and revenue volume and number of patents, these companies were far ahead of their competitors (NOLAN, 2005).

These indicators reaffirm the strength of the Chinese market and point to the focus of R&D efforts by companies in the technological sector. The predominance of China as the major patent holder is related to the impetus generated by government policies aimed at an environment favorable to R&D (ROCHA et al., 2013).

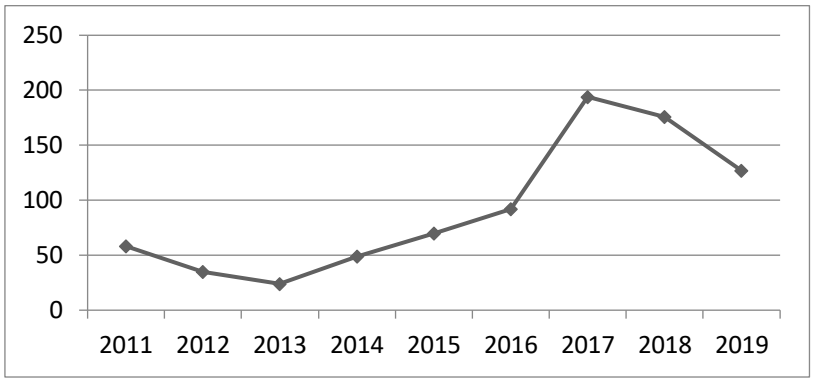


Figure 3. Annual evolution of patent application filing in the database
Source: Prepared by the authors (2020).

Over the past ten years, a greater concentration of patent filing applications can be seen between the years 2016 to 2019, which corresponds to 65% of all applications, with 2017 being the most prominent year compared to the others (FIGURE 3). The introduction and adaptations of patent laws in the countries facilitated the process of reducing bureaucracy in all the necessary procedures, observing a jump in the number of patents deposited.

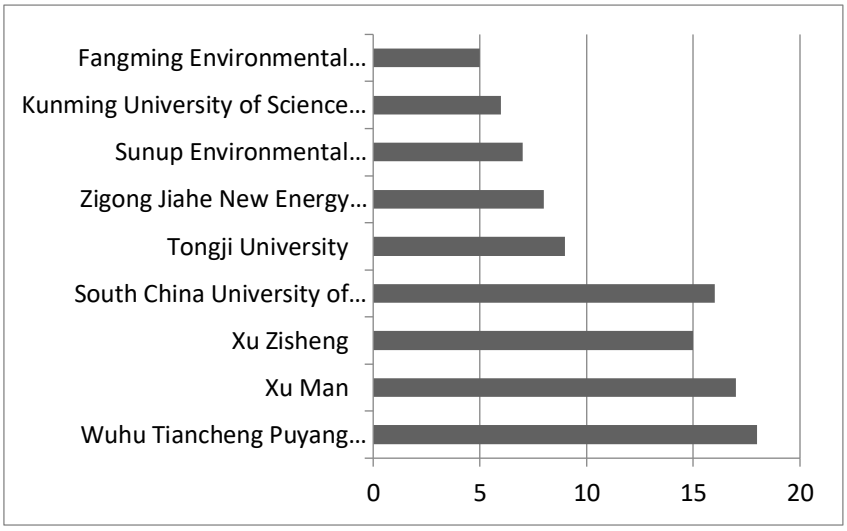


Figure 4. Largest filers of patent applications
Source: Prepared by the authors (2020).

Of the patents filed, it can be identified that there is a greater concentration of orders originating from companies, with a percentage of 38%, followed by deposits from universities with 31% and inventors in individuals also with 31% (Figure 4).

The largest filers of patent applications are Wuhu Tiancheng Puyang Traditional Chinese Medicine Technology LTD, which corresponds to approximately 2%, followed by Xu Man with 17 applications, Xu Zisheng with 15 applications and the South China University of Technology with 16 applications of patents. Of the patent applications filed, 22 inventors did not mention their names in the inventions, and the inventors who filed more patents were Huang Zhuqing with 19 deposits, Xu Man with 17 deposits and Xu Zisheng with 13 deposits (FIGURE 5).

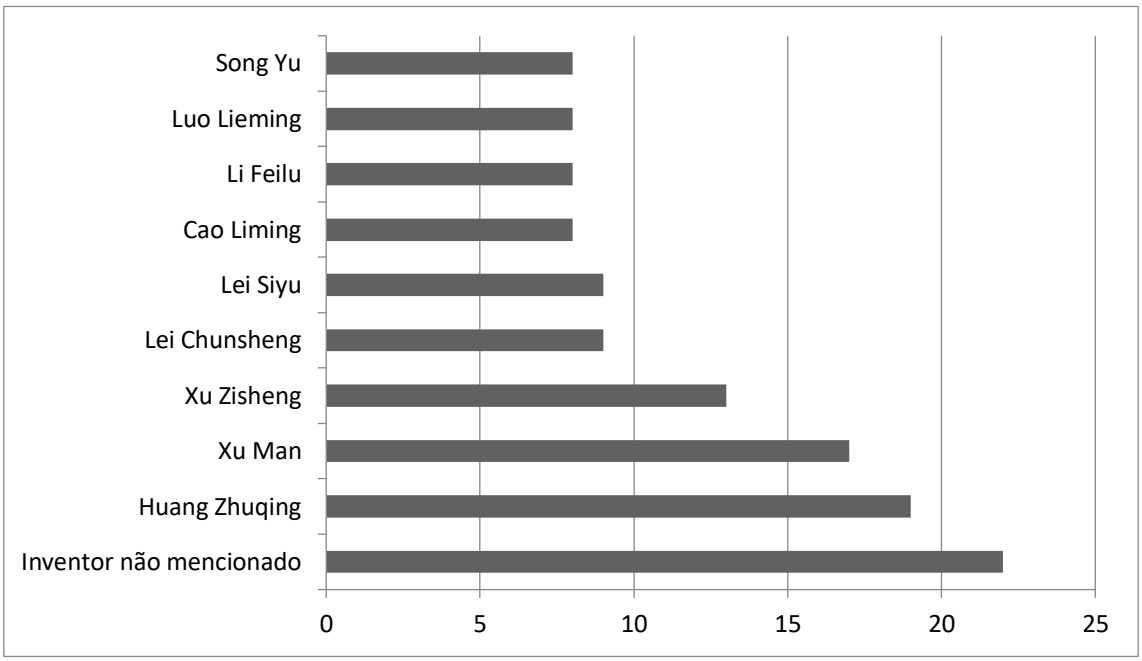


Figure 5. Number of patent applications by inventors (2011-2019)

Source: Prepared by the authors (2020).

Through the International Patent Classification - CIP codes, it is possible to infer the similarity of themes between patents according to how close these codes are. The more prefixes the patents have in common, the more similar they will be. Citing the example of three patents, H01L27/18, H01L27/00 and H01L31/00, it is possible to say that the first two have a closer relationship compared to the last (CHEN; CHIU, 2013). Patents are classified by 7 sections ranging from section A to section Y, each with its own specific area in relation to its series to be contemplated. It was observed in this research that the most frequent patents are classified in section C, Chemistry and Metallurgy, followed by section A, which refers to Human Needs, and section B of processing and transportation operations.

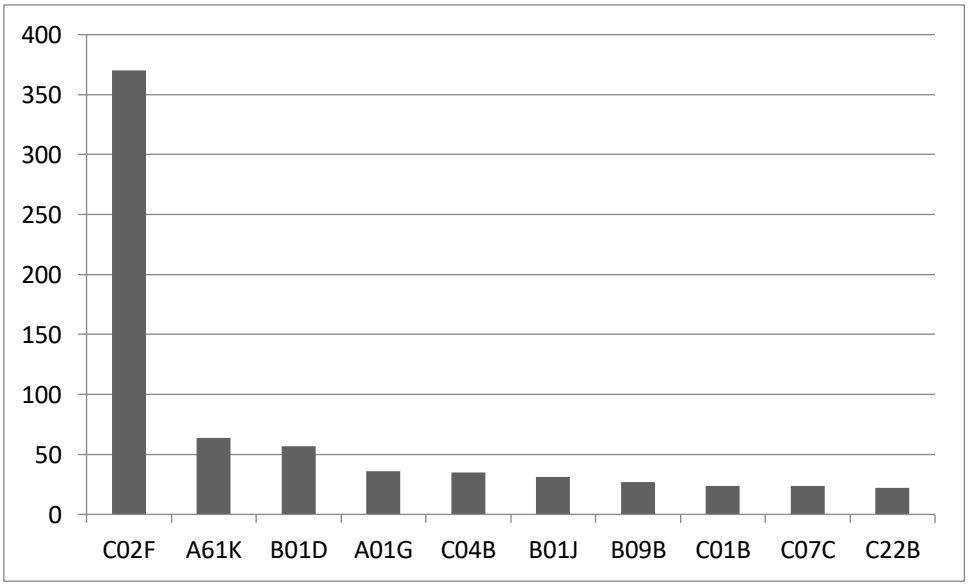


Figure 6. Distribution of patent deposits by CIP code on the WIPO basis

Source: prepared by the authors (2020).

In view of the distribution regarding the classification of patents, approximately 41% of patents correspond to the treatment of water, waste water, sewage or sludge and sludge, followed by 11% are patents deposited that aim to meet human needs (Figures 6; Table 2).

In addition, 7% of the patents deposited correspond to Processing and Transport Operations, with a relationship in view of their classification with social water technologies.

Table 2. Classification of patents for Social Water Technologies

| Code | Specification |
|---|---|
| C02F | Water, wastewater, sewage or sludge and sludge treatment. |
| A61K | Preparations for medical, dental or hygienic purposes. |
| B01D | Division |
| A01G | Horticulture; cultivation of vegetables, flowers, rice, fruits, vines, hops or algae; forestry; irrigation. |
| C04B | Lime; Magnesia; Slag; Cements and their compositions. |
| B01J | Chemical or physical processes |
| B09B | Elimination of solid waste |
| C01B | Non-metallic elements and their compounds |
| C07C | Acyclic or carbocyclic compounds |
| C22B | Production or refining of metals; pre-treatment of raw materials. |

Source: Prepared by the authors (2020).

The collection of patent documents is extremely important for mapping know-how, technological innovation and concentration of intellectual capital in strategic areas for the country's development. Knowledge of the temporal situation of technologies is also valuable in projecting technological trends, possible areas of investment by the government and private organizations (SPEZIALLI and SINISTERRA, 2015).

Government investment in the environment, through programs and public policies aligned with the country's vast territorial dimension, climate and vegetation, generates strategic and competitive interest on the part of foreign countries, since Brazil, as well as other countries in the world, lacks the development of green technologies (RASSENFOSSE et al., 2013).

## 5. Conclusion

Social Technologies are the result of knowledge acquired and related between popular knowledge and scientific knowledge that aim to meet human needs, whether through creation, or through innovation.

In view of the importance of using social water technologies, they have a strategic differential, as they address a natural problem, the lack of water. Thus, there is a need for investments in R&D, due to these instruments having relevance in carrying out the entire process of capturing and treating water for communities that are affected by the drought problem.

China, in turn, is gaining prominence when comparing itself with other countries, for implementing an

economic policy that favors and stimulates innovation, or patent deposits, with the purpose of solving problems of social demands and generating economic, social development. and environmental.
There has been an increase in patent filings in the last 10 years with equity between university, companies and inventors per individual, with the largest patent filers being professors linked to universities in China. With patentometry, it was possible to identify that the patents deposited linked to social water technologies are related to water treatment and that they meet human needs. Thus, it is clear that there are innovations linked to social water technologies, with a lack of Brazil in investments in public policies that corroborate with the country's technological advancement.

## 6. Acknowledgement

This study was financed in part by the Coordenação de Aperfeiçoamento Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001.

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